RCRA Permit Renewal
MRP Properties Company, LLC

E.P.A. ID: KSD087418695

Prepared for:
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Arkansas City
KANSAS

June 10, 2011

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BUILDING A BETTER WORLD

RCRA PERMIT RENEWAL APPLICATION PART A & PART B

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Arkansas City, Kansas

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SECTION 1

Introduction

1.0 INTRODUCTION (40 CFR 270.10)

1.1 Scope, Purpose, and Structure of the Application

This document comprises a Part A and Part B Permit Application for renewal of existing permit number KSD087418695 issued by the Kansas Department of Health and Environment (KDHE) for hazardous waste operations at the former Total Petroleum, Inc. (Total) refinery in Arkansas City, Kansas (Site), which is under the ownership of MRP Properties Company, LLC (MRP). The permit will address closure/post-closure care for the land treatment unit (LTU), post-closure care for the closed #3A aerated lagoon and closed #1 and #2 surface impoundments, and corrective action requirements for the facility. This application is submitted pursuant to the requirements of 40 CFR 270.10(h).

This application is arranged in numbered sections using a legal-type section numbering system. For example, major sections are numbered 1.0, 2.0, etc. Subsections are numbered 1.1, 1.2, 1.3, etc. These subsections may be further divided as 1.1.1, 1.1.2, etc. Tables, figures, and plates are sequentially numbered according to the section wherein they are referenced. For example, the first table referenced in Section 4.0 is numbered Table 4-1. The second table referenced in the Section 4.0 is numbered 4-2. Separate appendices, attachments, tables, figures, and plates are provided at the end of the narrative portion of the application. The Table of Contents presents tables, figures, and plate numbers and titles. Appendices are titled and arranged in alphabetical order and provided as the final attachments to the application.

This section is meant to meet the applicable requirements of 40 CFR Parts 264 and 270, in general. Part A was prepared in accordance with the specific requirements of 40 CFR Part 270.13, while Part B was prepared in accordance with 40 CFR Part 270.14 and 270.28.

1.2 Regulatory Summary

The Site is comprised of four regulated hazardous waste management units. The hazardous waste management units subject to permitting at the Site include the LTU, the closed #1 and #2 surface impoundments, and the closed #3A aerated lagoon. The dates of permit applications and significant regulatory correspondence are summarized as follows:

DATE	EVENT
1/1/80	Original Part A submitted.
1/1/83	KDHE requested modification of Part A.
1/11/84	Revised Part A submitted.
5/24/85	Part B for operation of LTU submitted.
5/24/85	Interim status closure plan for the #1 and #2 surface impoundments submitted.
9/13/85	Part B revisions for LTU submitted to KDHE.
9/27/85	Revised interim status closure plan for the #1 and #2 surface impoundments submitted.
11/13/85	Revised interim status closure plan for the #1 and #2 surface impoundments submitted.
11/22/85	Part A and Part B for the #1 and #2 surface impoundments as protective filing submitted.
2/4/86	Part B revisions for LTU submitted.
2/20/86	KDHE approved interim status closure plan for #1 and #2 surface impoundments.
2/87	RFA site visit conducted. 50 Solid Waste Management Units (SWMUs) listed.
2/12/87	Part B revisions for LTU submitted to KDHE.
8/87	RFA finalized.
8/1/87	Closure of the #1 and #2 surface impoundments initiated.
8/3/87	Part B revisions for LTU submitted to KDHE.
11/16/87	KDHE and EPA issued RCRA Facility Investigation (RFI) HSWA permit to operate LTU.
12/10/87	Interim closure report for the #1 and #2 surface impoundments submitted.
2/10/88	Closure sampling report submitted to KDHE.
3/9/88	KDHE approved closure proposal for the #1 and #2 surface impoundments, will not consider either to be clean closed.
7/25/88	Closure of the #1 and #2 surface impoundments certified by Facility representatives.
2/24/89	Unit and Waste Characterization Plan, Part B Permit Response submitted to EPA.
4/7/89	EPA approved Unit and Waste Characterization Plan, Part B Permit Response.
4/19/89	Surface Water and Sediment Characterization Plan submitted to EPA.
5/4/89	KDHE called for post-closure permit application for the #1 and #2 surface impoundments.
6/26/89	EPA approved Surface Water and Sediment Characterization Plan.
8/7/89	Soil Characterization Plan, Phase II submitted to EPA.
9/29/89	EPA approved Soil Characterization Plan, Phase II.
11/17/89	Short-term/Long-term Groundwater Monitoring Program Work Plan submitted to EPA.
11/30/89	Post-closure permit application for the #1 and #2 surface impoundments submitted.
2/5/90	EPA approved Short-term/Long-term Groundwater Monitoring Program Work Plan.
4/17/90	Unit and Waste Characterization Report submitted to EPA.

DATE	EVENT
9/4/90	Surface Water and Sediment Characterization Report submitted to EPA.
9/14/90	Short-Term Groundwater Monitoring Program Report submitted to EPA.
10/31/90	KDHE approved LTU application of non-hazardous waste.
3/91	Soil Characterization Report submitted to EPA.
3/24/91	Class 3 permit modification submitted to add the #3A aerated lagoon as a hazardous waste surface impoundment due to regulatory change adding benzene toxicity as a hazardous waste characteristic.
11/13/91	Revised Part A application submitted.
6/22/92	Addendum to Class 3 modification for the #3A aerated lagoon submitted.
8/4/92	Final RFI Report submitted to EPA.
8/28/94	Notice of cession to receive hazardous waste at the land treatment unit submitted.
5/15/95	KDHE commented on Part B Renewal Permit Application.
7/5/95	KDHE commented on the #3A aerated lagoon closure plan.
8/11/95	Extension requested for the #3A aerated lagoon closure plan submittal.
6/19/96	Closure/post-closure cost estimate submitted.
2/11/97	KDHE commented on the #3A aerated lagoon closure plan.
4/28/97	Final revised the #3A aerated lagoon closure plan submitted.
5/2/97	KDHE approved closure plan for the #3A aerated lagoon.
5/14/98	Class I permit modification (contingency plan, waste analysis plan, and contact information) submitted.
7/8/97	KDHE approved Class I permit modification.
8/15/97	KDHE approved extension for Part B permit renewal application.
10/10/97	KDHE commented on the #3A aerated lagoon closure report.
11/6/97	Extension requested for Part B permit application renewal.
11/6/97	Notification of intent to close the land treatment unit submitted.
12/31/97	KDHE commented on Part B permit renewal application.
2/5/98	Closure of the #3A aerated lagoon certified by Facility representatives.
3/16/98	RCRA application submitted to KDHE.
4/29/98	Owner name changed from Total Petroleum, Inc. to TPI Petroleum, Inc. (TPI)
7/28/98	Phase II RFI Work Plan submitted to EPA.
8/1/98	Closure period for LTU initiated.
10/20/98	KDHE submitted comments on RCRA application dated March 18, 1998.
3/10/99	KDHE accepts the 3A Lagoon closure report and closure certification and releases the facility from financial assurance for closure
5/26/99	Final Phase II RFI Work Plan submitted to EPA.
10/25/99	EPA approves the Phase II RFI work plan
2/4/2000	KDHE approved the revised LTU closure plan (January 25, 2000)
6/5/00	Phase II RFI Report submitted to EPA
6/8/00	Revised closure and post-closure cost estimates submitted to KDHE
7/31/00	Revised Part B submitted to U.S. EPA
9/21/00	KDHE comments on revised RCRA application dated 7/31/00
10/26/00	Total submits revised RCRA application

DATE	EVENT
1/23/01	Request for 180 day temporary authorization to implement a new sampling and analysis plan submitted to KDHE
4/9/01	KDHE approves request for a 180 day temporary authorization to implement new groundwater sampling and analysis plan
10/24/01	KDHE/EPA issue RCRA permit
10/26/01	EPA approves the RCRA Facility Investigation. The RFI consists of the Final RFI (8/4/92), Phase II RFI (June, 2000), and the Phase II RFI Addendum (4/18/2001)
11/7/01	Request for Class II permit modification for four new recovery wells and revised groundwater sampling and analysis plan submitted to KDHE
11/16/01	KDHE approves temporary authorization to install groundwater recovery wells RW-45, -55, -65, -75
2/15/2002	CMS work plan submitted to U.S. EPA
2/22/02	U.S. EPA approves the CMS work plan
7/22/02	Class II permit modification approved for installation of RW-45 through 75
9/19/02	KDHE approves LTU closure plan modification 01 providing closure of the LTU consistent with corrective action for other SWMUs listed in Part II of the facility permit
10/24/02	TPI Petroleum, Inc. completes installation of LTU groundwater corrective action and submits a start-up plan to KDHE and EPA
5/2005	TPI submits “Proposed Cleanup Goals”, Version 2 for the RCRA Corrective Action
9/29/05	EPA approves the proposed cleanup goals for the RCRA Corrective Action
12/19/05	TPI submits a Class 1a permit modification request to modify the LTU Closure Plan to cease annual core sampling; modification 02
12/23/05	KDHE approves the requested Class 1a permit modification for the LTU Closure Plan, modification 02 effective 12/30/05
4/5/06	Part A submitted to KDHE to update facility owner/operator information reflecting TPI merging with and into Michigan Reutilization, LLC with MRLLC being the surviving entity.
4/18/06	Michigan Reutilization, LLC submits a request for a permit modification for a single agency lead.
4/24/06	Michigan Reutilization, LLC submits Five Year Permit Review Report
9/8/06	KDHE approves Class 1A permit modification regarding the requested name change to Michigan Reutilization, LLC
12/29/06	KDHE comments on the Five Year Permit Review Report
2/16/07	KDHE approved the permit modification for a single agency lead
2/15/08	Michigan Reutilization, LLC submits a request to discontinue operation of the LTU groundwater corrective action system
5/1/08	Michigan Reutilization, LLC sold certain of its assets and liabilities to MRP Properties Company, LLC (MRP)
8/11/08	MRP submits plan describing the Exposure Unit approach to support risk evaluation to EPA and KDHE

DATE	EVENT
10/2/08	MRP submits a permit modification request, including a revised Part A application and other business-related information, reflecting a facility name change from Michigan Reutilization, LLC to MRP Properties Company, LLC.
10/27/08	MRP submits request for a 180 day temporary authorization to discontinue pumping groundwater from recovery well RW-80A
11/3/08	KDHE approves Class 1A permit modification regarding the requested name change to MRP Properties Company, LLC
11/4/08	KDHE approves request for the 180 day temporary authorization to discontinue pumping RW-80A
11/7/08	KDHE and EPA approve the concept of using exposure units to evaluate soil risks
1/13/09	KDHE and EPA approve the use of Exposure Units in assessing the site risk
7/24/09	Exposure Unit Supplemental Soil Investigation Work Plan submitted to KDHE and EPA
1/25/10	MRP submits request for Class IA permit modification to replace the product recovery tank (Tank 7132) with an existing vessel (V-7106)
4/23/10	KDHE approves Class IA permit modification replacing Tank 7132 with V-7106
7/23/10	Exposure Unit Supplemental Soil Investigation – Field Sampling Plan and Quality Assurance Project Plan submitted to KDHE and EPA
10/26/10	KDHE approves Exposure Unit Supplemental Soil Investigation Work Plan, Field Sampling Plan, and Quality Assurance Project Plan
12/21/10	MRP submits request for a 180 day temporary authorization to suspend operation of the LTU groundwater corrective action system
1/4/11	KDHE approves the 180 day temporary authorization to shut down the LTU system

The #1 and #2 surface impoundments have been closed according to approved, interim status closure plans, and are currently in the post-closure period. The #3A aerated lagoon has been closed under interim status closure plan in accordance with the applicable regulations of 40 CFR 265 as of February 5, 1998.

This Part B Permit Application includes a closure plan for the LTU. A notice of intent to close the LTU was submitted to KDHE on November 6, 1997 and the closure period for the LTU was initiated on August 1, 1998. On September 19, 2002, KDHE approved a permit modification providing for closure of the LTU consistent with corrective action for other Solid Waste Management Units (SWMUs) listed in Part II of the RCRA Permit. The revised closure plan includes an extension to the closure time frames established in 40 CFR 264.113 (b) to coincide with the implementation of corrective action activities under Part II of the RCRA Permit.

The 1997 notice of intent to close the LTU along with certifications for the closure of surface impoundments #1 and #2, and the #3A aerated lagoon and the approval letters from KDHE are enclosed in Appendix A. Approved closure plans for the #1 and #2 surface impoundments and the #3A aerated lagoon are included in Appendix B for reference purposes. This Part B Permit Application also includes discussion concerning post-closure monitoring and maintenance of the closed #1 and #2 surface impoundments, the closed #3A aerated lagoon, and the LTU.

The CMS and subsequent activities related to Solid Waste Management Units (SWMUs) are being implemented in accordance with the existing permit conditions. The existing permit conditions establish the regulatory structure for completion of the RFI/CMS process.

1.3 Certification (40 CFR 270.11)

The following certification conforms with the requirements set forth at 40 CFR 270.11(d) and is submitted in accordance with 270.11(a) and (b).

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Date: June 10, 2011

Name and Title: Kirk A. Saffell - Vice president - HSE

Signature: Kirk A. Saffell

SECTION 2

Part A

2.0 PART A (40 CFR 270.11(d) and 270.13)

The Part A Application has been amended in accordance with 40 CFR 270.13 to be consistent with the current activities at the facility and other information presented in this Part B Permit Application. The application reflects that no hazardous wastes are being treated, stored, or disposed at the facility.

Four regulated units are covered within this permit application. They are surface impoundments #1 and #2, the #3A aerated lagoon, and the land treatment unit. Surface impoundments #1 and #2, as well as, the #3A aerated lagoon were closed under interim status closure plans approved by the KDHE. A notice of intent to close the LTU was submitted to KDHE on November 6, 1997. Subsequent permit modifications provide for closure of the LTU consistent with corrective action for the Solid Waste Management Units (SWMUs) listed in Part II of the RCRA Permit.

Photographs of the current conditions are presented at the end of the Part A Permit Application.

EPA ID: |K|S|D|0|8|7|4|1|8|6|9|5|

SEND COMPLETED FORM TO: KDHE-BWM 1000 SW JACKSON, SUITE 320 TOPEKA, KS 66612	Kansas Department of Health and Environment **Notification of Regulated Waste Activity** **(RCRA SUBTITLE C SITE IDENTIFICATION FORM)** **FORM 8700-12**
1. Reason for Submittal MARK ALL BOX(ES) THAT APPLY	**Reason for Submittal:** ☐ To provide Initial Notification of Regulated Waste Activity (to obtain an EPA ID Number for hazardous waste, or used oil activities) ■ To provide Subsequent Notification of Regulated Waste Activity (to update site identification information) ☐ As a component of a First RCRA Hazardous Waste Part A Permit Application ☐ As a component of a Revised RCRA Hazardous Waste Part A Permit Application (Amendment #) ☐ As a component of the Hazardous Waste Report ☐ Site was a TSD facility and/or generator of >1,000 kg of hazardous waste, >1 kg of acute hazardous waste, or >100 kg of acute hazardous waste spill cleanup in one or more months of the report year.
2. Site EPA ID Number	**EPA ID Number** KSD087418695
3. Site Name	**Name:** MRP Properties Company, LLC
4. Site Location	**Street Address:** 1400 South M Street **City, Town, or Village:** Arkansas City **County:** Cowley **State:** Kansas **Country:** USA **Zip Code:** 67005
5. Site Land Type	**Site Land Type:** ■ Private ☐ County ☐ District ☐ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other
6. (NAICS) Code(s) a five digit code	**A.** 423320 **B.** **C.** **D.**
7. Site Mailing Address	**Street or PO Box:** 1400 South M Street **City, Town, or Village:** Arkansas City **State:** Kansas **Country:** USA **Zip Code:** 67005
8. Site Contact Person	**First Name:** Brenda **MI:** B **LAST** Epperson **Title:** Manager **Street or PO Box:** 1400 South M Street **City, Town or Village:** Arkansas City **State:** Kansas **Country:** USA **Zip Code:** 67005 **Email:** brenda.epperson@valero.com **Phone:** (210) 345-4619 **Ext:** **Fax:** (210) 345-4976

EPA ID: |K|S|D|0|8|7|4|1|8|6|9|5|

9. Legal Owner and Operator of the Site	**A. Name of Site's Legal Owner:** MRP Properties Company, LLC	**Date Became Owner: (mm/dd/yyyy):** 05/01/2008
	Owner Type: ☐ Private ☐ County ☐ District ☐ Federal ☐ Tribal ☐ Municipal ☐ State ▣ Other LLC	
	Street or PO Box: 1400 South M Street	
	City, Town or Village: Arkansas City	**Phone:** (620) 442-5100
	State: Kansas **Country:** USA	**Zip Code:** 67005
	B: Name of Site's Operator: N/A	**Date Became Operator: (mm/dd/yyyy):**
	Operator Type: ☐ Private ☐ County ☐ District ☐ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other	

10. Type of Regulated Waste Activity
Mark "Yes" or "No" for all activities; complete any additional boxes as instructed. (See instructions on pages 10 to 14.)

A. Hazardous Waste Activities
Complete all parts for 1 through 6.

Y▣N☐ 1. Generator of Hazardous Waste
If "Yes", choose only one of the following –a, b, or c.

☐ a. LQG: Greater than 1,000 kg/mo (2,200 lbs/mo) of non-acute hazardous waste; or generates more than 1 kg (2.2 lbs) of acutely hazardous waste
☐ b. SQG: 100 to 1,000 kg/mo (220-2,200 lbs/mo) of non-acute hazardous waste; or accumulates less than 1 kg (2.2 lbs) of acutely hazardous waste
☐ c. KSQG: 25 to less than 100 kg/mo (55-220 lbs/mo) of non-acute hazardous waste; or accumulates less than 1 kg (2.2 lbs) of acutely hazardous waste
▣ d. CESQG: Less than 25 kg/mo (55lbs/mo) of non-acute hazardous waste

In addition, indicate other generator activities.

Y☐N▣ d. Short-Term Generator (generate from a short-term or one-time event and not from a on-going processes. If Yes, provide info under Comments Section.

Y☐N▣ e. United States Importer of Hazardous Waste

Y☐N▣ f. Mixed Waste (hazardous and radioactive) Generator

Y☐N▣ 2. Transporter of Hazardous Waste.
If "Yes", mark all that apply.

☐ **a. Transporter**

☐ **b. Transfer Facility (at your site)**

Y▣N☐ 3. Treater, Storer, or Disposer of Hazardous Waste (at your site) Note: A hazardous waste permit is required for this activity.

Y☐N▣ 4. Recycler of Hazardous Waste (at your site) Note: A permit may be required

Y☐N▣ 5. Exempt Boiler and/or industrial Furnace
If "Yes", mark each that applies.

☐ a. Small Quantity On-site Burner Exemption

☐ b. Smelting, Melting, and Refining Furnace Exemption

Y☐N▣ 6. Underground Injection Control

Y☐N▣ 7. Receives Hazardous Waste from Off-Site

B. Universal Waste Activities; Complete all parts 1-2:

Y☐N▣ 1. Large Quantity Handler of Universal Waste (you accumulate 5,000 kg or more) refer to Kansas regulations to determine what is regulated). Indicate types of universal waste generated and/or accumulated at your site (Mark all boxes that apply.

a. Batteries ☐
b. Pesticides ☐
c. Mercury containing equipment ☐
d. Lamps ☐
e. Others ☐

Y☐N▣ 2. Destination Facility for Universal Waste.
Note: A haardous waste permit may be required for this activity.

C. Used Oil Activities
Mark all boxes that apply.

Y☐N▣ 1. Used Oil Transporter
If "Yes", mark each that applies.

☐ a. Transporter

☐ b. Transfer Facility

Y☐N▣ 2. Used Oil Processor and/or Re-refiner
If "Yes", mark each that applies.

☐ a. Processor

☐ b. Re-refiner

Y☐N▣ 3. Off-Specification Used Oil Burner

EPA ID: | K | S | D | 0 | 8 | 7 | 4 | 1 | 8 | 6 | 9 | 5 |

	Y☐N☒ **4. Used Oil Fuel Marketer** **If "Yes", mark each that applies.** ☐ a. Marketer Who Directs Shipment of Off-Specification Used Oil to Off-Specification Used Oil Burner ☐ b. Marketer Who First Claims the Used Oil Meets the Specifications

11. Description of Hazardous Wastes

A. Waste Codes for Federally Regulated Hazardous Wastes. Please list the waste codes of the Federal hazardous wastes handled at your site. List them in the order they are presented in the regulations (e.g., D001, D003, F007, U112). Use an additional page if more spaces are needed.

D001						
SEE PAGE 10 0F 10						

12. Comments

Effective May 1, 2008, Michigan Reutilization, LLC sold certain of its assets and liabilities to MRP Properties Company, LLC. Accordingly, the name of the owner of the referenced facility and Hazardous Waste Management Facility Permit has been transferred from "Michigan Reutlization, LLC" to "MRP Properties Company, LLC".

13. Certification. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information, submitted is, to be the best of my knowledge and belief, true accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature of operator, owner, or an authorized representative	Name and Official Title (type or print)	Date Signed (mm/dd/yyyy)
BBEpperson	Brenda B. Epperson, Manager	08/26/2011

United States Environmental Protection Agency

HAZARDOUS WASTE PERMIT INFORMATION FORM (8700-23)

1. Facility Permit Contact (See instructions on page 16)	**First Name:** Brenda	**MI:** B	**Last Name:** Epperson
	Phone Number: (210) 345-4619		**Phone Number Extension:**
2. Facility Permit Contact Mailing Address (See instructions on page 16)	**Street or P.O. Box:** P.O. Box 696000		
	City, Town, or Village: San Antonio		
	State: Texas		
	Country: USA		**Zip Code:** 78269-6000
3. Legal Owner Mailing Address and Telephone Number (See instructions on page 17)	**Street or P.O. Box:** P.O. Box 696000		
	City, Town, or Village: San Antonio		
	State: Texas		
	Country: USA	**Zip Code:** 78269-6000	**Phone Number** (210) 345-4619
4. Operator Mailing Address and Telephone Number (See instructions on page 17)	**Street or P.O. Box:** Same as above.		
	City, Town, or Village:		
	State:		
	Country:	**Zip Code:**	**Phone Number**
5. Facility Existence Date (See instructions on page 17)	**Facility Existence Date (mm/dd/yyyy):** 1925		

6. Other Environmental Permits (See instructions on page 17)

A. Permit Type *(Enter code)*	B. Permit Number	C. Description
N	IWA18P002	NDPES Permit
R	KSD087418695	RCRA Permit
E	0523	Construction Debris Landfill

7. Nature of Business (Provide a brief description; see instructions on page 18)

This facility was formerly a petroleum refinery. The refinery closed in 1996 and the process units and tank farm were demolished by 2003. Current operations consist of post-closure care and groundwater corrective action associated with four closed regulated units.

8. Process Codes and Design Capacities (See instructions on page 18)

A. PROCESS CODE - Enter the code from the list of process codes below that best describes each process to be used at the facility. Thirteen lines are provided for entering codes. If more lines are needed, attach a separate sheet of paper with the additional information. For "other" processes (i.e., D99, S99, T04 and X99), describe the process (including its design capacity) in the space provided in Item 9.

B. PROCESS DESIGN CAPACITY- For each code entered in column A, enter the capacity of the process.

1. **AMOUNT - Enter the amount. In a case where design capacity is not applicable (such as in a closure/post-closure or enforcement action) enter the total amount of waste for that process.**
2. **UNIT OF MEASURE - For each amount entered in column B(1), enter the code in column B(2) from the list of unit of measure codes below that describes the unit of measure used. Select only from the units of measure in this list.**

C. PROCESS TOTAL NUMBER OF UNITS - Enter the total number of units for each corresponding process code.

PROCESS CODE	PROCESS	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
	Disposal:	
D79	Underground Injection Well Disposal	Gallons; Liters; Gallons Per Day; or Liters Per Day
D80	Landfill	Acre-feet; Hectare-meter; Acres; Cubic Meters; Hectares; Cubic Yards
D81	Land Treatment	Acres or Hectares
D82	Ocean Disposal	Gallons Per Day or Liters Per Day
D83	Surface Impoundment Disposal	Gallons; Liters; Cubic Meters; or Cubic Yards
D99	Other Disposal	Any Unit of Measure Listed Below
	Storage:	
S01	Container	Gallons; Liters; Cubic Meters; or Cubic Yards
S02	Tank Storage	Gallons; Liters; Cubic Meters; or Cubic Yards
S03	Waste Pile	Cubic Yards or Cubic Meters
S04	Surface Impoundment Storage	Gallons; Liters; Cubic Meters; or Cubic Yards
S05	Drip Pad	Gallons; Liters; Acres; Cubic Meters; Hectares; or Cubic Yards
S06	Containment Building Storage	Cubic Yards or Cubic Meters
S99	Other Storage	Any Unit of Measure Listed Below
	Treatment:	
T01	Tank Treatment	Gallons Per Day; Liters Per Day; Short Tons Per Hour; Gallons Per Hour; Liters Per Hour; Pounds Per Hour; Short Tons Per Day; Kilograms Per Hour; Metric Tons Per Day; or Metric Tons Per Hour
T02	Surface Impoundment Treatment	Gallons Per Day; Liters Per Day; Short Tons Per Hour; Gallons Per Hour; Liters Per Hour; Pounds Per Hour; Short Tons per Day; Kilograms Per Hour; Metric Tons Per Day; or Metric Tons Per Hour
T03	Incinerator	Short Tons Per Hour; Metric Tons Per Hour; Gallons Per Hour; Liters Per Hour; Btu Per Hour; Pounds Per Hour; Short Tons Per Day; Kilograms Per Hour; Gallons Per Day; Liters Per Day; Metric Tons Per Hour; or Million Btu Per Hour
T04	Other Treatment	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; Btu Per Hour; Gallons Per Day; Liters Per Hour; or Million Btu Per Hour
T80	Boiler	Gallons; Liters; Gallons Per Hour; Liters Per Hour; Btu Per Hour; or Million Btu Per Hour
T81	Cement Kiln	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; Btu Per Hour; Liters Per Hour; Kilograms Per Hour; or Million Btu Per Hour
T82	Lime Kiln	
T83	Aggregate Kiln	
T84	Phosphate Kiln	
T85	Coke Oven	
T86	Blast Furnace	
T87	Smelting, Melting, or Refining Furnace	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; Btu Per Hour; Gallons Per Hour; Liters Per Hour; or Million Btu Per Hour
T88	Titanium Dioxide Chloride Oxidation Reactor	
T89	Methane Reforming Furnace	
T90	Pulping Liquor Recovery Furnace	
T91	Combustion Device Used In The Recovery Of Sulfur Values From Spent Sulfuric Acid Halogen Acid Furnaces Other Industrial Furnaces	
T92	Listed In 40 CFR §260.10	
T93		
T94	Containment Building - Treatment	Cubic Yards; Cubic Meters; Short Tons Per Hour; Gallons Per Hour; Liters Per Hour; Btu Per Hour; Pounds Per Hour; Short Tons Per Day; Kilograms Per Hour; Metric Tons Per Day; Gallons Per Day; Liters Per Day; Metric Tons Per Hour; or Million Btu Per Hour
	Miscellaneous (Subpart X):	
X01	Open Burning/Open Detonation	Any Unit of Measure Listed Below
X02	Mechanical Processing	Short Tons Per Hour; Metric Tons Per Hour; Short Tons Per Day; Metric Tons Per Day; Pounds Per Hour; Kilograms Per Hour; Gallons Per Hour; Liters Per Hour; or Gallons Per Day
X03	Thermal Unit	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; Btu Per Hour; or Million Btu Per Hour
X04	Geologic Repository	Cubic Yards; Cubic Meters; Acre-feet; Hectare-meter; Gallons; or Liters
X99	Other Subpart X	Any Unit of Measure Listed Below

UNIT OF MEASURE	UNIT OF MEASURE CODE
Gallons	G
Gallons Per Hour	E
Gallons Per Day	U
Liters	L
Liters Per Hour	H
Liters Per Day	V

UNIT OF MEASURE	UNIT OF MEASURE CODE
Short Tons Per Hour	D
Metric Tons Per Hour	W
Short Tons Per Day	N
Metric Tons Per Day	S
Pounds Per Hour	J
Kilograms Per Hour	R
Million Btu Per Hour	X

UNIT OF MEASURE	UNIT OF MEASURE CODE
Cubic Yards	Y
Cubic Meters	C
Acres	B
Acre-feet	A
Hectares	Q
Hectare-meter	F
Btu Per Hour	I

8. Process Codes and Design Capacities (*Continued*)

EXAMPLE FOR COMPLETING Item 8 (shown in line number X-1 below): A facility has a storage tank, which can hold 533.788 gallons.

Line Number		A. Process Code (From list above)			B. PROCESS DESIGN CAPACITY (1) Amount (Specify)	B. PROCESS DESIGN CAPACITY (2) Unit of Measure (Enter code)	C. Process Total Number of Units	For Official Use Only
X	1	S	0	2	5 3 3 . 7 8 8	G	0 0 1	
	1	D	8	0	0 .	A	003	
	2	D	8	1	0 .	B	001	
	3				.			
	4				.			
	5				.			
	6				.			
	7				.			
	8				.			
	9				.			
1	0				.			
1	1				.			
1	2				.			
1	3				.			

NOTE: If you need to list more than 13 process codes, attach an additional sheet(s) with the information in the same format as above. Number the lines sequentially, taking into account any lines that will be used for "other" processes (i.e., D99, S99, T04 and X99) in Item 9.

9. Other Processes (*See instructions on page 18 and follow instructions from Item 8 for D99, S99, T04 and X99 process codes*)

Line Number (Enter #s in sequence with Item 8)		A. Process Code (From list above)			B. PROCESS DESIGN CAPACITY (1) Amount (Specify)	B. PROCESS DESIGN CAPACITY (2) Unit of Measure (Enter code)	C. Process Total Number of Units	D. Description of Process
X	1	T	0	4	.			In-situ Vitrification
	1				.			
	2				.			
	3				.			
	4				.			

10. Description of Hazardous Wastes (See instructions on page 18)

A. EPA HAZARDOUS WASTE NUMBER - ***Enter the four-digit number from 40 CFR, Part 261 Subpart D of each listed hazardous waste you will handle. For hazardous wastes which are not listed in 40 CFR, Part 261 Subpart D, enter the four-digit number(s) from 40 CFR Part 261, Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.***

B. ESTIMATED ANNUAL QUANTITY - ***For each listed waste entered in column A, estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A, estimate the total annual quantity of all the non-listed waste(s) that will be handled which possess that characteristic or contaminant.***

C. UNIT OF MEASURE - ***For each quantity entered in column B, enter the unit of measure code. Units of measure which must be used and the appropriate codes are:***

ENGLISH UNIT OF MEASURE	*CODE*	*METRIC UNIT OF MEASURE*	*CODE*
POUNDS	*P*	*KILOGRAMS*	*K*
TONS	*T*	*METRIC TONS*	*M*

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure, taking into account the appropriate density or specific gravity of the waste.

D. PROCESSES

1. PROCESS CODES:

For listed hazardous waste: For each listed hazardous waste entered in column A select the code(s) from the list of process codes contained in Items 8A and 9A on page 3 to indicate the waste will be stored, treated, and/or disposed at the facility.

For non-listed hazardous waste: For each characteristic or toxic contaminant entered in column A, select the code(s) from the list of process codes contained in Items 8A and 9A on page 3 to indicate all the processes that will be used to store, treat, and/or dispose of all the non-listed hazardous wastes that possess that characteristic or toxic contaminant.

NOTE: THREE SPACES ARE PROVIDED FOR ENTERING PROCESS CODES. IF MORE ARE NEEDED:

1. ***Enter the first two as described above.***
2. ***Enter "000" in the extreme right box of Item 10.D(1).***
3. ***Use additional sheet, enter line number from previous sheet, and enter additional code(s) in Item 10.E.***

2. PROCESS DESCRIPTION: ***If a code is not listed for a process that will be used, describe the process in Item 10.D(2) or in Item 10.E(2).***

NOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER - Hazardous wastes that can be described by more than one EPA Hazardous Waste Number shall be described on the form as follows:

1. ***Select one of the EPA Hazardous Waste Numbers and enter it in column A. On the same line complete columns B, C and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.***
2. ***In column A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.***
3. ***Repeat step 2 for each EPA Hazardous Waste Number that can be used to describe the hazardous waste.***

EXAMPLE FOR COMPLETING Item 10 (shown in line numbers X-1, X-2, X-3, and X-4 below) - A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operations. In addition, the facility will treat and dispose of three non-listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

Line Number		*A. EPA Hazardous Waste No. (Enter code)*				*B. Estimated Annual Quantity of Waste*	*C. Unit of Measure (Enter code)*	*D. PROCESSES*									
								(1) PROCESS CODES (Enter code)									*(2) PROCESS DESCRIPTION (If a code is not entered in D(1))*
X	**1**	K	0	5	4	900	P	T	0	3	D	8	0				
X	**2**	D	0	0	2	400	P	T	0	3	D	8	0				
X	**3**	D	0	0	1	100	P	T	0	3	D	8	0				
X	**4**	D	0	0	2												Included With Above

10. Description of Hazardous Wastes (*Continued; use additional sheets as necessary*)

Line Number	A. EPA Hazardous Waste No. (Enter code)	B. Estimated Annual Quantity of Waste	C. Unit of Measure (Enter code)	D. PROCESSES (1) PROCESS CODES (Enter code)	D. PROCESSES (2) PROCESS DESCRIPTION (If a code is not entered in D(1))
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					

10. Description of Hazardous Wastes (*Continued; Additional Sheet*)

Line Number	*A. EPA Hazardous Waste No. (Enter code)*	*B. Estimated Annual Quantity of Waste*	*C. Unit of Measure (Enter code)*	*E. PROCESSES*			
				(1) PROCESS CODES (Enter code)			*(2) PROCESS DESCRIPTION (If a code is not entered in E(1))*

11. Map (See instructions on page 19)

Attach to this application a topographic map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in this map area. See instructions for precise requirements.

12. Facility Drawing (See instructions on page 20)

All existing facilities must include a scale drawing of the facility (see instructions for more detail).

13. Photographs (See instructions on page 20)

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas (see instructions for more detail).

14. Comments (See instructions on page 20)

Currently, no hazardous waste treatment, storage, or disposal activities occur at the site requiring a permit. No hazardous waste or non-hazardous waste is accepted at the Land Treatment Unit. Surface impoundments #1 and #2, as well as Aerated Lagoon #3A are in post-closure care.

On May 1, 2008, Michigan Reutilization, LLC sold certain of its assets and liabilities to MRP Properties Company, LLC.

Process Codes and Design Capacities included on Page 6 describe the Land Treatment Unit (D81) in post-closure care and three closed surface impoundments (D83) also in post-closure care. These four regulated units do not receive any waste.

Photographic Log

Client:	**MRP Properties Company, LLC**	**Project:**	**Part A Application**
Site Name:	**Arkansas City**	**Site Location:**	**Regulated Units**

Photograph ID: 1

Photo Location:
Land Treatment Unit

Survey Date:
1/4/2011

Comments:
View toward the north.

Photograph ID: 2

Photo Location:
Closed #3A Aerated Lagoon

Survey Date:
1/4/2011

Comments:
View toward the #3B pond and oxidation ponds in the background. Photograph direction is toward the southeast.

Photographic Log

Client:	**MRP Properties Company, LLC**	**Project:**	**Part A Application**
Site Name:	**Arkansas City**	**Site Location:**	**Regulated Units**

Photograph ID: 3

Photo Location:
Closed #1 and #2 Surface Impoundments

Survey Date:
1/4/2011

Comments:
Bioreactor tanks constructed on the #2 closed surface impoundment. #1 surface impoundment in the foreground. Photo direction is toward the east.

SECTION 3

Facility Description

3.0 FACILITY DESCRIPTION (40 CFR 270.14(b)(1))

3.1 Former Refinery Description

The former refinery site is (Site) located southeast of the incorporated limits of Arkansas City in southwestern Cowley County, Kansas. The site occupies approximately 300 acres near the confluence of the Walnut River and the Arkansas River, as shown on Plates 3-1 and 3-2. The refinery was initially constructed in the 1920's and has had several different owners. The refinery was purchased by Total in April, 1978. Total was the last owner to operate the refinery, shutting down the refining operations in 1996. Ultramar Diamond Shamrock Corporation (UDS) acquired Total on September 25, 1997. On April 29, 1998 the company name was changed from Total to TPI Petroleum, Inc. (TPI). In January 2006 TPI a Michigan corporation, merged with and into Michigan Reutilization, LLC (MRLLC) a Michigan limited liability company, with Michigan Reutilization, LLC being the surviving entity. May 1, 2008, MRLLC sold certain of its assets and liabilities to MRP Properties Company, LLC.

Crude oil was supplied to the refinery via pipeline and trucks. The integrated refining processes included two crude fractionation units, HF alkylation, two catalytic reformers, gas plant, hydrocracker, propylene splitter, sulfur recovery plant and other supporting facilities.

The former refinery had a nominal operating capacity of 60,000 barrels per stream day. Refinery products included unleaded gasoline, liquefied petroleum gas (LPG), propylene, fuel oils, jet fuels, and asphalt. The refinery received approximately 85% of its crude oil supply by pipeline and transported approximately 85% of its refined products by pipeline. The remaining product was transported by truck.

In 1994, a major upgrade to the wastewater treatment plant (WWTP) was completed. The WWTP has an NPDES Permit issued under the provisions of the Clean Water Act. The API separator was converted to a lift station and closure of the #3A aerated lagoon was initiated. Two 1,000,000-gallon oil separation tanks and two bioreactors were installed. The separation tanks replaced the API separator and the bioreactors replaced the #3A aerated lagoon. Refining operations ceased in September 1996, and the Site was then used as an asphalt distribution

terminal. The asphalt is received from off-site sources via truck. The asphalt was mixed to specification prior to being transported off site via truck.

Asphalt terminal operations are currently active at the Site. Refinery process units and tank farm have been demolished.

3.2 Definition of Facility

The term facility is defined in 40 CFR 260.10 for purposes of this permit application. The facility includes the closed #1 and #2 surface impoundments, the closed #3A aerated lagoon, and the LTU.

3.3 Current Regulatory Status

The facility is required to close the Land Treatment Unit (LTU) consistent with the SWMUs at the site, provide post-closure care for the #1 Surface Impoundment, #2 Surface Impoundment, and the #3A Aerated Lagoon; perform groundwater compliance monitoring and corrective action for the Waste Management Area for the facility in accordance with the conditions of the post-closure care Permit. Treatment, storage or disposal of hazardous waste is not authorized.

The four hazardous waste management units at the facility which are subject to corrective action, in accordance with 40 CFR 264.100, are identified as #1 Surface Impoundment, #2 Surface Impoundment, #3A Aerated Lagoon, and the Land Treatment Unit. In accordance with 40 CFR 264.95(b)(2) and 264.97(b), the four hazardous waste management units have been incorporated into one waste management area for the purpose of groundwater monitoring and corrective action.

3.3.1 #1 and #2 Surface Impoundments Description

3.3.1.1 Operational Description

The #1 and #2 surface impoundments were operated as two oil skimming ponds. They have historically been referred to as the #1 and #2 oil skimming ponds, the #1 and #2 oil-water separator ponds, or as the #1 and #2 hazardous waste surface impoundments. Their location is shown on Plate 3-1. These units are also identified as SWMUs 1 and 2 in the RCRA Corrective Action Process.

The two surface impoundments were constructed and placed into operation in 1956. During operation, the #1 surface impoundment had a capacity of 1,152,000 gallons and the #2 surface impoundment had an approximate capacity of 761,250 gallons; both while providing 3 feet of freeboard. The surface areas of the #1 and #2 surface impoundments were approximately 0.50 acres and 0.33 acres, respectively. The surface impoundments would be considered unlined by current RCRA standards and were replaced by a concrete American Petroleum Institute (API) Separator System constructed in 1986.

When in operation, the two surface impoundments were used to recover oil emulsions from refinery process wastewater prior to further wastewater treatment. Wastewater first entered the #1 surface impoundment and then flowed to the #2 surface impoundment. The impoundments received oil-water emulsions passing through the oil traps in the refinery process wastewater sewer system. Floating oil and oil-water emulsions in the two surface impoundments were skimmed off. Oil was returned to the crude oil processing units. Oil-water emulsions were pumped to slop oil emulsion tanks and then transported to the refinery's land treatment unit (LTU). Grit, sediment, and heavy emulsions in the two surface impoundments sank to the bottom of the impoundments. The resulting bottom sludges were periodically dredged and taken to the refinery's land treatment unit. Sludges were removed from the #1 and #2 surface impoundments in 1976 and again during closure in 1987.

The primary function of the two surface impoundments was to clarify refinery wastewater prior to further treatment. The sludges which accumulated in the #1 and #2 surface impoundments were the same as API Separator Sludge, which today is the listed RCRA hazardous waste K051 and/or Slop Oil Emulsion Solids which is the listed RCRA hazardous waste K049. It was for this reason that the two surface impoundments were listed on the Part A application as hazardous waste management units. The two surface impoundments, primarily the #1 surface impoundment, also received cooling tower blowdown which had the potential to be considered D007 hazardous waste due to chromium content. At one point, there was a possibility that sludges in the #1 and #2 surface impoundments might have become classifiable as D003 hazardous waste due to sulfides content. Therefore, the two surface impoundments were also listed on the Part A as having the potential to receive or contain these additional waste codes.

3.3.1.2 Closure History

Following a formal request on November 30, 1984 by the KDHE for the Part B RCRA permit application, an interim status Closure and Post-Closure Plan was submitted for the two surface impoundments on May 24, 1985. As required by the EPA, a full Part B permit application for the #1 and #2 surface impoundments was also submitted to the KDHE in November, 1985. The 1985 Part B permit application for the two surface impoundments also contained a copy of a Closure and Post-Closure Plan which was styled after 40 CFR 264 regulatory citations. The interim status Closure and Post-Closure Plan for the two surface impoundments was revised and resubmitted on September 27, 1985 and again on November 13, 1985 following comments by the KDHE.

KDHE approved the Closure and Post-Closure Plan for the #1 and #2 surface impoundments on February 20, 1986. The approved Closure and Post-Closure Plan for the two surface impoundments contained a closure plan for clean closure by removal and decontamination under the then applicable regulations of 40 CFR 265.228(a) and (b) [now 265.228(a)(1)], and a contingency closure and post-closure plan for closure as a landfill under the then applicable regulation of 40 CFR 265.228(c) [now 265.228(a)(2)].

The approved Closure and Post-Closure Plan for the two surface impoundments contained a sampling methodology that was subsequently employed to determine whether post-closure would be required for each of the #1 and #2 surface impoundments. The approved methodology was essentially to remove waste liquids, sludges, and the uppermost soil in contact with sludges from the impoundments and then perform an approved program of sampling and analysis of the impoundment subsoil to determine which closure scenario was feasible and what remaining volume of soil would require removal in order to accomplish an approved closure by removal and decontamination under 40 CFR 265.228.

Based on the sampling and analytical results of subsoil in the #1 surface impoundment as summarized in an Interim Closure Report (February 10, 1988), it was proposed that the #1 surface impoundment would require closure under the Contingency Closure Plan of the approved Closure and Post-Closure Plan. This conclusion meant that the #1 surface impoundment would require closure as a landfill under 40 CFR 265.310 for the remaining soil and then be provided with post-closure care, as provided for in the approved Closure and Post-Closure Plan.

Based on the analytical results from subsoil in the #2 surface impoundment, the #2 surface impoundment was concluded and proposed to be successfully closed by removal and decontamination according to the approved Closure and Post-Closure Plan (as opposed to the Contingency Closure Plan) by removing an additional 18 to 24 inches of the underlying subsoil from the #2 surface impoundment. Removal of the additional soil from the #2 surface impoundment was planned to reach soil at background levels of total lead and chromium. Lead and chromium were identified and approved by the KDHE as the appropriate hazardous waste constituents of concern to consider for closure removal purposes. The additional removal of subsoil from the #2 surface impoundment was proposed to accomplish closure by removal under 40 CFR 265.228(a), after which post-closure care would not be applicable.

KDHE approved these proposed closure methods for the #1 and #2 surface impoundments in a letter on March 9, 1988. In the approval letter, KDHE approved closure of the #1 surface impoundment per the approved Contingency Closure Plan. The KDHE approved closure of the #2 surface impoundment according to the portion of the closure plan which provided for closure by removal and decontamination in accordance with the 40 CFR 265.228(a). The KDHE also approved and specified the additional amount of soil, 18 to 24 inches, required to be removed in order to accomplish closure by removal and decontamination for the #2 surface impoundment.

In the same correspondence, KDHE also stated that neither surface impoundment would be regarded as "clean closed" and that both would require post-closure care and permitting. Unfortunately, these issues regarding closure were not resolved. Closure of the #1 and #2 surface impoundments proceeded according to the specific itemized approvals provided by the KDHE and according to the previously approved Closure and Post-Closure Plan.

Closure of the two hazardous waste surface impoundments began in August 1987. Between August 19, 1987 and October 23, 1987, 47,436 barrels of oily sludge material were processed and removed from the two surface impoundments. In the processing of the oily sludge material, 1,265 cubic yards of dry solids were generated and disposed of at the Site hazardous waste LTU. The remaining bottom sludges were removed from the two surface impoundments between October 21 and November 19, 1987. A total of 7,817 cubic yards of bottom sludges were removed from the two impoundments and also disposed at the Site LTU. Sampling of the

underlying subsoil was then conducted in both impoundments according to the methodology approved by the KDHE. Laboratory analytical results were submitted to KDHE on February 10, 1988 with proposed approaches as to the completion of closure of each pond.

In accordance with the approved Closure and Post-Closure Plan for the #1 and #2 surface impoundments and in accordance with the approved closure completion method determinations, closure of the #1 surface impoundment was completed according to the Contingency Closure Plan by closing it as a landfill under 40 CFR 265.310 with respect to the remaining affected soils in the #1 surface impoundment. Closure of the #2 surface impoundment was completed by removing the additional 18 to 24 inches of soil from the #2 surface impoundment specified by KDHE. This soil was taken to the refinery's hazardous waste LTU for treatment and disposal. Due to reaching background levels of chromium and lead by removal of contaminated soil, the #2 surface impoundment was considered to be successfully closed under the then applicable regulation of 40 CFR 265.228(a).

3.3.1.3 Certification of Closure

On July 25, 1988, a certification of closure package was submitted for the two closed surface impoundments. The certification package included certifications of closure for the #1 and #2 surface impoundments by Site representatives and by an independent registered professional engineer as required by 40 CFR 265.115. These documents certified that the two surface impoundments were closed per the approved Closure and Post-Closure Plan, the #1 surface impoundment was closed per the approved Contingency Closure Plan, and the #2 surface impoundment was closed per the approved Closure Plan.

Also included in the closure certification package was the survey plat and legal description submitted in accordance with 40 CFR 265.116 and the post-closure notices submitted in accordance with 40 CFR 265.119. These submitted documents pertained to the closed #1 surface impoundment which was closed as a landfill. Copies of the KDHE approval of closure are attached in Appendix A.

On May 4, 1989, the KDHE requested that a Part B application for a RCRA Post-Closure Care Permit be submitted for both the #1 and #2 surface impoundments. On November 30, 1989, a

Part B Post-Closure Care Permit application was submitted to KDHE (Roberts/Schornick and Associates (RSA), 1989).

3.3.2 #3A Aerated Lagoon Description

3.3.2.1 Operational Description

The #3A aerated lagoon operated as an aggressive biological treatment unit, within the refinery's wastewater treatment system until September 21, 1994. The #3A aerated lagoon was an irregularly shaped surface impoundment that is approximately 200 feet by 200 feet and covers approximately 35,700 square feet. During operation, the lagoon had sloping walls which varied between a 2:1 and 4:1 ratio of horizontal to vertical and had a freeboard of 2.42 feet.

The #3A aerated lagoon was created in 1990 as a sub-unit of the previously existing #3 aerated lagoon. The former #3 aerated lagoon was reconstructed by subdividing it and constructing the #3A aerated lagoon and the #3B aerated lagoon. This reconstruction was completed before the effective date of the RCRA toxicity characteristic (TC) regulations of September 25, 1990 (Section 2.5 of Part B Permit Renewal Application (RSA, November 1992)). During reconstruction, the #3 aerated lagoon was drained, sludges were removed, the dike that separated the #3A aerated lagoon and the #3B aerated lagoon was constructed, bottom soil was compacted, and construction of new appurtenant features and equipment were added. This work was completed before September 24, 1990.

The design volume of the #3A aerated lagoon at its maximum operating capacity was approximately 252,600 cubic feet or approximately 1,889,500 gallons. During peak operation, the lagoon had an influent flow rate of up to 900 gallons per minute, and a hydraulic retention time of approximately 1.5 days. The lagoon was equipped with three 10-horsepower (hp) aerators mounted on floating tri-pontoon assemblies. To satisfy the definition of aggressive biological treatment by high rate aeration, a minimum of 6 hp per million gallons of treatment volume is required per 40 CFR Section 261.31 (b)(2). The #3A aerated lagoon had 30 hp of aeration which exceeds the calculated minimum requirement of 11.3 hp for the #3A Aerated lagoon. Based on this evaluation, the #3A aerated lagoon met the definition of an aggressive biological treatment unit.

The wastes managed at the #3A aerated lagoon were petroleum refinery wastewater. The wastewater that entered the #3A aerated lagoon exhibited benzene toxicity (hazardous waste code D018) during operation. Immediately upon entering the #3A aerated lagoon, the wastewater lost the benzene characteristic due to the aggressive biological treatment. During closure activities, both the sludge and wastewater were characterized and were determined to be non-hazardous.

3.3.2.2 Closure Plan History

As stated previously, the unit ceased accepting waste on or before September 21, 1994. During September and October 1994, the wastewater and sludge were removed from the lagoon. The wastewater was treated utilizing the on-site treatment plant. The sludge was characterized, and confirmed to be non-hazardous then applied to the land treatment unit. Following excavation or removal of the sludge, verification samples were collected on October 24, 1994 and submitted for analysis.

On October 21, 1994, a draft Closure Plan for the #3A aerated lagoon was submitted to KDHE. Several revised Closure Plans were subsequently submitted to KDHE. On May 2, 1997, KDHE approved the closure plan dated April 30, 1997 (EnecoTech, 1997).

As a result of discussions with KDHE, the #3A aerated lagoon was closed in accordance with 40 CFR Section 265.228, by removing soil impacted above the KDHE risk-based closure cleanup standards for soil, with provisions for post-closure care and monitoring. Risk-based closure of the soil enables construction over the unit in accordance with the provisions of 40 CFR Section 265.117(c)(1). However, there has been no such construction and at this time there are no plans for post-closure construction on the unit.

The closure approach described in Section 4.4 of the approved closure plan (EnecoTech, 1997) was to remove soil that exceeded the KDHE risk-based non-residential closure cleanup standards, or alternate cleanup goals discussed in the contingent closure.

The approach for the risk-based soil closure for the #3A aerated lagoon consisted of:

1. Soil sampling and comparison of soil analytical results with KDHE risk-based cleanup standards;
2. Decontamination of all appurtenances and equipment;
3. Backfilling the #3A aerated lagoon with clean fill;
4. Submittal of required closure certification in accordance with 40 CFR Section 265.115; and,
5. Performance of post-closure care.

The soil sampling prescribed in the approved closure plan was performed on May 28 and May 29, 1997. The #3A aerated lagoon was divided into four quadrants. Four soil samples were collected from each quadrant from each depth interval at uniformly spaced sample locations as described in the approved closure plan. The entire soil sampling event was observed by Ms. Andrea Austin of the KDHE on November 12, 1997.

The flume connecting the former #3A aerated lagoon and the #3B lagoon was decontaminated by high pressure power washing. This work was performed on June 5, 1997 by RUST Industrial Cleaning Service located in Ponca City, Oklahoma.

The runoff and over spray from the power washing was collected and contained on plastic sheeting setup to catch runoff. Liquid and solids were vacuumed into a vac-truck and then placed in the refinery wastewater treatment system. Approximately 450 gallons of potable water was used in the power washing.

Based upon the results of the soil sampling and discussions with KDHE staff, closure of the #3A aerated lagoon proceeded by backfilling with clean fill material as described in the approved closure plan.

The backfilling began on January 13, 1998, and was completed on January 23, 1998. The backfilling was supervised by Al Oakes, P.E. Mr. Oakes is a professional engineer registered in the State of Kansas. Following recommendations provided by Mr. Barry Barber, District Conservationist with the United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) in Winfield, Kansas, Ms. Andrea Austin of the KDHE agreed that

the 2-foot protective surficial layer specified in the approved closure plan could be changed to 1 foot in thickness. A copy of Mr. Barber's communication and the documentation specifying the seed mixture used for the final cover are included in the RCRA Closure Report (EnecoTech, 1998) attached as Appendix C.

The property deed was amended within 60 days of KDHE's approval of this closure report and closure certification, in accordance with Kansas State law.

The refinery property deed indicates that the specific land area has been used to manage hazardous waste, which use is restricted under 40 CFR Section 265 Subpart G regulations, and that a survey plat and record of type, location, and quantity of disposed hazardous waste is on file with the Registrar of Deeds.

3.3.2.3 Closure Certification

A RCRA Closure Report and Certification was submitted to KDHE on February 6, 1998 (EnecoTech, 1998), and is included as Appendix C. The report describes the closure activities completed, sample analytical results and certification that the activities were completed in accordance with the approved closure plan.

3.3.3 Land Treatment Unit (LTU) Description

3.3.3.1 Operational Description

The land treatment unit was constructed in June 1981 and was historically used to treat hazardous and non-hazardous refinery wastes. The LTU is divided into two cells (plot A and B). Plot A is approximately 2.22 acres and plot B is approximately 1.63 acres.

On September 13, 1985, a RCRA Part B Application for the LTU was submitted. On November 16, 1987, KDHE and EPA issued a RCRA permit. The LTU was permitted to accept hazardous and non-hazardous refinery waste streams. Typical hazardous wastes applied to the LTU include slop oil emulsion solids, heat exchanger bundle cleaning sludge, tank bottoms, API oil-water separator sludge, oily coke deposits, cooling tower sludges, and dissolved air floatation (DAF) sludge. Non-hazardous wastes managed have included items such as activated charcoal, bauxite, mole sieve, attapulgus clay, oily impacted soils, oily coke deposits, and tank bottoms. Alkyl

neutralization pit sludge and bottom sludge from the surface impoundments #1 and #2, and the #3A aeration lagoon were also applied to the LTU. Sludge from impoundments #1 and #2 were applied to the LTU during their closure that occurred between August and October of 1987. The sludge from aeration lagoon #3A was applied to the LTU in September of 1994. Before November 8, 1990, the LTU ceased accepting hazardous waste because of Land Disposal Regulation. The LTU continued to accepting non-hazardous waste as allowed under the delay of closure rule until 1997.

The following summarizes the operating conditions for the LTU:

- Wastes were only applied annually from April through October 1997.
- Wastes were not applied during heavy precipitation.
- Waste was applied evenly and tilled in as soon as practical to facilitate aeration.
- Soil pH was maintained between 6.5 and 8.0.
- Additional tilling and fertilization was conducted as needed to facilitate degradation of contaminants.
- Quarterly groundwater sampling pursuant to the groundwater monitoring plan was conducted.
- Annual soil core samples were collected and analyzed.
- Biannual Lysimeter Sampling was performed and analyzed.

Closure of the LTU was initiated on August 1, 1998. Pursuant to a Permit modification on September 19, 2002, the LTU closure plan was modified providing for closure of the LTU consistent with the corrective action requirements for the Solid Waste Management Units (SWMUs).

3.3.3.2 Closure History

Notification of intent to close the LTU was submitted to KDHE November 6, 1997 and the closure period began August 1, 1998. The LTU closure plan was modified in January 2000, September 2002, and August 2005.

3.4 Topographic Map

Two topographic maps are provided as Plate 3-1 and Plate 3-2. Plate 3-1 was developed from a 2005 orthorectified aerial photograph and ground control survey. The map scale is 1 inch equal to 200 feet. As a result of the scale, the map provides excellent presentation of the information required by 40 CFR 270.14(b)(19). Plate 3-2 with a scale of 1 inch equal to 1,000 feet also fulfills the surrounding land use requirements of 40 CFR 270.14(b)(19). In addition to the information shown on Plates 3-1 and 3-2, the remaining topographic map requirements are fulfilled on Figures 15-2; 100-year floodplain area and 15-6; injection and withdrawal wells within a three mile radius. Specific items of information are noted as follows:

1. Low-lying portions of the refinery site are considered to be in the 100-year flood plain area. Specific boundaries concerning flood plain information are shown on Figure 15-2.
2. Surface-water courses either are labeled or are interpretable from the topographic map. Predominant features are the Walnut River to the north and east, and the Arkansas River to the south of the Site.
3. Surrounding land uses are shown on Plate 3-2. The majority of the land surrounding the refinery is agricultural. Residential areas are located to the west, northwest, and northeast of the refinery. The Arkansas City wastewater treatment plant is located southwest of the Site. A large grain elevator borders the Site to the north.
4. The wind rose shown on Plate 3-1 was developed from 2001-2009 data collected at the City of Wichita Mid-Continent Airport and compiled by the National Climatic Data Center. This is the nearest weather station with sufficient wind data.
5. The north orientation is as shown on the topographic maps.
6. Legal boundaries of the Site are shown on Plate 3-1.
7. Security features are established for the Site consisting of a security fence encompassing the entire Site.
8. There are a number of groundwater withdrawal wells located on and near the Site. Plate 3-1 shows the on-site recovery wells and the Waste Management Area monitor well network. Groundwater withdrawal wells near the Site (i.e., within 3 miles) are shown on Figure 15-6.

9. Most major buildings and other structures at the Site are readily apparent on the aerial photograph associated with the topographic map.
10. An important flood control feature is the existing U.S. Army Corps of Engineers levee along the Walnut River. The levee along the eastern side of the Site has been constructed with a crest elevation 1070.0. The levee crest is visible on the Plate 3-1 topographic contours; and the levee outline is labeled for clarity.
11. Hazardous waste management units are indicated on the topographic map. The hazardous waste management units which are subject to permitting regulations are the LTU, closed #1 and #2 surface impoundments, and the closed #3A aerated lagoon.

SECTION 4

Waste Analysis

4.0 WASTE ANALYSIS 40 CFR 270.14(b)(3)

The information presented in this section will provide a historical overview of the wastes managed at each of the regulated units and the characteristics of each waste stream. Both of the surface impoundments have been closed in accordance with KDHE approved closure plans and certified closed. On or before November 8, 1990, the LTU stopped accepting hazardous waste and, as of the date of this application, it no longer accepts non-hazardous waste. Closure of the LTU was initiated on August 1, 1998.

This section will provide a description of the wastes managed at each unit, characteristics of the waste streams, and amendments to the waste analysis plan to reflect closure of the units.

4.1 Waste Stream Descriptions and Characterizations (40 CFR 270.14(b)(2))

The processes involved in generating wastes and the waste descriptions for constituents applied to the closed surface impoundments #1 and #2, the closed #3A aerated lagoon, and the LTU are described below.

4.2 Closed Surface Impoundments #1 and #2 (40 CFR 270.14(b)(2))

The #1 and #2 surface impoundments were operated as two oil skimming ponds. The two impoundments were operated in a series to recover oil and oil-water emulsions from refinery process wastewater prior to further wastewater treatment. The impoundments were used to process oily water that consisted of a water phase, oil phase, emulsions phase (mixture), and solids. The recovered free oil was returned to the refining process to be re-refined into usable petroleum products. The slop oil emulsion solids and dredged sludges were sent to the LTU for treatment. The water phase went to the aeration and oxidation ponds for further treatment prior to discharge under the facility's NPDES permit.

The waste streams generated in this unit were K051, K049, and D007 RCRA hazardous wastes. K051 waste is API separator sludge from the petroleum refining industry and is listed due to its potential hexavalent chromium and lead toxicity. K049 waste is slop oil emulsion solids from the refinery operations and is listed due to its potential hexavalent chromium and lead toxicity. D007 waste is hazardous waste that is hazardous due to its chromium toxicity.

The analysis for the API separator solids and slop oil emulsions can be found in Appendix D.

The K049 (slop oil emulsions) and K050 (API separator sludge) from surface impoundments #1 and #2 were sent to the LTU for land treatment under its permit.

The KDHE approved closure plan for surface impoundments #1 and #2 identified lead and chromium as contaminants of concern in the sludge from these impoundments that required analysis during closure.

4.2.1 Closed #3A Aerated Lagoon

The #3A aerated lagoon processed treated refinery wastewater. Prior to entering the #3A aerated lagoon, the refinery process water was processed through an API separator which removed the free oil and an induced air floatation (IAF) unit which removed the oil-water emulsions.

The characteristics of wastewater entering the #3A aerated lagoon exhibited the toxicity characteristic (TC) for benzene (waste code D018). Upon entry into the #3A aerated lagoon, the wastewater lost its TC for benzene due to the biological treatment provided by the lagoon system. Prior to initiating closure, the water and sludge in the lagoon were characterized and determined to be non-hazardous. The analysis is included in Appendix E.

4.3 Land Treatment Unit (40 CFR 264.13(b))

The LTU consists of two plots designated as Plot A (north) and Plot B (south). The LTU is a land farming treatment system for biological degradation of petroleum constituents. The LTU was permitted to accept hazardous and non-hazardous refinery waste streams. Typical hazardous waste streams applied to the LTU include slop oil emulsion solids, heat exchanger bundle cleaning sludge, tank bottoms, API separator sludge, oily coke deposits, cooling tower sludges, and dissolved air floatation (DAF) sludge. Non-hazardous wastes managed have included activated charcoal, Bauxite, mole sieve, attapulgus clay, oily contaminated soils, non-hazardous oily coke deposits, tank bottoms, oily residues from the crude oil pipeline system, as well as wastes derived from tank clean-out operations. Since November 8, 1990, only non-hazardous waste streams were managed at the LTU.

The characteristics of the waste streams were variable. The waste streams were characterized as required under the existing waste analysis plan. The methods of characterization included: waste sampling and laboratory analysis, process knowledge, and knowledge of the characteristics of the source materials. Waste streams were characterized on a periodic basis to determine if the characteristics had changed. Appendices D, E, and F contains representative waste characterization information for waste streams managed at the LTU. This information supplements the characterization data provided in the 1992 Application (a copy of the analytical summary is included in Appendix F).

An estimated annual quantity for each of these wastes in addition to other miscellaneous wastes applied to the LTU are identified in Table 4-1. This table summarizes the quantities of waste applied to the LTU for the time period from 1990 to 1997. No waste was applied after 1997.

Some of the large volumes of waste are summarized below:

- In 1990 and 1994 large portions of the waste applied to the LTU consisted of 3A lagoon sludge. Laboratory data of the 3A lagoon sludge is included in the waste characterization section in Appendix E.
- In 1987, a total of 13,882,000 pounds of waste were applied to the LTU. Eighty percent (80%) of the waste was from the clean-out of the #1 and the #2 hazardous waste surface impoundments. Characterization information on 1981-1987 wastes were presented in the Land Treatment Demonstration Report submitted to KDHE on November 17, 1988 (Radian, 1988).
- In 1986, 968,000 pounds of slop oil emulsions, 568,000 pounds of API separator sludge and approximately 2,000 pounds of leaded tank bottoms sludge were applied to the LTU.
- Between 1981 and 1985, slop oil emulsion wastes were deposited at the LTU. Slop oil emulsion wastes include oily wastes from refinery operations and oily residues from the crude oil pipeline system, as well as wastes derived from tank clean-out operations.

4.4 Waste Analysis Plan (40 CFR 270.14(b) and (c), 264.13(b), 264.113(d)

The LTU is not accepting waste at the time of this application. The closure period for the unit was initiated in August 1, 1998. The effective date of this permit will be after the initiation of

corrective action activities. Therefore, a waste analysis plan has not been developed for continued use of the unit. This is consistent with the post-closure permit application requirements set forth in 40 CFR 270.28.

4.4.1 Hazardous Waste Management Unit Past Process and Closure Design

The basic waste operations and closure methods are described for surface impoundments #1 and #2, the closed #3A aerated lagoon, and the LTU in Section 12 of this application.

SECTION 5

Security

5.0 SECURITY (40 CFR 270.14(b)(4))

The LTU, the closed #3A aerated lagoon, and the closed #1 and #2 surface impoundments are located within the interior of the Site. An established security system is operated and maintained for the entire Site which is designed to prevent unknowing entry and to minimize the possibility for the unauthorized entry of persons or livestock into the refinery, including the areas of permitted hazardous waste management units.

Access to the Site is restricted by a fence that encompasses the entire property boundary. This fence was installed as an added security measure in accordance with 40 CFR 264.14(b)(2). Entrance gates at the refinery are either locked or guarded at all times in accordance with 40 CFR 264.14(b)(2)(ii). Operations personnel provide surveillance inside the Site during business hours.

Under 40 CFR 264.14(c) there are two warning signs posted at the LTU, as additional security measures. The signs bear the legend, "Danger - Keep Out - Authorized Personnel Only". The signs are legible from a distance of 25 feet.

The closure design of the #1 and #2 surface impoundments and the #3A aerated lagoon minimizes the requirement for a separate additional security system under 264.14(a) by precluding the possibility of physical contact with waste or waste contaminated structures, because they were physically removed during closure. Further, the possibility that unauthorized entry could disturb any of the potentially contaminated subsoil in the capped #1 and #2 surface impoundments is precluded by the cap and final cover design.

Regardless of the reduced need for security provisions under 264.14(a)(1) and (2), the facility will continue to provide security in the form of a chain-link fence, for the closed #1 and #2 surface impoundments, the closed #3A aerated lagoon and the LTU during the post-closure period, as part of the Site-wide security system.

SECTION 6

Inspection Schedule

6.0 INSPECTION SCHEDULE (40 CFR 270.14 (b)(5))

An inspection of each active regulated hazardous waste management unit which includes the sections of the LTU, will be conducted weekly and within one day after major storm events (more than 3 inches of precipitation in 24 hours), excluding holidays and weekends. These inspections will be conducted until final closure of the LTU is approved. The closed regulated hazardous waste management units, which include #1 and #2 surface impoundments and #3A aerated lagoon will be inspected at least once every six months. Inspections as discussed in Sections 6.1 and 6.2 will be made by the facility staff or other designated personnel. All inspectors will be properly trained as discussed in Section 11.0.

The purpose of each inspection is to detect any deterioration, malfunction or failure of run-on and runoff controls, unit or equipment failure, malfunction, or deterioration associated with the Facility that might represent an operating problem or a hazard to human health or the environment. Any problem detected during an inspection will be reported to the Senior Environmental Specialist immediately upon completion of the inspection. The Senior Environmental Specialist will be responsible for initiating action in response to problems identified during an inspection. Written inspection logs of these inspections will be maintained at the Site.

The results of each inspection will be recorded on inspection log sheets. Typical Blank Inspection Log Sheets for the LTU and for the closed units (#1, #2 and #3A) are provided as Tables 6-1 and 6-2. The inspections will include visual inspection for deterioration, malfunctions, or improper operation of run-on and runoff controls. The log for each inspection will include the date and time of the inspection, the printed inspector's name, the inspector’s signature, a notation of observations, and the date and nature of any repairs or other corrective actions taken. These typical forms may be modified as needed, but will include the items described above at a minimum.

All problems noted during an inspection will be corrected in a timely fashion to minimize hazards. Corrective action will be taken immediately if a hazard is imminent or already exists. The Contingency Plan and the Facility Emergency Plan will be implemented, if determined to be

necessary by the Senior Environmental Specialist, in response to an imminent or actual emergency.

General Facility communications, safety and emergency equipment, security devices, and monitoring equipment may be used to support safe operation at the facility, but are not specifically required or required to be inspected by this plan.

Specific inspection procedures for each regulated hazardous waste management unit are described in the following sections.

6.1 Land Treatment Unit Inspection

An inspection log sheet is provided as Table 6-1. The inspections will be conducted on a weekly basis or within one day after major storm events (more than 3 inches of precipitation in 24 hours), excluding holidays and weekends during closure of the unit. The inspector will observe and note the condition of each of the following items for proper function during the inspection of the units and surrounding area:

Land Treatment Unit

1. Check for rainwater accumulation.
2. If water is trapped, check the pump that transfers back to the wastewater system. Notify the Senior Environmental Specialist if the pump will not turn on under high level conditions.
3. Check all dikes for evidence of erosion or other damage.
4. Check condition of warning signs.

Groundwater Monitoring Wells near the LTU

1. Check for damage to outer components of each well.
2. Check that locks are present and well caps are locked.
3. Check for erosion or standing water at well pad or casing.
4. All other components are inspected during groundwater sampling events.

Upon final closure of the LTU, inspections will be conducted as outlined in 6.2. This will reduce the inspection frequency to once every six months.

6.2 Post-Closure Inspection of Surface Impoundments #1, #2, and #3A Aerated Lagoon Units

A post-closure inspection log sheet is provided as Table 6-2. Post-closure inspections of the three closed units will be performed every six months. Inspections will also be performed after any flood event that causes flood waters to contact the final cover of the closed units. The inspector will observe and note the condition of each of the following items for proper function:

Closed #1 and #2 and #3A Units

1. Check the compacted clay cap (Closed Surface Impoundment #1) for signs of settlement, subsidence, erosion, standing water, and other damage.
2. Check for any damage that might have been caused by improper run-on from surrounding units.
3. Check for adequate drainage from the unit and for any erosion damage that might have been caused by runoff.
4. Check for adequate vegetative cover. Note any stressed vegetation. Also note if the vegetative cover requires mowing or other maintenance.

General Inspection Items for the Area Surrounding the Closed #1 and #2 and #3A Units

1. Note any unauthorized use of the closed areas.
2. Check that all warning signs are present and legible.

Groundwater Monitoring Wells

1. Check for damage to outer components of each well.
2. Check that locks are present and well caps are locked.
3. Check for erosion or standing water at well pad or casing.
4. All other components are inspected during groundwater sampling events.

The semi-annual inspection schedule is designed to be frequent enough to identify and correct problems at the closed surface impoundments before significant deterioration can develop.

Copies of all completed post-closure inspection records will be maintained in an inspection log file and kept at the facility for at least three years following the date of inspections.

SECTION 7

Contingency Plan

7.0 CONTINGENCY PLAN (40 CFR 270.14(b)(7))

7.1 Introduction

A copy of the Contingency Plan is provided in Appendix G of this document. The Contingency Plan is designed to minimize the hazards to human health or the environment from fires, explosions, or any unplanned sudden or non-sudden release of hazardous waste constituents to air, soil, or surface water. The Contingency Plan will be implemented whenever the Incident Commander determines that there is an imminent or actual emergency situation. The term Incident Commander as used in the Contingency Plan is equivalent to the term Emergency Coordinator as used in the regulations.

The Incident Commander has the authority to order any reasonable measures, including the stoppage of facility operations and processes, to ensure that fires, explosions, and releases of hazardous waste do not occur, recur, or spread. The primary Incident Commander and all alternates are listed in Appendix G. All persons listed as Incident Commanders are qualified to coordinate all emergency response measures, are familiar with the responsibilities of the Incident Commander, operations and activities at the facility, the location and characteristics of hazardous wastes stored at the facility, the location of all records located at the facility, and the facility layout. All alternate Incident Commanders have the authority to commit the resources required to implement the Contingency Plan.

7.2 Implementation of the Contingency Plan

The decision to implement the Contingency Plan will be based on the determination of whether an imminent or actual danger is presented by a situation that could threaten human health or the environment. The Incident Commander will use professional judgment to determine if any fire, spill, release, or flooding conditions involving hazardous waste require the implementation of the Contingency Plan. The Incident Commander will determine if the implementation of the Contingency Plan also requires the evacuation of the facility or surrounding areas. The Incident Commander will also determine if it is necessary to designate a spokesperson to advise persons outside the facility of any situation on-going inside the facility.

After the implementation of the Contingency Plan, any emergency equipment used will be cleaned so that it is fit for reuse, or it will be replaced. The Secretary of the KDHE will be notified that post-emergency equipment maintenance has been completed and that facility operations have resumed.

Copies of coordination agreements made with local authorities are provided in an attachment to the Contingency Plan. It should be noted that the facility depends on agreements made with local emergency response authorities to provide assistance requiring police and medical services. The fire department will be contacted for situations requiring fighting equipment not included in the contingency plan. Facility personnel will respond to hazardous waste issues.

Upon completion of any response action taken in accordance with the Contingency Plan, the Incident Commander will immediately notify the Secretary of the KDHE that all follow-up actions required by 40 CFR 264.56(h) have been completed. This notification will be made before normal operations are resumed in the area where the emergency incident occurred.

The Incident Commander will note in the facility operating record, the time, date, and details of any emergency incident that requires the implementation of the Contingency Plan. A telephone report will also be made to the Secretary of the KDHE within 24 hours of the identification of a release and a written report will be provided within 15 days of the any emergency incident that requires the implementation of the Contingency Plan. The written report will contain the following information:

- The name, address, and telephone number of the facility.
- The date, time, and type of an emergency incident.
- A description of the type and quantity of materials/waste involved.
- The extent of any injuries.

An assessment of any actual or potential disposition of any materials/waste recovered as a result of response to the incident.

7.3 Amendment of Contingency Plan

The contingency plan will be reviewed, and immediately amended, if necessary, whenever:

- The facility permit is revised;
- The plan fails in an emergency;
- The facility changes in its design, construction, operation, maintenance, or other circumstances in a way that increases the potential for fires, explosions, or releases of hazardous waste or hazardous waste constituents, or changes the response required in an emergency;
- The list of emergency coordinators changes; or
- The list of emergency equipment changes.

The modification of the contingency plan will be made in accordance with 40 CFR 270.42.

SECTION 8

Emergency Preparedness and Prevention

8.0 EMERGENCY PREPAREDNESS AND PREVENTION (40 CFR 270.14(b)(8) and (9))

Emergency preparedness and prevention procedures are provided in the Contingency Plan, Appendix G. The hazardous waste management units at the facility are designed, constructed, maintained, and operated to minimize the possibility of fire, explosion, or any unplanned sudden or non-sudden release of hazardous waste or hazardous waste constituents to air, soil, surface water, or groundwater.

Personnel involved in hazardous waste activities at the facility have access to emergency services via cellular phones at all times. Information concerning emergency conditions will be issued to all employees via cellular phone.

Due to the reduction in Site activity, demolition of the process units and tank farm, and the closure of hazardous waste management units, hazardous wastes are not handled in quantities that exceed 55 gallons. When handled, efforts are taken to limit hazards in loading operations, runoff from hazardous waste handling areas to other areas of the facility, undue exposure of personnel to hazardous waste, and releases to atmosphere. This is accomplished by only allowing trained personnel to handle hazardous waste, keeping the waste in areas that provide secondary containment and prevent runoff and flooding, providing proper personal protective equipment to facility personnel if required, and by keeping all containers closed except when adding waste.

The contingency plan details procedures and responsibilities that will be utilized during any emergency that requires the implementation of the plan.

6/10/11

SECTION 9

Traffic Information

9.0 TRAFFIC INFORMATION (40 CFR 270.14(b)(10)

Access to the Site is provided by U.S. Highway 166 bypass (County Road 77) onto Mill Road. The main plant entrance is located at the intersection of Mill Road and South 'M' Street. The Mill Road and South 'M' Street are both two lane, asphalt roads. Traffic enters the Site through the main gate. The main gate is secured with a lock. A chain-link security fence surrounds the Site perimeter and gates, which are normally locked, prevent unauthorized vehicle entry. The speed limit is posted on major roads within the Site and is 15 mph in the asphalt terminal and 25 mph elsewhere.

Vehicle traffic is limited to supporting asphalt operations, decommissioning activities, scheduled environmental monitoring activities and other miscellaneous operations. The total number of vehicles operated in the Site varies, but generally no more than 10 vehicles would be operating within the Site at any one time. Asphalt tank trucks are the heaviest vehicles to be used on the plant roads.

Routine vehicle traffic consists mainly of asphalt loading and unloading operations. Asphalt operations are mainly in the northern portion of the plant, to the north of the railroad tracks. Additional asphalt storage in the southern portion of the plant in tank L-30 also occurs. Additional traffic within the facility is routed on access roads. Tank trucks carrying asphalt out of the Site, travel from the northern portion of the Site, through the front gate onto public roads.

There are no longer any vehicles routinely involved in hazardous waste transfer operations for the #1 and #2 surface impoundments, #3A aerated lagoon, and the land treatment unit. Non-routine activities include one-half ton to three-ton trucks used for maintenance, well sampling, and inspections.

Existing facility roads provide satisfactory access to the LTU closed surface impoundments #1 and #2, and closed #3A aerated lagoon for inspection and maintenance purposes. Roads inside the Site consist of both paved and gravel surfaces. Paved roads are used in the asphalt terminal area where the most traffic occurs. Gravel roads give access to the less heavily traveled areas, including the LTU, the #1 and #2 surface impoundments and #3A aerated lagoon unit. The design and construction of both paved and gravel roads conform to Kansas Department of

Transportation requirements. Asphalt patch material is used for maintenance of paved roads, and gravel fill material is applied periodically to non-paved roads as preventive maintenance.

SECTION 10

Location Information

10.0 LOCATION INFORMATION 40 CFR 270.14(b)(11)

10.1 Seismic Information (40 CFR 270.14(b)(11)(i))

The Site is located in Cowley County, Kansas, which is not listed in Appendix VI of 40 CFR 264. Therefore, no further demonstration for the seismic standard of 264.18(a) is required.

10.2 Fault Information (40 CFR 270.14(b)(11)(ii)(A)

There are no faults within 3000 feet of the Site (Merriam, 1963), (USGS, 2011).

10.3 Flood Plain Information (40 CFR 270.14(b)(11)(iii))

The Site is located between the Walnut River and the Arkansas River. The eastern boundary of the Site is approximately ½ mile upstream of the confluence of the two rivers. The topography at the Site varies from 1,045 feet above mean sea level (AMSL) (east side of Site) to 1,078 feet AMSL (near southern boundary). The approximate berm elevations at the regulated units are summarized below:

- surface impoundments #1 and #2, and #3A aerated lagoon: 1,069 AMSL
- land treatment unit: 1,070 AMSL

The 100-year flood area at the refinery is delineated on the Flood Insurance Rate Map (FIRM) for Cowley County, Kansas and Incorporated Areas (FEMA, 2010). A copy of this map is included in Appendix H. Based on the FIRM, the four regulated units are located outside the 100 year flood area.

During the permitting process for the LTU, KDHE approved construction of the dikes around the LTU with a design elevation of 1,070 feet AMSL.

The Army Corps of Engineers has constructed a levee system along the Walnut River to protect Arkansas City including the Site from floods. The elevation and design of the levee system and structural characteristics were designed to protect the facility against the 100-year flood elevation and have taken into account the hydrodynamic and hydrostatic forces of the river. These existing levees surrounding the Site range in elevation between 1,070 and 1075 feet AMSL in most areas.

The Army Corps of Engineers levee system is designed to protect the area that includes the regulated units from the 100-year flood. Because the regulated surface impoundments (#1 and #2 and #3A aerated lagoon) are closed, flooding of the area would cause no adverse effect to the environment. Immediately following a flood event, as prescribed in Section 6, the surface impoundments would be inspected and any damage to the protective cover would be repaired. The LTU is protected by a dike with an approved design elevation of 1,070 feet AMSL. If a flood were to breach the levee system, the water reaching the LTU would have a substantially reduced velocity and thus a relatively substantial reduced ability to erode the dike protecting the LTU.

Based upon the above analysis, the permitted units are sufficiently protected from damage due to flooding of the Walnut and Arkansas Rivers.

SECTION 11

Personnel Training

11.0 PERSONNEL TRAINING (40 CFR 270.14(b)(12))

11.1 Training Plan

Personnel involved in hazardous waste management, post-closure care and monitoring are required to undergo an initial and continuing training program designed to ensure safe and efficient handling of hazardous waste and to maintain compliance with applicable regulations found in 40 CFR 264.16. The training consists of a program of initial classroom instruction or on-the-job training, a general terminal safety program, specific training for hazardous waste management operations that teaches them to perform their duties in a way that ensures the facility's compliance and the operation of the hazardous waste management units located at the facility.

Employees will complete the required training within six months of the date of their employment or assignment at the facility, or when they are moved to a new position at the facility. Employees hired will not work in unsupervised positions until they have completed the training requirements covered in the following sections.

11.1.1 Initial Training Program

The initial training program consists of classroom instruction directed by a person trained in hazardous waste management procedures and includes instruction which teaches facility personnel hazardous waste management procedures (including contingency plan implementation) relevant to the positions in which they are employed. The majority of the information provided is supplied by two training videos. The videos provide general information concerning the management of hazardous waste and information about the training required before employees can handle hazardous wastes. The information covered includes: an overview of the regulatory framework covering hazardous waste, defining hazardous wastes, segregation of wastes (incompatible waste), proper labeling of waste, container management, accumulation start dates, waste determination, proper disposal of hazardous waste, cradle-to-grave manifest system, contingency plan, emergency procedures, and personal protective equipment.

11.1.2 General Refinery Safety Training

Qualified Site personnel train new employees in general Site safety and contingency plan procedures. These procedures include plant safety, emergency procedures, emergency equipment, fire prevention and control, spill prevention and control, contingency plan implementation, safe waste loading and unloading, proper inspection of facilities and equipment, and proper record keeping. Employees are trained in the following emergency response procedures:

1. Use, inspection, repair, and replacement of monitoring and emergency equipment.
2. Use of the communication systems that consist oftelephones and cellular telephone.
3. Response to chemical hazards.
4. Use of personnel protective equipment required for the job function.
5. Response to fire, explosion, or spills, including use of the proper fire extinguishing agent for a particular type of fire, and proper containment practices for spills.
6. Response to groundwater contamination incidents.
7. Shutdown of operations.
8. Implementation of contingency plans.

11.1.3 Specific Training for Hazardous Waste Management Operations

Employees are also trained according to their specific job descriptions where they involve hazardous waste management activities. Training provided includes:

1. Operational procedures for the specific area.
2. The hazards of the waste managed in the area.
1. Facility monitoring and inspection procedures specific to the activity.
2. Post-closure care and monitoring.
5. Record keeping and any reporting requirements.
6. Spill response and proper disposal of any hazardous waste cleaned-up.
7. Implementation of emergency and contingency plans.

11.1.4 Training Review

Personnel assigned to areas involved in hazardous waste management activities are required to complete an annual Continuing Training Program. The annual training will include a review of the hazardous waste training information presented in the initial training as well as any new information relevant to the handling of hazardous waste. The annual training will include the following subjects:

1. Review of hazardous waste characteristics.
2. Use of personnel protective equipment.
3. Hazardous waste management procedures.
4. Emergency response plans including any changes in facility operations.
5. New or revised regulatory requirements.
6. Review of any incidents involving hazardous wastes since the last annual training.
7. Review of the contingency plan and its implementation.

11.2 Provisions for Implementing the Training Program

All new employees will complete the required training within six months of beginning employment. During the initial six months of employment, on-the-job training will be provided by a supervisor that has completed the required training, in each of the preceding subject areas.

11.3 Continuing Training

In addition to the initial and annual training provided to facility personnel, outside training resources may be utilized to supplement the required training. Personnel may be trained by various private companies or governmental agencies to meet the requirements for hazardous waste operators as specified in 29 CFR 1910.120.

11.4 Job Titles and Job Descriptions

Environmental Manager: The Environmental Manager is responsible for ensuring that personnel receive the required training from qualified personnel or other sources, regarding all aspects of hazardous waste management at the facility. The Environmental Manager will periodically attend formal seminars on hazardous waste management. The Environmental Manager for the

facility is not located at the facility. However, through periodic visits, established compliance programs, and supervision of operation personnel, the Environmental Manager will support compliance of the facility.

Senior Environmental Specialist: The Senior Environmental Specialist is responsible for overall operation of the facility and operational compliance with environmental permits. The Senior Environmental Specialist will direct all activities of the facility consistent with permit conditions and applicable environmental regulations.

Senior Environmental Specialist/Environmental Coordinator: The Senior Environmental Specialist/Environmental Coordinators are responsible for performing activities associated with hazardous waste management. The Senior Environmental Specialist/Environmental Coordinators will be trained in the proper management and handling of hazardous waste.

11.5 Personnel Training Records

Records of personnel training will be documented and maintained at the facility.

The following documents and records will be maintained at the facility:

3. The job title for each position at the facility related to hazardous waste management, and the name of the employee filling each job.
4. A written job description for each position involved in hazardous waste management. This description will include the requisite skill, education, or other qualifications, and duties of employees assigned to each position.
5. A written description of the type and amount of both introductory and continuing training that will be given to the person filling the position.
6. Records documenting that the required training or job experience has been given to, and completed by personnel filling the position.

Training records on current personnel will be kept until closure of the facility and training records on former employees will be kept for at least three years from the date the employee last worked at the facility. Personnel training records may be transferred with personnel that are transferred within the company.

SECTION 12

Closure Plans

12.0 CLOSURE PLANS

A description of the four regulated RCRA units at the Site was provided in Section 3. Physical closure of the #1 and #2 surface impoundments and the #3A aerated lagoon have been completed and the required owner/operator and independent engineer Certification of Closure are exhibited in Appendix A. The closure plans for the #1 and #2 surface impoundments and the #3A aerated lagoon are included in Appendix B. The closure plan for the LTU is included in Appendix I. The #1 and #2 surface impoundments and the #3A aerated lagoon are identified in Part II of the Permit as solid waste management units (SWMUs) 1, 2, and 3, respectively, and the LTU is identified as SWMU 48.

The Post-Closure Care Plans for the #1 and #2 surface impoundments and the #3A aerated lagoon are included in Appendix K. The post-closure care for the #1 and #2 surface impoundments and the #3A aerated lagoon are combined into one plan due to the physical proximity of the Units, common wastes handled, constituents of concern, and an integrated groundwater monitoring system. As described in Section 3, the LTU will be closed as a SWMU under the corrective action process. Consequently, the current approved post-closure care plan will be addressed following the completion of the corrective action process for the LTU. The post-closure care plan will be subject to revision based on the corrective measure study findings.

In accordance with 40 CFR 264.95(b)(2) and 264.97(b), the four hazardous waste management units have been incorporated into one waste management area for the purpose of groundwater monitoring and corrective action. The groundwater monitoring program for the waste management area is described in detail in Section 15. The facility will submit annual groundwater monitoring reports for the waste management area in accordance with Part I of the facility's hazardous waste management permit.

The remainder of this section summarizes the closure plans, implementation of closure, and findings or closure status for each of the RCRA Units. The Closure Plan for the LTU is presented in Appendix I and the Closure Certification Statements for the #1 and #2 surface impoundments and the #3A aerated lagoon are provided in Appendix A.

12.1 Land Treatment Unit Closure Plan (40 CFR 264.111 through 264.116 and 40 CFR 264.280)

On November 6, 1997, the KDHE was notified that closure of the LTU would commence on or before July 31, 1998. Closure activities for this unit were initiated on August 1, 1998.

The approved LTU Closure Plan was submitted as a separate document, dated January 25, 2000 and was subsequently modified in 2002 and 2005. The approved closure plan has been modified to provide for closure of the LTU consistent with the corrective action requirements of the facility Permit. While the closure plan modifications provide for an approach to closure and corrective action that is consistent with the other Solid Waste Management Units (SWMUs) at the site, KDHE retains sole authority for closure of the LTU as a RCRA regulated unit. Appendix I contains the LTU Closure Plan.

Maintenance and inspection of the LTU will continue until an approved corrective action is identified.

12.2 #3A Aerated Lagoon Closure

Closure of the #3A aerated lagoon was certified in February 1998. The #3A aerated lagoon was closed in accordance with 40 CFR 265.228, by removing soil impacted above the KDHE risk-based closure cleanup standards for soil, with provisions for post-closure care and monitoring. Risk-based closure of the soils enables construction over the unit in accordance with the provisions of 40 CFR 265.117(c)(1). However, at this time there has been no such construction and there are no plans for post-closure construction on the unit. The Post-Closure Care plan will be modified and submitted to KDHE for approval if construction plans for the unit are prepared and before construction begins. The closure approach, as described in Section 4.4 of the approved closure plan (EnecoTech, 1997) (Appendix B), was to remove soil that exceeds the KDHE risk-based non-residential closure cleanup standards, or alternate cleanup goals discussed in the contingent closure.

The approach for the risk-based soil closure for the #3A aerated lagoon consisted of:

1. soil sampling and comparison of soil analytical results with KDHE risk-based cleanup standards;
2. decontamination of all appurtenances and equipment;
3. backfilling the impoundment with clean fill;
4. submittal of required closure certification in accordance with 40 CFR 265.115; and
5. performing post closure care.

The soil sampling prescribed in the approved closure plan was performed on May 28 and May 29, 1997. The results of the soil sampling are summarized in the Closure Report (EnecoTech, 1998). Based upon the results of the soil sampling and discussions with KDHE staff, closure of the #3A aerated lagoon proceeded by backfilling with clean fill materials as described in the approved closure plan.

The backfilling began on January 13, 1998 and was completed on January 23, 1998. Compaction testing of the backfill soils indicated that the 95 percent proctor density requirement was achieved. A 1-foot thick protective surface layer was applied on top of the backfill soil. The protective surface layer was seeded on January 23, 1998 using a seed mix recommended by the Natural Resources Conservation Service (NRCS).

Additional details of closure activities are provided in the Closure Report previously submitted to KDHE. A copy of the closure report and certification is included in Appendix C.

12.3 #1 and #2 Surface Impoundments Closure

Closure of the #1 and #2 surface impoundments was certified in 1988. Closure of these two hazardous waste surface impoundments began in August 1987. On December 10, 1987, interim closure report was submitted to the KDHE. The interim closure report described the first stage of closure activities which consisted of removal and processing of the impoundments oily liquid sludge contents and semi-solid bottom sludge.

After removal of liquids and sludges, the underlying subsoil was sampled in both impoundments according to methodology approved by the KDHE. Laboratory analytical results were submitted to KDHE on February 10, 1988, and proposed approaches to completion of closure of each pond.

In accordance with the approved Closure and Post-Closure Plan for the #1 and #2 surface impoundments, and in accordance with the approved closure completion method determinations, closure of the #1 surface impoundment was completed by closing it as a landfill under 40 CFR 265.310. The #1 surface impoundment contains 18,000 cubic feet of listed Hazardous Waste defined by 40 CFR 261.32 as K051 – API Separator Sludge from the Petroleum Refining Industry and K049 –Slop Oil Emulsions Solids from the Petroleum Refining Industry. The waste was stabilized in place before backfilling and capping. Post-closure care was initiated upon completion of closure activities for the #1 surface impoundment.

Closure of the #2 surface impoundment was completed by removing 18 and 24 inches of additional soil from the impoundment as specified by KDHE. These soils were taken to the LTU for treatment and disposal. By removing contaminated soils from the #2 surface impoundment until background total levels of chromium and lead were reached, the #2 surface impoundment was considered to be successfully closed by removal and decontamination under the then applicable regulation of 40 CFR 265.228(a). Post-closure care was not initially implemented for the #2 surface impoundment. Subsequent to completion of closure activities, the regulations of 40 CFR 270.1(c) were amended to specifically require surface impoundments formerly closed by removal and decontamination under 40 CFR 265.228 to obtain a RCRA Post-Closure Care Permit unless an equivalency demonstration is made and approved. The equivalency determination must indicate that the closure by removal under 265.228(a)(1) is equivalent to the closure by removal that would be required under 264.228(a)(1). Unless and until the facility requests and obtains an equivalency determination under 40 CFR 270.1(c)(5) and (6), a RCRA Post-Closure Care Permit is required for the #2 surface impoundment.

Physical closure of the #1 surface impoundment was completed by backfilling with clean compacted soils to the design grade; constructing an engineered low permeability clay cap consisting of at least 2 feet of compacted clay; placing a minimum of 1 foot of topsoil as a

protective cover; and establishing a grass vegetative cover. The surface of the #1 surface impoundment is sloped at an approximately 1% grade.

During closure, the interior dike between the #1 and #2 surface impoundments was essentially left in place after removing contaminated soils in contact with liquid wastes. The interior dike serves to separate the closed #1 and #2 surface impoundments in the subsurface.

The #2 surface impoundment was backfilled with clean compacted soil and provided with a 1-foot layer of topsoil and a final grass vegetative cover. Although the backfill soils were compacted, an engineered low permeability cap was not constructed for the #2 surface impoundment as was required for the #1 surface impoundment. The area of the #2 surface impoundment is sloped at an approximately ½% grade.

The surface features of the closed #1 and #2 surface impoundments blend continuously together and slope very gently to surrounding drainage containment structures. The final contours are shown on the facility Topographic Map Plate 3-1.

A copy of the closure certification for the #1 and #2 surface impoundments is included in Appendix A.

The facility is not, at this time, requesting that an equivalency determination be made for the #2 surface impoundment. However, the facility reserves the right to develop information for an equivalency demonstration in the future and to request the KDHE to then make an equivalency determination for the #2 surface impoundment. Alternatively, the facility may, during the post-closure period to be established under a RCRA permit for either the closed #1 or #2 surface impoundments, request a permit modification to shorten or cease the post-closure period as allowed in 40 CFR 264.117(a)(2).

SECTION 13

Post-Closure Plans

13.0 POST-CLOSURE PLAN

The Post-Closure Care Plans for the three surface impoundments (surface impoundments #1, #2, and the #3A aerated lagoon) are summarized in this section. The Post-Closure Care Plan for the LTU is located in Appendix J. As described in Section 12, the LTU will be closed as a SWMU under the corrective action process. Consequently, the current approved post-closure care plan will be addressed following the completion of the corrective action process for the LTU. The post-closure care plan will be subject to revision based on the corrective measure study findings.

The #1 and #2 surface impoundments and #3A aerated lagoon have been closed in accordance with the approved closure plans for these units as described in Section 12. The post-closure care for the #1 and #2 surface impoundments and #3A aerated lagoon is established in a single post-closure care plan as discussed in Section 13.2. The Post-Closure Care Plan for the #1 and #2 closed surface impoundments and #3A aerated lagoon is included in Appendix K.

The post-closure care established for each of these units is compliant with the general post-closure requirements in 40 CFR 264.118, as well as 40 CFR 264.228(b) and (c) relating to the closed surface impoundments; and, 40 CFR 264.280(c), (d), and (e), relating to land treatment units.

13.1 Land Treatment Unit Post-Closure Care Plan (40 CFR 264.280 and 264.117 through 264.120))

In order to establish the post-closure cost estimate in a conservative manner, the post-closure care plan assumes that closure will not result in the removal of all waste constituents to applicable health-based levels. Accordingly, the post-closure care plan includes establishment and maintenance of a vegetative cover. Groundwater monitoring is incorporated in the waste management area corrective action groundwater monitoring network for the four regulated units.

The current post-closure care plan also addresses post-closure contact, post-closure care period, site security, and run-on/runoff control.

The LTU Post-Closure Care Plan is presented in Appendix J.

13.2 #1 and #2 Surface Impoundment and #3A Aerated Lagoon Post-Closure Care Plan (40 CFR 264.228 and 264.117 through 264.120)

The Post-Closure Plan for the #1 and #2 surface impoundments and the #3A aerated lagoon addresses post-closure care of all three of these closed Hazardous Waste Management Units. Post-closure care includes inspection, maintenance, and monitoring activities to minimize any potential hazards to human health and the environment.

The post-closure care plan also addresses the following issues: post-closure contact, post-closure care period, site security, run-on/runoff control, post-closure certification, post-closure costs, and financial assurance either within the Plan or by reference to the appropriate Section of the Permit Application.

The #1 and #2 surface impoundments and #3A aerated lagoon Post-Closure Care Plan is provided in Appendix K.

SECTION 14

Financial Requirements

14.0 FINANCIAL REQUIREMENTS (40 CFR 270.14(b)(15) &(18))

This Section summarizes the required Closure and Post-Closure Cost Estimates, Financial Assurance Mechanism(s), and Liability Coverage. A Closure Cost Estimate is provided for the LTU. Post-Closure cost estimates are provided for the four RCRA units: the #1 and #2 surface impoundments, the #3A aerated lagoon, and the LTU. Post-Closure Cost Estimates are also included for ongoing operation of the groundwater corrective action and the associated groundwater monitoring program.

14.1 LTU Closure Cost Estimate (40 CFR 264.142)

A closure cost estimate for the LTU is presented in Appendix L Table 1. The cost estimate is based on the closure plan implementation cost, in current dollars, assuming that a third party performs the work. The Closure Cost Estimate will be adjusted annually as required by 40 CFR 264.142(b-d) until completion of closure, and a copy of the cost estimate will be maintained at the facility.

14.2 Regulated Unit Post-Closure Cost Estimates (40 CFR 264.144)

Post-closure cost estimates for the LTU, the #1 and #2 surface impoundments, and the #3A aerated lagoon are presented in Appendix L Tables 2, 3, and 4, respectively. The cost estimates are based on the cost of hiring a third party to implement the respective post-closure care plans. The post-closure cost estimates will be adjusted for inflation as required annually and the most current estimates will be maintained at the facility.

14.3 Post-Closure Cost Estimates for Groundwater Corrective Action and Monitoring (40 CFR 264.144)

The facility groundwater corrective action and groundwater monitoring programs are part of the post-closure care of the four regulated units. Post-closure costs estimates are presented in Appendix L Tables 5 and 6. Table 5 details costs for the groundwater monitoring program (both during the corrective action and compliance monitoring phases). Table 6 details costs for ongoing operation and maintenance of the groundwater corrective action.

The cost estimates are based on the groundwater corrective action and monitoring programs being implemented by a third party. The cost estimate will be updated annually for inflation and a copy will be maintained at the Site.

14.4 Financial Assurance (40 CFR 264.143, and 40 CFR 264.145 through 264.147)

MRP currently uses a corporate guarantee as the financial assurance mechanism for this Site. The documentation demonstrating the ability to satisfy the financial assurance requirements with a corporate guarantee is included in Appendix L. The current closure and post-closure cost estimate is $4,889,675. On an annual basis, the facility will update the closure/post closure estimates to reflect the current status of closure activities and adjust the costs for inflation.

14.5 Liability Requirements (40 CFR 264.147)

MRP's demonstration of the required liability coverage for sudden and non-sudden accidental occurrences is provided to KDHE on an annual basis along with the financial assurance documentation identified in Section 14.4. A copy of the required liability coverage is included in Appendix L. On April 29, 2011, KDHE sent a letter stating that the Site is in compliance with the third party liability coverage requirements of 40 CFR 264/265 Subpart H.

SECTION 15

Groundwater Monitoring Plan

15.0 GROUNDWATER MONITORING AND CORRECTIVE ACTION PROGRAM

This section of the permit application presents general hydrogeologic information, groundwater quality data, the groundwater monitoring plan, and the groundwater corrective action program associated with the four regulated units at the Site. As shown on Plate 3-1, the four regulated units, along with the groundwater region between them, comprise the Waste Management Area (WMA). The source of the hazardous constituents in the groundwater is due to the presence of floating phase separated petroleum hydrocarbons on the water table and likely not from the regulated units. However, since the groundwater protection standard has been exceeded, the facility is required to implement a corrective action plan under 40 CFR 264.100.

The section consists of:

- 15.1 Background Information and Groundwater Characterization [40 CFR 270.14 (c)(2), c(4), c(7), c(8)]
- 15.2 Monitoring Program [40 CFR 270.14(c)(8)]
- 15.3 Sampling and Analysis Plan [40 CFR 270.14c(5)]
- 15.4 Engineering Feasibility Plan [40 CFR 270.14(c)(8)(iii) and (iv)]

15.1 Background Information and Groundwater Characterization [40 CFR 270.14 (c)(2), c(4), c(7), and c(8)]

The regional and local hydrogeological setting of the facility is summarized in the following sections. Regional hydrogeology was investigated as part of the RCRA Facility Investigation (RFI) and submitted with the August 4, 1992 Final RFI Report (RSA, 1992). The following sections also include the required characterization of impacted groundwater at the facility.

15.1.1 Surface Soil

According to the United States Department of Agriculture (USDA) Soil Survey of Cowley County (1980), there are four soil types found at the facility; the Canadian fine silty loam (CA), the Dale Silt Loam (DA), the Lincoln-Tivoli Complex (LG) and the Verdigris Silt Loam (VD). The approximate distribution of these soil types is shown on Figure 15-1.

Canadian series (CA) soil is generally deep, well drained, with moderately rapid permeability. This soil type ranges in depth up to about 60 inches and is formed in loamy and sandy alluvium. Slopes of this soil type range from 0 to 1 percent. Canadian series soil is generally located in the southern portion of the facility.

Dale series (DA) soil type is generally deep, well drained and moderately permeable. Soil depths occur to about 60 inches, and are formed in loamy alluvium. This soil type has slopes of about 0 to 1 percent and trend in an east west direction in the central portion of the facility.

The Lincoln-Tivoli Complex (LG) soil type tends to be a deep soil that is excessively drained with rapid permeability. The depth of this soil type occurs within the upper 60 inches. This soil type is found on floodplain or terrace deposits. Slopes of this soil type range from 0 to 15 percent and are found along the Arkansas and Walnut Rivers at the northeastern and southern boundaries of the facility.

The Verdigris Series (VD) soil type is deep and moderately well drained and has moderate permeability. Soil depths occur to about 60 inches and form in silty alluvium. Slopes of this soil type are about 0 to 2 percent and are found on low terraces and floodplains. The Verdigris soil type is located on the northern side of the facility.

15.1.2 Topography [40 CFR 270.14 (b)(19)]

Low lying portions of the Site are within the 100-year floodplain between the Walnut River and the Arkansas River, as shown on Figure 15-2. The facility has very little relief and gently slopes towards the northeast. Facility elevations range from approximately 1,078 feet above mean sea level (AMSL), near the southern boundary of the facility, to 1,045 feet AMSL, at the east side of the facility.

15.1.3 Geology [40 CFR 270.14 (c)(2)]

The Site is located southeast of Arkansas City in Cowley County, Kansas. Cowley County is in south central Kansas. Structurally, this area is east of the Nemaha Ridge, and west of the Dexter Anticline. Locally, the facility is located at the confluence of the Arkansas and Walnut Rivers. The region is underlain by Permian-age rocks that dip toward the west (Bayne, 1962).

Quaternary alluvium overlies these Permian deposits and is found along major rivers and streams.

The areas along both the Arkansas and Walnut Rivers, including the facility, are underlain by unconsolidated Quaternary-age alluvial deposits. These deposits consist of clay, silt, sand, chert, and limestone gravel (RSA, 1992). The thickness of alluvial deposits in the region is typically less than 25 feet, although recent alluvial deposits along the Arkansas River can be as much as 50 feet in thickness. The distribution of the alluvial deposits in the area of confluence of the Arkansas and Walnut Rivers is shown in the Regional Geologic Map on Figure 15-3. A regional stratigraphic column and explanation for the geologic map is included on Figure 15-4.

The bedrock surface in the area is the Permian-age Chase Group that is comprised of interbedded limestone, chert, and shale. The Chase Group has a total thickness of about 350 feet; about half of which is limestone and the other half shale (Bayne, 1962). Bedrock dips to the west, with younger Permian rocks of the Sumner Group regionally overlying the Chase Group. The Chase Group overlies older Permian rocks of the Council Grove and Admire Groups. Progressively older lithologies are exposed at the surface east of the Site.

There are three prominent structures in Cowley County, the Dexter Anticline, the Winfield Anticline, and the Nemaha Anticline. The Dexter Anticline is located in the eastern part of the county and trends northeast southwest. The east flank has a dip of over 200 feet per mile, while the west flank has a dip of about 100 feet per mile. The Winfield Anticline, which trends northeast-southwest in the central part of the county has a dip less than the Dexter Anticline but can be observed in surface features. The Nehema Anticline extends from central Oklahoma to northeast Kansas, and crosses the northwestern corner of the county. None of these structural features significantly affects the geology at the Site.

15.1.4 Surface Water

The Site is located between the Arkansas and Walnut Rivers upstream of the confluence of the two rivers. The Arkansas River flows southeasterly through Arkansas City then meanders to the northeast where it merges with the south-southeast flowing Walnut River. The two rivers are principal waterways in Cowley County.

Portions of the Site are located within the 100-year flood plain of the Walnut River and the Arkansas River. The maximum peak flow recorded on the Arkansas River is 103,000 cubic feet per second (cfs) on June 10, 1923 and on the Walnut River, the maximum peak flow recorded is 105,000 cfs on April 23, 1944. The maximum peak flow periods of record for the Arkansas and Walnut Rivers are 1903-2009 and 1898-2009, respectively.

Mean daily flows from the Arkansas City gauging station on the Arkansas River and the Walnut River for 1960 through 2010 were obtained from the USGS. For the Arkansas River at Arkansas City (USGS Station 07146500) the mean of the annual maximum mean daily flow was 29,161 cubic feet per second (cfs). The month when the annual maximum occurred was highly variable from year to year, generally occurring from March through June, or from September through November. The mean of the annual minimum mean daily flow at this station and for this period was 317 cfs. The month when the annual minimum occurred was generally either January or from August through October.

For the Walnut River at Winfield (USGS Station 07147800) the mean of the annual maximum mean daily flow for this period was 24,088 cfs. The month when the annual maximum occurred was again highly variable but most often from April through June, or in November. The mean of the annual minimum mean daily flow for the Walnut River at Winfield for this period was 56 cfs. The month when the annual minimum occurred was most often August, September, or October.

15.1.5 Hydrogeology [40 CFR 270.14(c)(2)]

Groundwater occurs in alluvial and bedrock aquifers in the vicinity of the Site. The alluvial deposits along the Arkansas River Valley provide large quantities of water (500 to 1,000 gallons per minute) which ranges in quality from good to poor. Locally, groundwater from bedrock aquifers can yield large to small quantities of water that ranges from good to poor quality. Chloride concentrations in water wells completed in alluvial sediments at the Site vicinity range from approximately 16 ppm to 650 ppm (Bayne, 1962). Figure 15-5 describes regional groundwater availability.

Recharge of alluvial aquifers in the region is due mainly to infiltration of precipitation. On an intermittent basis, the Arkansas and Walnut Rivers contribute to alluvial aquifer recharge (Bayne, 1962). During flood conditions, when river water elevations are above the level of the

groundwater in the aquifer, movement is in the direction of the aquifer (away from the stream) and aquifer recharge occurs. Regionally, discharge of groundwater usually occurs by flow to streams and rivers, and by evapotranspiration, pumping, and leakage into hydraulically connected aquifers.

As shown on Figure 15-6, 47 water wells and one surface water intake were identified within a three-mile radius of the Site. Total well depth, depth to groundwater, ownership, location, and water use are summarized on Table 15-1.

15.1.6 Meteorology [40 CFR 270.14(b)(19)/40 CFR 270.14(c)(2)]

15.1.6.1 Temperature

According to Army Corps of Engineers (ACOE), December 1984, the climate of Cowley County, Kansas is normal for middle latitude, interior continental areas. It is characterized by large variations in annual and daily temperatures, long, hot summers and cold, short winters. The average daily temperature in winter is 36.6^{o}F. The recorded high and low temperatures for Cowley County are 118°F on August 12, 1936 and -27°F on February 13, 1905, respectively.

15.1.6.2 Precipitation

Long-term precipitation data are currently available for the 1971-2000 30-year climate normals period. Precipitation in Cowley County is highest during the spring and summer (April-September). Seventy-two percent of the average annual precipitation of 36.7 inches occurs during late evening or nighttime thunderstorms. Ten to eleven inches of the annual precipitation occurs as snowfall.

15.1.6.3 Severe Storms

Occasionally tornadoes and severe thunderstorms occur within Cowley County. Storms are usually localized in extent and are of short duration. Crop damage by hail is not as extensive in Cowley County as in areas further west.

15.1.6.4 Prevailing Wind Direction and Speed

The closest location recording data on wind speed and direction is Wichita, Kansas. Plate 3-1 includes a wind rose for Wichita, Kansas (2000-2009) which indicates that the prevailing wind is

from the south at an annual mean speed of 13 mph. The secondary prevailing wind direction is from the north.

15.1.6.5 Evaporation

The average evaporation from March to November for the closest station (Elk City Lake Station, located approximately 55 miles east-northeast of the facility) was 51 inches per year, based on data from 1960 to 1992 (available period of record). No evaporation data is recorded for Arkansas City, Kansas.

15.1.7 Facility Stratigraphy [40 CFR 270.14(c)(2)]

15.1.7.1 Alluvium

Alluvial sediments observed in test borings at the refinery ranged in thickness from approximately 38 to 52 feet. The alluvium is comprised primarily of sandy silt/silty sand, sand, and gravelly sand with varying amounts of silt and clay. Sediments typically become coarser with depth beneath the refinery, such that the saturated alluvium can be divided into upper and lower units. The upper alluvial unit is comprised of finer grained sediments including clay, silty clay, and sandy silt/silty sand that grade at depth into a very fine to coarse-grained sand. The upper unit ranges in thickness from approximately 8 feet to 40 feet. Commonly, only the basal portion of the upper unit is saturated. The upper alluvial unit is thickest at the northern end of the refinery, where sediments are generally finer grained.

The lower unit is comprised primarily of gravelly sand, and is the main water bearing zone in the alluvial aquifer. The lower unit is found at depths between 10 and 35.5 feet and ranges in thickness between 8 and 29 feet.

Underlying Quaternary alluvium are the shales and impure limestones of the Permian age Chase Group. The upper and lower alluvial units and the Permian age bedrock are discussed in greater detail below.

Figures 15-7, 15-8, and 15-9 are geologic cross sections of the facility, which show stratigraphic relationships. Figure 15-10 shows the cross-section locations.

15.1.7.2 Bedrock

A shale bedrock underlies Quaternary alluvium at the facility at depths ranging from 38 to 52 feet. The bedrock, according to available information (Bayne, 1962), is part of the Permian age Chase Group. Beneath the Site, the bedrock was observed to consist of blue and gray calcareous shale containing some very hard, light yellowish brown, microcrystalline limestone. The thickness of the shale reportedly ranges up to 350 feet in the refinery vicinity (Bayne, 1962).

A contour map of the bedrock surface is shown on Figure 15-11. The contour map shows two apparent paleochannels trending from northwest to southeast, across the center of the Site.

15.1.8 Facility Hydrogeology [40 CFR 270.14(c)(2)]

The groundwater in the alluvial sediments is unconfined. Groundwater at the refinery is encountered at depths ranging from approximately 8 to 44 feet below the ground surface in May, 2010 (deeper water table is adjacent to the recovery wells). The uppermost groundwater beneath the facility occurs in the alluvial deposits, as shown in the geologic cross-sections (Figures 15-7, 15-8, and 15-9). The groundwater flow direction in the alluvial aquifer is northeast toward the Walnut River at an average gradient of approximately 0.0029 feet/foot. A groundwater potentiometric surface contour map showing the potentiometric surface and the extent of phase separated hydrocarbons (PSH) in May, 2010 is included as Figure 15-12.

As shown on the potentiometric surface contour map, water from the Arkansas River enters the alluvial sediments and flows in a northeast direction beneath the facility toward the Walnut River.

Effects of groundwater pumping from the ICM wells is indicated on the May, 2010 groundwater potentiometric surface contour map. The water table is depressed in the vicinity of the ICM recovery wells creating a groundwater capture zone preventing off-site groundwater migration.

Comparison of water levels in clustered monitor wells at the LTU and the closed No. 1 and No. 2 surface impoundments indicate both upward and downward hydraulic gradients within the alluvial aquifer. Generally, the calculated vertical gradients are of very low magnitude (less than 0.005 ft/ft, up or down) and are derived from head differences that are generally less than the range of measurement accuracy.

The alluvium at the site has been described by others (RSA, 1992) to consist of two zones, an upper and a lower zone based upon the lithology of the alluvium. These two zones are hydraulically connected. The upper zone is characterized by finer grained deposits, typically sand; and the lower zone is characterized by coarser deposits, typically, sandy gravel. The groundwater potentiometric surface is encountered in both zones. In the northern portion of the refinery, close to the Walnut River, the alluvium contains interbeds of clay and clayey silty sand, and the sandy gravel layer becomes silty sandy gravel. Limited areas of perched groundwater may exist in this area. This alluvial sequence is illustrated on the north-south cross-section C-C' (Figure 15-9). In the area of the regulated units, from the LTU to the Walnut River, the finer grained sediments sit above the water table (except during flood conditions), and therefore have no impact on flow paths in the saturated zone.

Well logs show that the lithology of the saturated alluvial aquifer is relatively uniform. The direction of groundwater flow, and of contaminant migration is governed by the groundwater gradient; no apparent preferential pathways are indicated.

Paleochannels described by others (RSA, 1992), observed on the top of bedrock structure contour map shown on Figure 15-11 do not represent preferential pathways, and have no significant impact on contaminant migration. These undulations of the bedrock surface trend NNW-SSE across the site, essentially perpendicular to the groundwater flow direction. The westernmost "undulation" passes through the locations of wells 92 and WN-8A, and the easternmost 'undulation' through MW-9 and MW-8. These wells are shown on Figure 15-10. As the cross sections indicate, these are subtle features in comparison to the total saturated thickness of the alluvium. The material in the 'undulations' shown on section B-B' (Figure 15-8) between the LTU and the Closed Surface Impoundments is gravelly sand or sand, whereas the surrounding material is mapped as gravelly sand.

The elevation of the top of the bedrock underlying the refinery ranges from 1016 to 1024 feet AMSL, as shown on Figure 15-11. It represents a gently undulating surface of low relief, with a NNW-SSE trending fabric, and with no overall slope.

The following sections further detail the shallow and deep zones of the alluvial aquifer as well as the bedrock aquifer. Although the alluvial aquifer is separated in this section for the purpose of

discussion, the shallow and deep alluvial aquifer zones are hydraulically connected and coexist as one aquifer across the majority of the Site.

An approximate groundwater flow velocity was estimated for the shallow alluvial aquifer zone, the deep alluvial aquifer zone, and the bedrock aquifer in the following sections.

Based upon an average hydraulic gradient, an average hydraulic conductivity, and a conservative effective porosity estimate, the groundwater particle velocity equation (USGS, 1972) was used to calculate the average groundwater horizontal flow velocity. The equation is:

$$v = K I / n$$

where: v = Average particle velocity (ft/day)

K = Hydraulic Conductivity (ft/day)

I = Hydraulic Gradient (ft/ft)

n = Effective Porosity (percentage)

15.1.8.1 Shallow Alluvial Aquifer Zone Slug Testing

Based on slug tests conducted at the refinery, shallow alluvial monitor wells MW-1 through MW-6 had hydraulic conductivities that ranged from 1.98 $x10^{-2}$ centimeters per second (cm/sec) (56 feet/day) to 1.75$x10^{-1}$ cm/sec (496 feet/day) with an arithmetic mean of 7.55 x 10^{-2} cm/sec (214 feet/day). Based on an average hydraulic gradient of 0.0029 feet/foot, and an average effective porosity for a sandy gravel of 0.30, the calculated average flow velocity was calculated to be 2.1 feet/day.

15.1.8.2 Deep Alluvial Aquifer Zone Slug Testing

Monitor wells MW-7 through MW-16 were completed as deep alluvial wells. The hydraulic conductivities of these wells, based on rising and falling head slug tests, ranged from 2.59$x10^{-2}$ cm/sec (73 feet/day) to 1.71 x 10^{-1} cm/sec (485 feet/day). The arithmetic mean for the deep alluvial wells was calculated to be 8.65$x10^{-2}$ cm/sec (245 feet/day). Based on an average

hydraulic gradient of 0.0029 feet/foot and an average effective porosity for a sandy gravel of 0.30, the calculated average flow velocity was 2.4 feet/day.

15.1.8.3 Bedrock Aquifer Slug Testing

Based on slug tests, the bedrock monitor well (BR-1) had a falling head calculated hydraulic conductivity of 5.83×10^{-5} cm/sec (0.165 feet/day) and rising head calculated hydraulic conductivity of 7.05×10^{-5} cm /sec (0.2 feet/day).

At the time that the short-term groundwater monitoring program (RSA, 1992) was conducted (June 5, 1990), there was a difference in head of approximately 31.3 feet between the clustered deep alluvial monitor well (MW-7, 1046.71 feet, AMSL) and the bedrock monitor well (BR-1,1015.41 feet AMSL). It was concluded (RSA, 1992) that the alluvial and bedrock aquifers were not in hydraulic communication in the vicinity of the cluster wells.

Groundwater data from July 21, 1992 show that the groundwater in bedrock monitor well BR-1 had stabilized at an elevation of 1049.37 feet, AMSL. The groundwater elevation in monitor well MW-7 on July 21, 1992 was 1047.20 feet AMSL (approximately 2.17 feet of head difference) between monitor wells BR-1 and MW-7. Groundwater within the shale in the vicinity of monitor well BR-1 is confined and is not in direct communication with groundwater in the alluvial aquifer (RSA, 1992).

15.1.8.4 Groundwater Pumping Tests

Various groundwater pumping tests have been conducted at the facility. Based on a review of available information, calculated transmissivities for the alluvial aquifer have ranged from approximately 8,000 to 120,552 gallons per day per foot (Groundwater Technology, Inc., 1988 and Engineering Enterprises Inc, 1985). Given an average saturated thickness of approximately 26 feet at the facility and the above transmissivities, hydraulic conductivity's ranging from approximately 1.5×10^{-2} cm/sec to 2.2×10^{-1} cm/sec (40 feet/day to 620 feet/day) can be calculated. This range in hydraulic conductivity is very similar to the range calculated from alluvial aquifer slug tests 1.98×10^{-2} cm/sec to 1.75×10^{-1} cm/sec (56 feet/day to 496 feet/day).

15.1.9 Petroleum Hydrocarbons [40 CFR 270.14(c)(4)(i)]

This section provides a discussion of the nature, extent and sources of the petroleum hydrocarbons observed in the subsurface at the Site and a conceptual model of movement of petroleum hydrocarbons in the subsurface.

Petroleum Product Storage and Release Information

During the operations liquid petroleum hydrocarbons were stored in above ground tanks and conveyed in buried pipelines at this Site. Accidental spills of product occurred. These spills, while responded to by Site personnel, contributed to soil and groundwater impacts at the site. Plate 15-1 shows locations of pipelines and product storage tanks with respect to the regulated units. This Plate also shows the tanks and any associated historical releases. Petroleum hydrocarbon recovery actions were implemented in the 1930s with significant enhancements in the 1980s and additional enhancements in 1995 (RW-40, RW-50, RW-60, RW-70, and RW-80), 2000 (RW-35), 2001 (RW-45, RW-55, RW-65, RW-75), 2003 (RW-11, RW-21, RW-31, RW-33), 2007 (NARW-1 and PARW-1), and 2008 (PARW-2, NARW-2, NARW-3, and NARW-4).

Plate 15-1 illustrates that the storage tanks between the LTU and the Closed Surface Impoundments primarily stored gasoline product, tank 125 immediately north of the LTU was used to store kerosene. Other tanks upgradient of the LTU and west of the LTU contained gasoline, diesel and crude oil. The product release data presented on Plate 15-1 indicates releases between the LTU and the Closed Surface Impoundments were mainly from gasoline storage tanks. Historical data from tanks west of the LTU indicate gasoline and diesel product releases occurred, and crude oil releases have been reported from Tank 120 located upgradient of the LTU.

Product pipeline corridors are located parallel to both the west and east sides of the LTU as shown on Plate 15-1. These pipelines are operated by ConocoPhillips and NuStar.

Conceptual Model of Petroleum Hydrocarbon Migration

Liquid petroleum hydrocarbon product (product) exists as a separate, immiscible phase when in contact with water and/or air. Differences in the physical and chemical properties of water and the product result in the formation of a physical interface between the liquids which prevents the two fluids from mixing. Non-aqueous phase liquids are typically classified as either light non-

aqueous phase liquids (LNAPLs) which have densities less than that of water, or dense non-aqueous phase liquids (DNAPLs) which have densities greater than that of water. The petroleum hydrocarbon constituents at the Site have densities less than water and float on top of the water table and are classified as light non-aqueous phase liquids (LNAPLs). The petroleum hydrocarbon products are multi-component organic mixtures composed of chemicals with varying degrees of water solubility. Physical and chemical properties that affect transport and fate of selected refined petroleum products are presented in Table 15-2.

Movement of the product in the subsurface is controlled by several processes. Upon release to the environment, the product will migrate downward under the force of gravity. If a small volume of product is released to the subsurface, it will move through the unsaturated zone where a fraction of the product will be retained by capillary forces as residual globules in the soil pores, thereby depleting the contiguous product mass until movement ceases. If sufficient product is released, it will migrate until it encounters a physical barrier (e.g., low permeability strata) or is affected by buoyancy forces near the water table. Once the capillary fringe is reached, the product may move laterally as a continuous, free-phase layer along the upper boundary of the water-saturated zone due to gravity and capillary forces.

Although the principal migration may be in the direction of the maximum decrease in water-table elevation, some migration may occur initially in other directions. A large continuous product phase may hydrostatically depress the capillary fringe and water table. Once the source is removed, mounded product migrates laterally, product hydrostatic pressure is removed, and the water table eventually rebounds. Infiltrating precipitation and passing groundwater in contact with residual or mobile product will dissolve the soluble hydrocarbon components and form an aqueous-phase hydrocarbon constituent plume.

Product constituents may exist in any of four phases within the subsurface: as an immiscible liquid phase, dissolved phase, gaseous phase (soil gas), in the adsorbed phase partitioned onto the soil or aquifer material.

Recovery of phase separated petroleum hydrocarbons floating on top of the water table began in 1981. In 1995, the ICM groundwater and product recovery system was installed. The system has been expanded at various times since then. Figure 15-12 illustrates the extent of the free phase

petroleum hydrocarbons at the refinery in May 2010. Since operation of the ICM system began, the overall horizontal extent of phase separated petroleum hydrocarbons has remained stable but free oil saturations have diminished in areas where product recovery activities have been conducted.

15.1.10 Groundwater Monitoring Network [40 CFR 270.14(c)(4),(7),(8)]

15.1.10.1 Corrective Action Monitoring Program Monitor Well Network

The groundwater in the Waste Management Area is routinely monitored via the corrective action monitoring program (CAMP) groundwater monitoring well network. This network is comprised of two background monitoring wells (Background), eight corrective action performance monitoring wells (CAP) and two supplemental wells (SUPP), listed on Table 15-3. Table 15-3 also includes the eight groundwater capture zone monitoring wells (CPZ), four of which are also the point of compliance wells located downgradient of the WMA. The CAMP and capture zone monitoring wells were resurveyed April 23, 2010, by Smith and Oakes, Inc., of Arkansas City, KS, in accordance with Section 4.3 of the groundwater sampling and analysis plan (Appendix P). The survey and well construction information for these wells is also included on Table 15-3. The monitor well construction diagrams for each of the monitor wells are included in Appendix N. Figure 15-13 shows the corrective action groundwater monitoring well network including the four Point of Compliance wells (CMW-01, CMW-02, CMW-03, and CMW-04). The eight groundwater corrective action performance monitoring wells are designed to monitor groundwater quality in the uppermost (alluvial aquifer) groundwater zone upgradient and within the WMA.

15.1.10.2 Additional Facility Groundwater Monitor Wells

In addition to the 12 CAMP monitor wells; the Site has additional monitor and recovery wells located in areas such as the former process and tank farm areas and the asphalt terminal. Figure 15-14 shows all of the active monitor and recovery wells at the facility. The monitor wells are used for groundwater level gauging and product thickness monitoring. The recovery wells located along the Walnut river boundary are designed for product recovery and groundwater capture, while the primary objective of the recovery wells in the north and former process areas is product recovery. MRP added 16 wells to the May 2010 semiannual groundwater sampling

event in order to obtain groundwater quality data from across the site. The GWPS constituents were analyzed for groundwater samples collected from these additional 16 wells along with the semiannual CAMP in May 2011. Eight of the additional wells are classified as shallow alluvial wells (5, 49, 72, 75, 93, 103, 106, AP-4), three are screened below the water table (RFI2-2C, RFI2-4C, RFI2-7C), one is a deep alluvial well (MW-14), and four are groundwater and product recovery wells in the north and process areas (NARW-1, NARW-2, NARW-3, and PARW-1).

15.1.11 Groundwater Quality in Waste Management Area [40 CFR 270.14(4),(7),(8)]

Groundwater samples have been collected from the CAMP monitor wells semi-annually. This section first presents and discusses the results from the May 2010 semiannual groundwater sampling event, which provides a representative picture of the groundwater impacts in the WMA. The May 2010 semiannual groundwater sampling event included the three-year monitoring event for which the full RCRA permit GWPS list of constituents was analyzed in each of the 12 CAMP monitor wells. This section next presents the data from the quarterly sampling of the bioreactor influent for the BTEX constituents. The bioreactor receives and treats the recovered groundwater. Finally, this section describes the results of the RCRA permit-required October 2009 analysis for the full 40 CFR Part 264 Appendix IX analyte list on three representative groundwater samples (i.e., one well with low level impacts and two wells containing moderate to high levels of dissolved phase constituents) as required in Section IV.D.4.c.iv of the permit.

15.1.11.1 Analyte List

The target GWPS analytes and their respective groundwater protection standards are established in Attachment B of the facility's current RCRA Permit. The 2010 quarterly bioreactor influent sampling events, conducted in March, May, August, and October, involved analysis of benzene, toluene, ethylbenzene, and total xylenes (BTEX). The first 2010 semiannual sampling event was conducted between May 17 and May 24, 2010. The groundwater samples collected from the CAMP monitor wells were analyzed for the RCRA Permit Attachment B groundwater protection standard (GWPS) constituents. The GWPS constituents include metals, cyanide, volatile organic compounds (VOCs), and semi-volatile organic compounds (SVOCs). MRP included analyses of methyl tert-butyl ether (MTBE), tert-butyl alcohol (TBA), total petroleum hydrocarbons (TPH)

gasoline range organics (GRO) and TPH diesel range organics (DRO) for this sampling event. The specific GWPS analytes are shown on Table 15-4.

In 2009, groundwater samples from monitor wells WN-1A, WN-7B, and MW-6 were tested for the full 40 CFR Part 264 Appendix IX analyte list (Table 15-5) during the fall 2009 semiannual groundwater sampling event.

15.1.11.2 Groundwater Sampling Protocol

The groundwater monitoring was conducted in accordance with the procedures in the approved Groundwater Sampling and Analysis Plan.

15.1.11.3 Groundwater Sampling Results

The May 17-19, 2010 CAMP groundwater monitoring laboratory analytical results are summarized on Table 15-6. Groundwater elevations were gauged across the entire site on May 13, 2010. The site-wide groundwater level gauging data from the May event was used to develop a groundwater potentiometric surface contour map (Figure 15-12) for the site. Table 15-6 includes the depth to groundwater gauging data for the 20 CAMP wells measured at the time the wells were sampled.

The data is also presented on concentration isopleth and data posting maps, Figures 15-15 through 15-22. Trend graphs and tables of the historic BTEX data (1998-2010) in the WMA and the bioreactor influent are included in Appendix M. BTEX, TPH-GRO, and TPH-DRO concentration isopleth contour maps are shown in Figures 15-15 through 15-20, respectively. Figures 15-21 and 15-22 present the groundwater sampling results for two groups of individual GWPS analytes. Group 1 analytes include: benzene; toluene; ethylbenzene; total xylenes; 1,2-dichloroethane (1,2-DCA); 1,2,4-trimethylbenzene (1,2,4-TMB); 1,3,5-trimethylbenzene (1,3,5-TMB); TPH-GRO; and TPH-DRO. Group 2 analytes include: benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; dibenz(a,h)anthracene; indeno(1,2,3-cd)pyrene; 2-methylnaphthalene; naphthalene; pyridine; and arsenic.

15.1.11.3.1 Background Monitoring Wells

The results of the May 2010 groundwater analyses at background monitor wells WN-1A and WN-1B are presented on Table 15-6. The data is also presented on concentration posting and isopleth maps, Figures 15-15 through 15-22, and on historic BTEX concentration tables and trend graphs included in Appendix M. Monitor wells WN-1A and WN-1B were analyzed for the GWPS constituents during the May 2010 sampling event. The analytical results were compared to the Tier 2 non-residential groundwater pathway risk-based standards (RSKs) for Kansas, RSK Manual – 5th Version (KDHE, October 2010).

The results indicated that there were no detections of the following: VOCs, cyanide, and TPH-DRO.

Metals: Five metals were detected in the groundwater samples from WN-1A and WN-1B: arsenic, barium, chromium, nickel, and vanadium. None of the detections exceeded the RSKs for the metals.

Semivolatile Organic Compounds: Seven SVOCs were detected in the groundwater sample from WN-1A. Three SVOCs were detected in the groundwater sample from WN-1B. None of the SVOC detections exceeded their respective RSKs.

Total Petroleum Hydrocarbons: TPH-GRO was detected below its RSK standard of 500 µg/L in groundwater samples from WN-1A (8.2J µg/L) and WN-1B (5.2J µg/L). There were no detections of TPH-DRO.

15.1.11.3.2 Corrective Action Performance Monitoring Wells

The results from May 2010 sampling of the corrective action performance (CAP) monitoring wells (WN-5B, WN-6A, WN-6B, WN-7B, WN-8B, MW-6, MW-13, and MW-17) are presented on Table 15-6. The data is also presented on concentration posting and isopleth maps, Figures 15-15 through 15-22, and on historic (1998-2010) BTEX concentration tables and trend graphs included in Appendix M. The CAP monitor wells were analyzed for the GWPS constituents during the May 2010 sampling event. Primary and duplicate samples were collected from

monitor wells WN-7B and MW-13. The analytical results were compared to the applicable Tier 2 RSKs.

The results indicate that there were no detections of total cyanide in any of the groundwater samples. One or more of the groundwater samples had detections of metals, VOCs, SVOCs, TPH-GRO and TPH-DRO.

Metals: All eight CAP monitor wells had at least one metal detected in groundwater samples. Arsenic was detected in groundwater from 7 wells, barium in 8 wells, chromium in 2 wells, lead in 4 wells, nickel in 2 wells, vanadium in 3 wells, and zinc in 1 well. None of the detections exceeded the respective RSKs for the metals.

Volatile Organic Compounds: Volatile organic compounds were detected in monitor wells WN-6B, WN-7B, WN-8B, and MW-6. Detections were primarily the BTEX constituents and (1,2,4-TMB and 1,3,5-TMB). Additionally, styrene and TBA were detected in the groundwater sample from monitor well WN-7B, and 1,2-DCA was detected in the groundwater sample from monitor well MW-6. No VOCs were detected in the groundwater samples from monitor wells WN-5B, WN-6A, MW-13, and MW-17.

The RSK for benzene of 5 µg/L was exceeded in the groundwater samples from WN-7B (140 µg/L in both primary and duplicate samples), WN-8B (33 µg/L), and MW-6 (1,200 µg/L). The 1,2-DCA RSK standard (5 µg/L) was exceeded in the groundwater sample from MW-6 with a detected concentration of 54 µg/L. The 1,2,4-TMB standard (17.4 µg/L) and 1,3,5-TMB standard (88.4 µg/L) were also exceeded in the groundwater sample from MW-6 at concentrations of 540 µg/L and 240 µg/L, respectively. There were no other exceedances of the respective Tier 2 RSKs for VOCs in the other wells.

Semivolatile Organic Compounds: One or more SVOCs were detected in 7 of the 8 CAP monitor wells. No SVOCs were detected in monitoring well WN-6A. Of the 29 SVOCs analyzed in the groundwater samples from the CAP wells, 24 were detected at least once. The RSK standards for dibenz(a,h)anthracene (0.027 µg/L), indeno(1,2,3-cd)pyrene (0.392 µg/L), 2-methylnaphthalene (34.6 µg/L), and naphthalene (2.11 µg/L) were exceeded in the groundwater samples from WN-7B at concentrations of 0.53J µg/L, 0.53J µg/L, 65 µg/L (69 µg/L, duplicate),

and 2.3 µg/L (2.3 µg/L, duplicate), respectively. The RSK for pyridine (9.28 µg/L) was exceeded in the sample from MW-17 with a concentration of 650 µg/L.

Total Petroleum Hydrocarbons: TPH-GRO was detected in each of the groundwater samples collected from the CAP monitoring wells. Exceedances of the TPH-GRO RSK (500 µg/L) included: WN-5B (950 µg/L), WN-7B (3,400 µg/L and 4,100 µg/L (WN-7B duplicate)), WN-8B (970J µg/L), and MW-6 (9,600 µg/L).

TPH-DRO was detected in groundwater samples from 6 of the 8 CAP monitoring wells. TPH-DRO was not detected in samples from monitoring wells WN-6A and MW-13. Exceedances of the TPH-DRO RSK (720 µg/L) were observed in groundwater samples from WN-7B (1,200 µg/L and 1,100 µg/L), WN-8B (982J µg/L), and MW-6 (23,800 µg/L).

Summary

The results of the GWPS analyses in the groundwater samples from the CAP monitoring wells indicate that there were no exceedances of applicable RSK standards in the groundwater samples from the two deep alluvial monitoring wells, WN-6A and MW-13. Exceedances of the RSK standards for several VOCs and SVOCs, TPH-GRO, and TPH-DRO were detected in the groundwater samples from 5 of the 6 shallow CAP monitoring wells.

15.1.11.3.3 Supplemental Information Monitoring Wells

Monitoring wells MW-12 and RCRA-4 comprise the supplemental information monitoring program. These wells were sampled for the GWPS constituents during the May 2010 sampling event. The results of the laboratory analyses for the May 2010 sampling event are summarized on Table 15-6. The data is also presented on concentration posting and isopleth maps, Figures 15-15 through 15-22, and on historic (1998-2010) BTEX concentration tables and trend graphs included in Appendix M.

Monitor wells MW-12 and RCRA-4 were analyzed for the GWPS constituents during the May 2010 sampling event. The laboratory analytical results were compared to the Tier 2 RSKs.

Volatile Organic Compounds: There were no detections of VOCs during the May 2010 sampling event. It is noted though that VOC's are periodically detected in MW-12 (see historic

data in Appendix M) and that benzene was found at 28 µg/L during the October 2010 semiannual sampling event. This level of occasional benzene detection is normal for this well historically.

Metals: Arsenic, barium, and nickel were detected in the groundwater sample from MW-12, all below their respective RSKs. Arsenic, barium, vanadium, and zinc were detected in the groundwater sample from RCRA-4. The arsenic concentration in the groundwater sample, 13 µg/L, exceeded the RSK for arsenic of 10 µg/L. There were no other RSK exceedances for the other metals in the RCRA-4 sample.

Semivolatile Organic Compounds: Five SVOCs were detected in the groundwater sample from MW-12. Six SVOCs were detected in the groundwater sample from RCRA-4. None of the detections exceeded the respective RSKs for the SVOCs.

Total Petroleum Hydrocarbons: TPH-GRO was not detected in the groundwater sample from RCRA-4. TPH-GRO was detected in the groundwater sample from monitoring well MW-12 at a concentration of 340J µg/L, which is less than the TPH-GRO RSK of 500 µg/L. TPH-DRO was detected in monitoring wells MW-12 at 580 µg/L and RCRA-4 at 410 µg/L. Neither of these concentrations exceeded the TPH-DRO RSK (720 µg/L).

15.1.11.4 Quarterly Bioreactor Influent Sampling Results

Quarterly bioreactor treatment system influent sampling was conducted on March 4, May 24, August 19, and October 14, 2010. The laboratory results of the quarterly influent samples are summarized on Table 15-7.

During the first, second, and third quarter sampling events of 2010, bioreactor influent samples were collected from three locations. The sample identified as BIO-INF-A, was collected from the East bioreactor influent line after combining flow from the East and West lines, which carry water from the RW series (RW-11 through RW-80A) recovery wells. Two additional water samples were collected, one from the north area influent line (BIO-INF-B), and the second from the lift station influent line (BIO-INF-C). These two bioreactor influent lines serve the PARW and NARW series recovery wells. Table 15-7 provides the individual sample results and a flow-weighted average concentration for the bioreactor influent water. During the fourth quarter 2010

sampling event, the NARW and PARW series recovery wells were down for maintenance, therefore, a water sample was collected only from the BIO-INF-A sampling point.

The flow-weighted average benzene concentrations in the bioreactor influent water were 4.7 µg/L, 2.9 µg/L, and 3 µg/L, for the first, second, and third quarters of 2010, respectively. In the fourth quarter 2010, the BIO-INF-A benzene concentration was 2.2 µg/L. As presented in Table 15-5, the benzene concentrations in the BIO-INF-B (ranged 8.3 µg/L to 12 µg/L) and BIO-INF-C (ranged 9.1 µg/L to 12 µg/L) water samples were higher than those in the BIO-INF-A (ranged non-detect to 2.8 µg/L) samples for the first, second, and third quarters of 2010. Approximately 75 percent of the bioreactor influent flow occurs through the East and West lines (from which BIO-INF-A is collected).

The flow-weighted average concentrations for toluene, ethylbenzene, and total xylenes in the quarterly bioreactor influent samples were all at trace levels (less than 5 µg/L). A potential trace of MTBE (0.35J µg/L) was detected in the first quarter BIO-INF-A water sample. No other detections of MTBE occurred during 2010.

15.1.11.5 2009 Full Appendix IX Sampling

2009 marked the five year interval for the analysis of the groundwater samples for the 40 CFR Appendix IX constituents. The Appendix IX testing was conducted during the second semiannual groundwater sampling event, which was conducted in October 2009. Appendix IX testing was performed on groundwater samples from one well, WN-1A, containing low levels of dissolved phase contaminants, and two wells, WN-7B and MW-6, containing moderate to high levels of dissolved phase contaminants. A duplicate sample from WN-6B was also analyzed for quality control purposes. The analytical results are summarized on Table 15-8 along with the appropriate available standards for comparison.

15.1.11.5.1 Background Monitor Well WN-1A

Monitor well WN-1A was analyzed for the Appendix IX constituents during the second semiannual sampling event (October 2009). The results of the laboratory analyses are presented on Table 15-8. The results indicate that there were no detections of the following: organochlorine pesticides, PCBs, chlorinated herbicides, dioxins, furans, sulfide, and cyanide.

Six Appendix IX metals were detected in the groundwater sample from WN-1A: barium, chromium, copper, nickel, vanadium, and zinc. None of the detections exceeded their respective groundwater protection standards (GWPS) for the metals.

Benzene (0.26J ug/L), 1,2-dichlorobenzene (0.46 ug/L), and chrysene (0.57J ug/L), were the only VOC, SVOC, and PAH compounds, respectively, detected in the groundwater sample from WN-1A. The GWPS for benzene (5 ug/L), 1,2-dichlorobenzene (600 ug/L), and chrysene (40 ug/L), were not exceeded in the WN-1A sample.

Summary

The results of the Appendix IX analyses in the groundwater sample from monitor well WN-1A indicate there were no exceedances in GWPS and no constituents detected that are not currently specified in the GWPS.

15.1.11.5.2 Corrective Action Performance Monitor Wells WN-7B and MW-6

Monitor wells WN-7B and MW-6 were analyzed for the Appendix IX constituents during the October 2009 semiannual groundwater sampling event. A duplicate groundwater sample, RCRA-MW-5, was collected from WN-7B. The results of the laboratory analyses are presented on Table 15-8. The results indicated that there were no detections of PCBs, chlorinated herbicides, dioxins, furans, or sulfide in the groundwater samples from either well. The compounds detected, which were typical for the site, are now summarized:

Metals

Barium and copper were detected in the groundwater sample from WN-7B. Arsenic, barium, copper, and vanadium were detected in the sample from MW-6. The respective GWPS for arsenic (10 ug/L), barium (2,000 ug/L), and vanadium (110 ug/L) were not exceeded in the

samples from WN-7B and MW-6. The current RCRA permit does not include a GWPS for copper, however, the Risk-Based Standards for Kansas (RSK) includes a Tier 2 non-residential groundwater standard of 1,300 ug/L. The RSK for copper (1,300 ug/L) was not exceeded.

Total cyanide was detected at an estimated concentration of 0.0025 milligrams per liter (mg/L) in both monitor wells WN-7B and MW-6. The GWPS for cyanide of 0.2 mg/L was not exceeded in these samples.

Organochlorine Pesticides

Two organochlorine pesticides, beta-BHC and delta-BHC, were detected at low-level concentrations of 0.078 ug/L (estimated) and 0.0089 ug/L (estimated), in the groundwater sample from MW-6. The permit does not include GWPS for these constituents and there are no RSK standards for either compound. No organochlorine pesticides were detected in the sample from WN-7B.

Volatile Organic Compounds

The groundwater sample from monitor well WN-7B contained all four BTEX constituents; no other Appendix IX constituents were detected. Only the benzene concentration exceeded the GWPS. The duplicate sample from monitor well WN-7B named RCRA-MW-5 contained the same BTEX constituents as WN-7B with the addition of isobutyl alcohol. Isobutyl alcohol was detected at 1700 ug/L in the duplicate sample while the primary sample was reported as not detected at 500 ug/L. The WN-7B sample and its duplicate sample were analyzed in two separate batches, potentially explaining the differences.

The groundwater sample from monitor well MW-6 contained the four BTEX constituents with only benzene (810 ug/L) exceeding the GWPS. Isobutyl alcohol was detected in MW-6 at a concentration of 48,000 ug/L. This constituent is not on the GWPS list nor is there a RSK standard. Two additional VOCs were detected in the groundwater sample from MW-6, 1,2,4-trimethylbenzene (880 ug/L) and 1,3,5-trimethylbenzene (150 ug/L), both of these constituents exceeded their respective GWPSs of 90 ug/L and 60 ug/L. There were no detections of MTBE in these groundwater samples.

Semivolatile Organic Compounds

Six SVOCs were detected in groundwater samples from one or both of WN-7B and MW-6. The following SVOCs were detected in the primary and duplicate WN-7B samples: 1,2-dichlorobenzene, 1-methylnaphthalene, 2-methylnaphthalene, dibenzofuran, N-nitrosodi-n-propylamine, and phenol. The following SVOCs were detected in the MW-6 sample: 1-methylnaphthalene, 2-methylnaphthalene, and dibenzofuran. The GWPS for 1-methylnaphthalene (10 ug/L) was exceeded in the primary and duplicate samples from WN-7B at 67 ug/L and 72 ug/L, respectively and the GWPS for 2-methylnaphthalene (10 ug/L) was exceeded in the primary and duplicate samples from WN-7B at 46 ug/L and 51 ug/L, respectively. The GWPSs for 1-methylnaphthalene and 2-methylnaphthalene were exceeded in the sample from MW-6 at 260 ug/L and 320 ug/L respectively. The GWPSs for 1,2-dichlorobenzene (600 ug/L), dibenzofuran (32 ug/L), and phenol (58,000 ug/L), were not exceeded in any of the groundwater samples. There is no GWPS or RSK standard for N-nitrosodi-n-propylamine.

Polycyclic Aromatic Hydrocarbons

Six PAHs were detected in the primary and duplicate groundwater samples from monitor well WN-7B: acenaphthene, benzo(a)anthracene, chrysene, fluorene, naphthalene, and phenanthrene. Phenanthrene (0.99 ug/L and 0.96 ug/L) was the only PAH detected from WN-7B (primary and duplicate samples) that exceeded its GWPS. The GWPS for phenanthrene is based on the Kansas surface water quality standards.

A toxic equivalency (TEQ) approach may be used to evaluate human health risks associated with the PAH phenanthrene. The PAH with the best characterization of toxicity [i.e., benzo(a)pyrene (BaP)] was given a value of 1. Phenanthrene has a toxic equivalency factor (TEF) of 0.001 compared to benzo(a) pyrene. By multiplying the TEF for phenanthrene a TEQ value is created that represents a concentration equivalent to benzo(a)pyrene. KDHE has developed a Tier 2 RSK groundwater standard for benzo(a)pyrene of 0.2 ug/L. Using the TEQ approach, the TEQ for phenanthrene is 200 ug/L.

Fourteen of the 16 PAHs were detected in the groundwater sample from MW-6; only acenaphthene and acenaphthylene were not detected. The detected concentrations in MW-6 for

the following eight PAHs exceeded their respective RSK criteria as presented in Table 15-8: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, naphthalene, and phenanthrene.

Summary

The results of the Appendix IX analyses in the groundwater samples from the CAP monitoring wells indicate that there were 10 Appendix IX constituents detected that are not currently specified in the GWPS. However, nine of these constituents (copper, nickel, beta-BHC, delta-BHC, dibenzofuran, N-nitrosodi-n-propylamine, anthracene, benzo(ghi)perylene, and benzo(k)fluoranthene) were below the analytical method reporting level. Isobutyl alcohol was detected above the method reporting level.

15.1.12 Groundwater Quality Outside the Waste Management Area

MRP voluntarily added 16 monitoring wells to the May 2010 groundwater sampling event to provide groundwater data outside the WMA. The groundwater samples from these 16 monitor wells were analyzed for the GWPS constituents. The laboratory results are presented on Table 15-9. Benzene, toluene, ethylbenzene, and total xylene isopleths contour maps are presented on Figures 15-15 through 15-18, respectively. TPH-GRO and TPH-DRO isopleth contour maps are presented on Figures 15-19 and 15-20, respectively, and the Group 1 and 2 analytes are posted on Figures 15-21 and 15-22, respectively.

Eight of the additional 16 wells are classified as shallow alluvial wells (5, 49, 72, 75, 93, 103, 106, AP-4) and depending on the groundwater level the screened interval may straddle the water table, three of the monitor wells are screened below the water table (RFI2-2C, RFI2-4C, RFI2-7C), one monitor well is completed as a deep alluvial well (MW-14), and four of the wells are groundwater and product recovery wells in the north and process areas (NARW-1, NARW-2, NARW-3, and PARW-1). The wells were sampled between May 19 and May 24, 2010. Groundwater samples were collected from the monitoring wells using low-flow sampling methods. Groundwater samples from the four recovery wells were collected from a sampling port at the surface using the installed submersible water pump.

The data indicate that all categories of analytes (metals, cyanide, VOCs, SVOCs, TPH-GRO, TPH-DRO) were detected in one or more of the 16 wells. Exceedances of one or more RSKs

were observed in 11 of the 16 supplemental site-wide monitoring wells sampled. RSK exceedances were observed for arsenic (3 wells), benzene (7 wells), 1,2,4-TMB (1 well), five SVOCs (2 wells), TPH-GRO (6 wells), and TPH-DRO (8 wells). No exceedances were observed in the groundwater samples from wells 72, 103, 106, MW-14, and NARW-2.

Metals: Metals were detected in all 16 of the groundwater samples. Barium was detected in all 16 wells; arsenic and vanadium each in 15 wells; nickel and zinc each in 11 wells; lead in 6 wells; chromium in 5 wells; selenium in 2 wells; and cadmium and mercury each in 1 well. The RSK for arsenic (10 µg/L), was exceeded in the groundwater samples from 3 wells: 5 (13 µg/L), RFI2-2C (16 µg/L), and RFI2-7C (19 µg/L). None of the RSKs for the other metals were exceeded in the groundwater samples. Total cyanide was detected in 5 groundwater samples (103, AP-4, RFI2-2C, NARW-3, and PARW-1) at concentrations ranging from 0.0029J milligrams per liter (mg/L) in RFI2-2C to 0.005J mg/L in well 103. There were no exceedances of the cyanide RSK of 200 mg/L.

Volatile Organic Compounds: No VOCs were detected in the groundwater samples from 7 wells: 49, 72, 93, 106, RFI2-7C, MW-14, and NARW-2. In the other 9 wells, detected VOCs included benzene, toluene, and total xylenes each in 8 wells; ethylbenzene, 1,2,4-TMB, and 1,3,5-TMB each in 8 wells; and 2-butanone (methyl ethyl ketone) and carbon disulfide each in 1 well. The RSK for benzene of 5 µg/L was exceeded in the groundwater samples from 7 wells: 5 (380 µg/L), 75 (4,900 µg/L), AP-4 (11 µg/L), RFI2-2C (8.6 µg/L), NARW-1 (10 µg/L), NARW-3 (28 µg/L), and PARW-1 (10 µg/L). The RSK for 1,2,4-TMB of 17.4 µg/L was exceeded in the groundwater sample from well 75 at a concentration of 31 µg/L. There were no other exceedances of the respective RSKs for the remaining VOCs analyzed.

Semivolatile Organic Compounds: 22 of the 29 SVOCs analyzed in the groundwater samples from the site-wide wells were detected. Exceedances of applicable RSK standards were limited to five SVOCs, with one exceedance each. The RSKs for benzo(a)anthracene (0.75 µg/L), benzo(a)pyrene (0.2 µg/L), dibenz(a,h)anthracene (0.027 µg/L), and naphthalene (2.11 µg/L), were exceeded in the groundwater sample from monitor well 75 at concentrations of 0.92 µg/L, 0.48 µg/L, 0.17 µg/L, and 18 µg/L, respectively. The RSK for 2-methylnaphthalene (34.6 µg/L) was exceeded in the groundwater sample from monitor well AP-4 at a concentration of 54 µg/L.

Total Petroleum Hydrocarbons: TPH-GRO was detected in 13 of the 16 groundwater samples collected from the supplemental site-wide monitoring wells and TPH-DRO was detected in 14 of the samples. Neither TPH-GRO nor TPH-DRO was detected in deep alluvial well MW-14.

Detections of TPH-GRO ranged from 43 µg/L in well 72 to 16,000 µg/L in well 75. The groundwater samples from wells 106, RFI2-7C, and MW-14 were non-detect for TPH-GRO. The RSK for TPH-GRO of 500 µg/L was exceeded in the groundwater samples from 6 wells: 5 (4,200 µg/L), 75 (16,000 µg/L), AP-4 (3,100 µg/L), RFI2-2C (750J µg/L), NARW-1 (600 µg/L), and NARW-3 (620 µg/L).

Detections of TPH-DRO ranged from 45J µg/L in well 106 to 9,600 µg/L in well AP-4. The groundwater samples from wells 72 and MW-14 were non-detect for TPH-DRO. The RSK for TPH-DRO of 720 µg/L was exceeded in the groundwater samples from 8 wells: 5 (4,200 µg/L), 49 (2,300 µg/L), 75 (7,300 µg/L), 93 (3,200 µg/L), AP-4 (9,600 µg/L), RFI2-2C (870 µg/L), RFI2-4C (3,000 µg/L), and NARW-1 (1,500 µg/L).

15.1.13 Topographic Map Requirements [40 CFR 270.14(c)(3)]

The topographic map requirements under 40 CFR 270.1 4(c)(3) are discussed in the following subsections.

15.1.13.1 Property Boundary

The Site is located between the Walnut River and the Arkansas River, upstream of their confluence as shown on Plate 3-2. The refinery property boundary is illustrated on both Plates 3-1 and 3-2. The property is surrounded by a chain-link fence. Entrance gates to the Site are secured.

15.1.13.2 Waste Management Area [40 CFR 270.14(c)(3)]

The facility's Waste Management Area, for the purposes of groundwater monitoring, is illustrated on Plate 3-1. The Waste Management Area encompasses the LTU, the closed #1 and #2 surface impoundments, and the closed #3A aerated lagoon.

Grouping of waste management units into waste management areas is allowed by 40 CFR 264.95. In this case, grouping the units into a single waste management area allows point of compliance groundwater monitoring to occur at the downgradient facility boundary.

15.2 Monitoring Program [40 CFR 270.14(c)(7),(8)]

Groundwater monitoring will consist of two phases, corrective action monitoring and compliance monitoring. The corrective action monitoring program (CAMP) is designed to meet the requirements of CFR 264.100 and to verify the effectiveness of the corrective action and to monitor the progress of the cleanup effort towards achieving the cleanup goals within the Waste Management Area. This will be done by monitoring groundwater quality within the Waste Management Area and by monitoring the capture zone of the ICM system to demonstrate no discharge of hazardous constituents to the Walnut River.

Once the groundwater analyses conducted in the CAMP demonstrate the water quality within the plume meets the groundwater protection standards, the facility will submit a request to KDHE to begin the compliance monitoring program as a Class I permit modification. Upon receiving KDHE approval, the facility shall implement the compliance monitoring program. This section, along with the Sampling and Analysis Plan in Appendix P, describes the Waste Management Area, the corrective action monitoring program (CAMP), and the compliance monitoring program.

15.2.1 Waste Management Area

As allowed by Sections 264.95(b)(2) and 264.97(b), the four regulated units have been incorporated into one waste management area for the purpose of groundwater monitoring. The Waste Management Area is defined as the area encompassing the land treatment unit (LTU) to the west and the former surface impoundments #1, #2, and #3A to the east extending to the point of compliance near the Walnut river boundary. Figure 15-13 shows the boundary of the Waste Management Area. The groundwater monitoring data (Figure 15-12) shows the groundwater flow direction and supports the definition of the Waste Management Area boundaries.

15.2.2 Corrective Action Monitoring Program [40 CFR 264.100]

The objective of the CAMP is to demonstrate the effectiveness of Corrective Action and to monitor the progress of cleanup effort toward achieving the cleanup goals within the Waste Management Area. The CAMP is described in Section 2.0 of the Sampling and Analysis Plan (Appendix P).

15.2.3 Compliance Monitoring Program

Once the CAMP data indicate that the groundwater quality within the Waste Management Area meets the groundwater protection standards, the facility will submit a Class I permit modification to KDHE requesting to begin the compliance monitoring program. The objective of the compliance monitoring program will be to confirm that the groundwater both within the plume and at the compliance point meet the groundwater protection standards. The Compliance Monitoring Plan is described in detail in Section 3.0 of the Sampling and Analysis Plan (Appendix P).

15.3 Sampling and Analysis Plan [40 CFR 264.97(d)]

The sampling and analysis procedures for both the Corrective Action Monitoring Program and the Compliance Monitoring Program are contained in Section 4.0 of the Sampling and Analysis Plan (Appendix P).

15.4 Engineering Feasibility Plan [40 CFR 270.14(c)(8)(iii) and (iv)]

The currently proposed engineering feasibility plan is being submitted to the KDHE under separate cover but is incorporated by reference into this permit renewal application. The proposed plan is entitled "Engineering Feasibility Plan, MRP Properties Company, LLC, Arkansas City, Kansas (Revision 7)". The most recent KDHE-approved version of the engineering feasibility plan is Revision 6, which was approved in April 2010. The proposed revisions include the following changes (more detail is provided in the revised engineering feasibility plan):

- The facility is proposing to remove Tanks TK-7111 and TK-7112 from their previous service as groundwater emergency containment tanks. These tanks were a protective

containment option at the time the original engineering feasibility plan was developed, because recovered groundwater was first processed through the nearby Tank 7131, then pumped to the lift station where it was pumped to the bioreactor tank (R-7101). Subsequent to the original submittal of the engineering feasibility plan the facility has made several significant improvements to the groundwater treatment system. Currently, recovered groundwater flows directly from the recovery wells into the bioreactor for treatment. The bioreactor is now equipped with two aeration blowers; only one is required for the operation of the unit. In the unlikely event of a major disruption to bioreactor operation, recovered groundwater would be diverted to the #3B Lagoon for temporary containment.

- The facility is proposing to remove recovery well RW-80A from the groundwater boundary containment system. Once removed from service, the well would be plugged and abandoned in accordance with Kansas requirements. This request is based on long term groundwater monitoring data and a 180 day temporary authorization to shut down recovery well RW-80A providing a technical demonstration indicating that RW-80A is not required for maintaining compliance with Section IV.C.2 – Prevention of Releases to the Walnut River; in fact, due to its location, RW-80A interferes with the capture zone in the vicinity of recovery well RW-75 and increases the gradient toward the Walnut River.
- The shutdown of recovery well RW-80A was field tested during a 180 day temporary authorization granted to MRP on November 4, 2008. RW-80A was shut down for a 180 day period between November 19, 2008 and May 18, 2009. During this time period, monthly capture zone monitoring indicated that the required 0.2-foot head difference was being achieved. The facility submitted the capture zone monitoring data on a monthly basis throughout the demonstration period to KDHE.

The facility is proposing to cease operation of the LTU groundwater corrective action system. The system consists of a soil vapor extraction system and an groundwater air sparging system. System monitoring data indicate that there are no further corrective action benefits of continued system operation. In correspondence dated December 21, 2010 the facility requested a 180-day temporary authorization to discontinue system operation. The request was granted on January 4,

2011. Per the plan submitted with its request, the facility will re-start the system during July 2011 to make system observations and evaluate potential rebound in recovery of subsurface hydrocarbon impacts. The facility intends to submit an evaluation of these data as a supplement to the current permit renewal application and proposed engineering feasibility plan.

SECTION 16

RCRA Facility Investigations

16.0 HSWA Activities and Site SWMU's 40 CFR 270.14(d)

16.1 Introduction to HSWA Requirements

This section of the permit application addresses the corrective action requirements for solid waste management units. HSWA requires that all permits issued after November 8, 1984 address releases of hazardous waste or hazardous constituents from any solid waste management unit, regardless of when waste was placed in the unit or whether the unit is closed.

The RCRA Facility Assessment (RFA), Phase I RCRA Facility Investigation (1992), and Phase II RCRA Facility Investigation (RFI) (2000) have been completed. The facility has an approved Corrective Measures Study (CMS) work plan and a proposed cleanup objectives report approved by the EPA (February 22, 2002). The facility has developed an exposure unit based approach to corrective action and a supplemental soil investigation was conducted during the fall of 2010. This soil investigation provided soil data to supplement the Phase II RFI data. The supplemental soil investigation covered the Process Area, Junk Storage Area, and the Construction Debris Landfill Area. Soil samples were also collected at the former transportation facility north of the Junk Storage Area and additional soil sampling was performed in the southeast corner of the Site at SWMUs 13 and 51.

16.2 Completed HSWA Activities

16.2.1 RCRA Facility Assessment

The RFA was completed for the EPA by A.T. Kearney, Inc. and Harding Lawson Associates. The findings are presented in the *RCRA Facility Assessment Report, August 1987*. The RFA identified 50 solid waste management units (SWMUs). The EPA also contracted with PRC Environmental Management, Inc. (PRC) to conduct a background file review, a site visit, and a recommendation for a sampling strategy. PRC prepared a draft sampling strategy report (PRC, 1997) which summarized the results of their site visit and file review, and presented their recommended sampling at each SWMU and AOC identified at the facility.

16.2.2 RCRA Facility Investigation

16.2.2.1 Short Term Groundwater Investigation

A short term groundwater investigation was completed at the request of the EPA. The results of the short term groundwater monitoring investigation are included in the *Final RFI Report* (RSA, 1992) also known as the Phase I RFI report. The investigation was designed to address technical concerns noted by the EPA and KDHE in the geological and hydrogeological information available on the refinery. The investigation had the following specific objectives:

- Define the hydraulic and lithologic properties of the uppermost aquifer, both horizontally and vertically.
- Define the hydraulic relationships between the uppermost unconsolidated alluvial aquifer and underlying consolidated bedrock formations.
- Define the vertical and horizontal changes in the hydraulic and chemical properties in the uppermost aquifer.
- Define the direction and rate of groundwater flow in all parts of the aquifer.
- Develop an analytical target compound list for groundwater monitoring.
- Develop a strategy for implementing long-term groundwater monitoring for the facility.

16.2.2.2 Unit and Waste Characterization

The unit and waste characterization information was compiled in the *Unit and Waste Characterization Report* (RSA, 1990) and submitted to the EPA on April 17, 1990.

16.2.2.3 Soil Characterization

The facility completed the soil characterization requirements contained in the RCRA permit for the site that became effective on December 2 1988. The facility submitted a work plan for the soil characterization investigation, and this work plan was approved by the EPA on September 29, 1989. The original plan included sampling and analytical testing of soils around the SWMUs identified in the RFA. The work plan stated that the vertical and horizontal extent of possible impacts would be investigated at the SWMUs. However, in a meeting between the EPA and the facility it was agreed that the soil characterization would be conducted in two phases. The first

phase consisted of the identification of impacts around SWMUs. A second phase was not deemed necessary (RSA, 1992).

The Phase I RFI soil characterization study was completed and the results of the investigation were submitted to the EPA in the *Phase I Soil Characterization Report* (RSA, 1991) and are included in the *Final RFI Report* (RSA, 1992).

16.2.2.4 Surface Water and Sediment Characterization Plan

A surface water and sediment characterization investigation was conducted in the Walnut River during 1989 and 1990. The results of this investigation were submitted to the EPA in the *Surface Water and Sediment Characterization Report* (RSA, 1990) and in the Final RFI Report (RSA, 1992). The Surface Water and Sediment Characterization Report concluded "It appears that the TPI facility operation is having minimal if any impact on the local Walnut River ecosystem". The final RFI report states "The Surface Water and Sediment Characterization investigation showed no obvious impacts to the Walnut River". Additional characterization of the Walnut River water quality was completed in the Phase II RFI in 1999. Results of the Phase II RFI sampling in the Walnut River at three locations 1) upstream of the site, 2) upstream of the outfall, and 3) at the downstream property boundary indicated similar concentrations supporting conclusions presented in the 1989 and 1992 reports described above. Of three sets of samples collected during low flow periods in October and November 1999 at each of the three surface water sample locations, there were no detections of Skinner List volatile organic compounds or semivolatile organic compounds with the exception of one estimated concentration (below the method reporting level) of chloroform. There were no significant differences in the metals concentrations over the course of the surface water sampling in 1999.

16.2.3 RCRA Facility Investigation Reports

On October 4, 1992, a Final RFI (Phase I RFI) report was submitted to the EPA. The report summarized the data collected in the above reports. In November of 1996, EPA submitted draft comments. A site visit was conducted by EPA in May of 1997. Based upon the comments and site visit, a Phase II RFI Work Plan was submitted to the EPA on July 24, 1998. EPA reviewed the Work Plan and submitted comments in March 1999. The revised Phase II RFI Work Plan was submitted to the EPA on May 26, 1999 and approved by the EPA on July 15, 1999. The

fieldwork was initiated in September 1999 and completed in December 1999. The results of the Phase II RFI were submitted to the EPA on June 5, 2000. KDHE provided comments on November 30, 2000. These comments were addressed in a response dated January 11, 2001 and in a subsequent document entitled "Addendum to TPI Petroleum, Inc, Phase II RCRA Facility Investigation", which was submitted to EPA and KDHE on April 18, 2001. The EPA approved the RCRA Facility Investigation report, with minor comments, on October 26, 2001.

16.2.4 Corrective Measures Study (CMS) Work Plan

Following EPA approval of the RFI, a CMS work plan was developed for the facility. The work plan was approved by EPA on February 22, 2002.

16.3 Description of Solid Waste management Units [40 CFR 270.14(d)]

Information available on each of the 55 SWMUs and Areas of Concern (AOCs) identified at the site is presented below. The locations of the SWMUs/AOCs are shown on Plate 16-1. As presented in this section, many of the SWMUs are no longer present as a result of demolition of the main refinery process area, and the excavation and reworking of soils during the demolition which included removal of process unit foundations and underground pipes to a depth of at least six feet bgs. Additionally, many of the individual SWMUs listed in this section have been grouped into Exposure Units for purposes of corrective action planning as described in the approved Exposure Unit Supplemental Soil Investigation Work Plan (MWH,2010). The ongoing facility characterization and future corrective action planning is the subject of Section 16.5.

16.3.1 SWMU 1 – Settling Pond No. 1

Settling Pond No. 1 is referred to in the facility's permit as the #1 closed surface impoundment and is a RCRA-regulated unit. This unit is currently in RCRA post closure care. Significant detail regarding this unit is included in other sections of this application. The unit is described in Section 3.2.1, the certification of closure is presented in Appendix A, the post closure plan is discussed in Section 13 and included as Appendix K.

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended that no further sampling be performed at this unit (PRC, 1997).

16.3.2 SWMU 2 – Settling Pond No. 2

Settling Pond No. 2 is referred to in the facility's permit as the #2 Surface Impoundment and is a RCRA-regulated unit. This unit is currently in RCRA post closure care. Significant detail regarding this unit is included in other sections of this application. The unit is described in Section 3.2.1, the certification of closure is presented in Appendix A, and the post closure plan is discussed in Section 13 and included as Appendix K.

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended that no further sampling be performed at this unit (PRC, 1997).

16.3.3 SWMU 3 – Settling Pond No. 3

The original Settling Pond No. 3 was constructed in 1956. In 1990, former Settling Pond No. 3 was reconstructed by subdividing it and constructing the #3A aerated lagoon and the #3B aerated lagoon. This reconstruction was completed before the effective date of the RCRA toxicity characteristic (TC) regulations of September 25, 1990. During construction, Settling Pond No. 3 was drained, sludge was removed, construction of the dike that separates the #3A aerated lagoon and the #3B aerated lagoon (now referred to as the #3B lagoon, since it is no longer aerated) was completed, bottom soils were compacted, and construction of new appurtenant features and equipment was completed on or before September 25, 1990.

The #3A aerated lagoon is a RCRA-regulated unit. This unit is currently in RCRA post closure care. Significant detail regarding this unit is included in other sections of this application. The unit is described in Section 3.2.2, the certification of closure is presented in Appendix A, and the post closure plan is discussed in Section 13 and included as Appendix K.

The #3B lagoon is a surface impoundment constructed of in-situ soils with an overflow dike. Its dimensions are roughly 500 feet by 300 feet by 7 feet deep. The #3B lagoon is equipped to receive, as needed, either treated groundwater from the bioreactors or untreated groundwater directly from the recovery wells (contingency situation only). The #3B lagoon also currently receives storm water runoff from the surface of the closed #3A aerated lagoon. During refinery operations, the water from the #3B lagoon flowed to the Shell Trap (SWMU 25) and was then pumped into the remaining aeration and settling lagoons. The Shell Trap is no longer in use, and

storm water collected in the #3B lagoon either evaporates or infiltrates. The #3B lagoon normally contains little (if any) standing water.

During Phase I of the RFI, soil samples were analyzed from soil borings drilled near SWMUs 3, 9, 10, and 11. PNAs, benzene, ethyl benzene, xylene, and lead were detected in some of these samples at concentrations exceeding background concentrations. These data are summarized in Table 12 of the Final RFI Report (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended that no further sampling be performed at this unit (PRC, 1997). The facility, however, did conduct additional sampling during the Phase II RFI and the results are included in the Phase II RFI report.

16.3.4 SWMU 4 – Oxidation Pond No. 1A

SWMU 4 was an aeration pond with limited-spray headers designed to accelerate biodegradation of organic compounds still entrained in wastewater after passing through the biological reactors and additional settling. The unit has about an 810,000-gallon volume when filled to freeboard limits and is about 200 feet long by 75 feet wide by 6- to 7-foot deep. It is unlined and composed of in-situ, re-compacted soils. The pond is located next to SWMUs 5 through 8 in the eastern part of the refinery.

The unit was most likely constructed in 1956 and continues to operate as a settling impoundment as part of the facility's wastewater treatment process.

The unit has been sampled for chromium contamination and found to contain elevated levels up to 1,330 parts per million (ppm) of chromium at several locations. During the RFA site visit, no odors were detected, though stains on the dikes were observed. During Phase I of the RFI, soil samples were analyzed from soil borings drilled near SWMUs 4, 5, 6, 7, and 8. PNAs, benzene, toluene, ethyl benzene, xylene, and lead were detected in some of these samples at concentrations exceeding background concentrations. These data are summarized in Table 13 of the Final RFI Report (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended that no further sampling be performed at this unit (PRC, 1997). The facility, however, did conduct additional sampling during the Phase II RFI and the results are included in the Phase II RFI report.

16.3.5 SWMU 5 – Oxidation Pond No. 1B

SWMU 5 is a flow-through lagoon with a volume of about 120,000 gallons. The impoundment is an aeration/settling pond that receives wastewater after passing through the biological reactors, the #3B aerated lagoon, and the oxidation pond no. 1A. The pond measures approximately 75 feet by 40 feet by about 5 feet deep. SWMU 5 is constructed of in-situ and re-compacted soils and designed with a perimeter dike.

The unit was likely constructed in 1956 and is still in use as part of the facility's wastewater treatment process.

During the RFA site visit by representatives from the EPA, dike stains were evident but no odors were detected (PRC, 1997). During Phase I of the RFI, soil samples were analyzed from soil borings drilled near SWMUs 4, 5, 6, 7, and 8. PNAs, benzene, toluene, ethyl benzene, xylene, and lead were detected in some of these samples at concentrations exceeding background concentrations. These data are summarized in Table 13 of the Final RFI Report (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended that no further sampling be performed at this unit (PRC, 1997). The facility, however, did conduct additional sampling during the Phase II RFI and the results are included in the Phase II RFI report.

16.3.6 SWMU 6 – Oxidation Pond No. 2

SWMU 6 is a flow-through lagoon with an operating volume of 1.3-million gallons. The impoundment was an aeration pond designed to accelerate biodegradation of organic compounds still entrained in refinery wastewater after passing through the biological reactors and additional settling. The pond is constructed of in-situ soil. The unit lies between SWMUs 5 and 7 and acts

as a flow-through device. Historically, two aerators have been used to help promote biological degradation of oily constituents. The unit measures about 300 feet by 85 feet by 6 feet.

The unit was likely constructed in 1956 and is still in use as part of the facility's wastewater treatment process.

During the RFA site visit by representatives from the EPA, oil stains were noted on the dike and the dikes were infested by burrowing animals. No other evidence or documentation of releases was found during the site visit. During Phase I of the RFI, soil samples were analyzed from soil borings drilled near SWMUs 4, 5, 6, 7, and 8. PNAs, benzene, toluene, ethyl benzene, xylene, and lead were detected in some of these samples at concentrations exceeding background concentrations. These data are summarized in Table 13 of the Final RFI Report (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). The facility, however, did conduct additional sampling during the Phase II RFI and the results are included in the Phase II RFI report.

16.3.7 SWMU 7 – Oxidation Pond No. 3

This impoundment further clarifies wastewater that meanders along a twisting route through a weir to SWMU 8. The pond holds 17.8-million gallons when filled to freeboard limits. During refinery operations, three aerators functioned, spaced at intervals to maximize aeration. The pond averages about 7 feet in depth, and is approximately 1,000 feet long by 500 feet wide. Internal dikes are present to increase retention time in the impoundment. The pond is constructed of in-situ soil.

The unit was likely constructed in 1956 and is still in use as part of the facility's wastewater treatment process.

There were no odors detected during the visual site inspection (VSI) conducted as part of the RFA (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987). During Phase I of the RFI, soil samples were analyzed from soil borings drilled near SWMUs 4, 5, 6, 7, and 8. PNAs, benzene, toluene, ethylbenzene, xylene, and lead were detected in some of these samples at

concentrations exceeding background concentrations. These data are summarized in Table 13 of the Final RFI Report (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). The facility, however, did conduct additional sampling during the Phase II RFI and the results are included in the Phase II RFI report.

16.3.8 SWMU 8 – Oxidation Pond No. 4

This unit is a flow-through device used for final clarifying of the wastewater effluent prior to discharge through a National Pollutant Discharge Elimination System (NPDES) outfall. Effluent is sampled at the Parshall flume before the effluent flows through a culvert under-the-road and then toward the outfall into the Walnut River. The unit meanders in a manner similar to SWMU 7; however, there were no aerators. The unit can hold up to 11.2 million gallons when filled to freeboard limits. The pond averages about 7 feet in depth, and is approximately 700 feet long by 500 feet wide. Internal dikes are present to increase retention time in the impoundment. The unit is constructed of in-situ soil.

The unit was likely constructed in 1956 and is still in use as part of the facility's wastewater treatment process.

During the VSI, there was little or no staining evident on the dike embankments (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987). During Phase I of the RFI, soil samples were analyzed from soil borings drilled near SWMUs 4, 5, 6, 7, and 8. PNAs, benzene, toluene, ethyl benzene, xylene, and lead were detected in some of these samples at concentrations exceeding background concentrations. These data are summarized in Table 13 of the Final RFI Report (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). The facility, however, did conduct additional sampling during the Phase II RFI and the results are included in the Phase II RFI report.

16.3.9 SWMU 9 – Evaporation Pond No. 1

This pond was used to manage storm water from process and non-process areas. It is about 50 feet wide by 150 feet long by 7 feet deep. Its estimated volume is about 375,000 gallons when filled to the freeboard limit. SWMU 9 discharges through a pipe that crosses the dike to SWMU 10.

The unit is estimated to have been built around 1956 and is still in use.

During the history of the plant, the water in this impoundment at times contained a sheen. There was staining observed along the embankment during the VSI (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987). During Phase I of the RFI, soil samples were analyzed from soil borings drilled near SWMUs 3, 9, 10, and 11. PNAs, benzene, ethyl benzene, xylene, and lead were detected in some of these samples at concentrations exceeding background concentrations. These data are summarized in Table 12 of the Final RFI Report (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). The facility, however, did conduct additional sampling during the Phase II RFI and the results are included in the Phase II RFI report.

16.3.10 SWMU 10 – Evaporation Pond No. 2

This pond received storm water from process and non-process areas which flowed from SWMU 9. This pond measures about 210 feet by 50 feet by 7 feet deep, and holds over 500,000 gallons when filled to freeboard limits. The unit is constructed of in-situ soil. It is fed by an inlet pipe that connects SWMU 9 with SWMU 10 through the dike. There is no outlet except to SWMU 11.

The unit is estimated to have been built around 1956 and is still in use.

During the VSI, the unit exhibited a scum layer on the water surface (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987). During Phase I of the RFI, soil samples were analyzed from soil borings drilled near SWMUs 3, 9, 10, and 11. PNAs, benzene, ethyl benzene,

xylene, and lead were detected in some of these samples at concentrations exceeding background concentrations. These data are summarized in Table 12 of the Final RFI Report (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). The facility, however, did conduct additional sampling during the Phase II RFI and the results are included in the Phase II RFI report.

16.3.11 SWMU 11 – Evaporation Pond No. 3

This basin receives storm water from SWMU 10 and served as the impoundment for the management of storm water from process and non-process area runoff. The unit is about 100 feet square and 6 feet deep. When filled to freeboard limits, it holds about 500,000 gallons. The unit is constructed of native soil.

The unit is estimated to have been built around 1956 and is still in use.

The dikes exhibited light staining during the VSI (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987). During Phase I of the RFI, soil samples were analyzed from soil borings drilled near SWMUs 3, 9, 10, and 11. PNAs, benzene, ethyl benzene, xylene, and lead were detected in some of these samples at concentrations exceeding background concentrations. These data are summarized in Table 12 of the Final RFI Report (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). The facility, however, did conduct additional sampling during the Phase II RFI and the results are included in the Phase II RFI report.

16.3.12 SWMU 12 – Marley Cooling Tower

SWMU 12 was an open-air, concrete basin structure, built mostly below grade. Basin contents were continuously pumped from the cooling tower to the basin and back again to the tower. The basin was approximately 6 to 8 feet deep by 15 feet wide by 30 feet long. Its volume was about 25,000 gallons.

It is believed that the Marley Cooling Tower began operation during the 1950s. The unit was not in operation during the VSI. The cooling tower water historically contained chromate. Other less toxic materials were substituted for the chromate during the 1980s or 1990s.

There were no documented releases from this unit.

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). Additional sampling was conducted in 1999 during the Phase II RFI.

In 2003, the refinery was subject to decommissioning. The decommissioning eliminated above and below grade structures in the main process area including underground piping to six feet below ground surface. The main process area was then re-graded, resulting in movement of some area soils. SWMU 12 was located within the footprint of these site decommissioning and re-work activities.

In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 12 is in exposure unit PA-10. Supplemental soil sampling was conducted in this exposure unit in the fall of 2010. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.13 SWMU 13 – Oily Lagoon No. 1/Asphalt Pit

The Oily Lagoon No. 1/Asphalt Pit was originally believed to have been used to burn general refuse at the Site prior to the late 1970s. The date of construction of the unit is unknown, but is believed to be prior to 1957. Asphalt and oily sludge were stored in the unit prior to closure. The unit was originally circular and was expanded to cover an area about 160,000 square feet (3.7 acres) when a dike was breached during unit closure. Nothing more is unknown about the construction of the unit.

A release occurred during closure when the dike was breached and the contents were spread over 3.7 acres. The closure addressed the entire area. The unit is also known to have emitted materials to the air while open burning was practiced prior to 1978. The VSI reports that, in 1987, the unit

was recently closed and that the closure was approved by KDHE (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). Additional sampling was conducted in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

16.3.14 SWMU 14 – Oily Lagoon No. 2

SWMU 14 was located close to the NPDES outfall and across the Corps of Engineers' dike from Oxidation Pond No. 4 (SWMU 8). The impoundment contents were removed prior to 1980 and the materials were placed in the Land Treatment Unit (SWMU 48). No further details are available regarding unit contents or age of construction. However, aerial photographs taken on October 15, 1977 and September 18, 1980 appeared to indicate that the area of the lagoon was approximately the same as SWMU 3 (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987). The area that was occupied by SWMUs 14, 16, and 47 is now part of the permitted construction debris landfill (CDL).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended no further sampling at this unit (PRC, 1997). However, extensive soil sampling was conducted in the CDL area during the fall of 2010 to characterize the soil impacts in the area occupied by SWMUs 14, 16, and 47. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.15 SWMU 15 – Earthen Ditch

The earthen ditch was a drainage trench about 1,500 feet long by 4 feet deep at its deepest point, with an average width of about 6 feet. The ditch historically received storm water as well as cooling tower blowdown water. The blowdown was conveyed by underground pipe to an outlet at the western end of the ditch. The water in the ditch flowed by gravity under the SWMU 3 overflow conduit and drained into a pool of water about 15 feet in diameter. The pooled contents were pumped via an underground pipe into the Shell Trap (SWMU 25). At one end of the pool, a

small overflow causeway was built that could connect the pool overflow to the flow from SWMU 8, near the NPDES outfall.

The date of construction is not known. By 1993 the earthen ditch was excavated and replaced with a cement-lined channel to manage storm water.

During Phase I of the RFI, soil samples were analyzed from a soil boring drilled at SWMU 15. PNAs, toluene, ethyl benzene, xylene, and lead were detected in this boring at concentrations exceeding background concentrations. These data are summarized in Table 14 of the Final RFI Report (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). Additional sampling was conducted in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

16.3.16 SWMU 16 – FCC Disposal Area

At SWMU 16, spent FCC catalyst was spread on the land adjacent to Walnut River, but within a protective dike. About 2,000 tons of materials were stockpiled in roughly a 1-acre area, which by 1987 appeared to have leveled itself to nearly surrounding grade (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987). The stockpile was underlain by soil. The area that was occupied by SWMU 14, 16, and 47 is now part of the permitted construction debris landfill (CDL).

There have been no documented releases. No odors, spills, or other indicators were evident during the site visit.

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). Extensive soil sampling was conducted in the CDL area during the fall of 2010 during the soil exposure unit supplemental soil investigation to characterize the soil impacts in the area occupied by SWMUs 14, 16, and 47. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.17 SWMU 17 – HEB Slab

The heat exchanger bundle (HEB) cleaning slab is a concrete slab located near the refinery warehouse that was formerly used in the process of HEB cleaning. This practice was moved to another location (SWMU 18), and during the VSI the slab was used to store polychlorinated biphenyl's (PCB) transformers, PCB-contaminated mineral oil transformers, and hazardous waste drums. The unit is 20 feet wide by 40 feet long, and has a small concrete curb to contain wash waters, spills, and rainfall.

The start-up date for the HEB slab could not be determined. The unit ceased being a HEB cleaning slab in 1986, when the newer HEB cleaning slab (SWMU 18) was opened.

Catalyst was observed on the ground near the HEB slab during the VSI (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987). During Phase I of the RFI, three surface soil samples collected from SWMU 17 were analyzed. Chromium slightly exceeded background concentrations in these samples. These data are summarized in Table 15 of the Final RFI Report (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). Additional sampling was conducted in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

16.3.18 SWMU 18 – New HEB Slab

The new HEB slab is located in the north process area. The unit is 40 feet wide by 60 feet long. The new slab is located within the footprint of the old laboratory, though the slab is a separate construction installed specifically for this purpose. The new slab is connected directly to the API Separator System (SWMU 28) by a drainage sump. The concrete curbing surrounding the HEB slab is about 1 foot high.

The unit was opened in 1986 and ceased operation as a HEB cleaning slab when the refinery closed in 1996.

No releases were documented for this area, although during the site visit, HEB sludge was observed on the ground surrounding the slab.

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). Additional sampling was conducted in 1999 during the Phase II RFI and the results are included in the Phase II RFI report. In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 18 is in exposure unit PA-2.

16.3.19 SWMU 19 – Trash Unloading Dock

The trash unloading dock is a concrete block platform. A 30 or 40 cubic yard, open-topped, metal roll-off container was placed adjacent to it. Non-hazardous industrial wastes were placed in the box until it was full, at which time the contents were disposed of at the county landfill.

The start-up date is unknown but was before 1988.

There have been no documented releases of hazardous constituents. No RCRA hazardous wastes are known to be placed in the SWMU.

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended that no further sampling be performed at this unit (PRC, 1997). However, additional sampling was conducted in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

16.3.20 SWMU 20 – Junk Storage Area

The junk storage area is a flat, open area that covers 5 to 6 acres. The area was used as a lay down yard for a variety of scrap materials.

There were no releases described in the files reviewed by any RFA activities (PRC, 1997). During the VSI, however, there appeared to be at least two areas in the 5- to 6-acre plot that were of concern (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987). Drums containing asphaltic or oily sludge were found in a degraded condition in the area. Other drums with solidified material were found near a trash mound. These drums were removed from the

area. During Phase I of the RFI, surface soil samples collected from SWMU 20 were analyzed for oil and grease. These data are summarized in Table 16 of the Final RFI Report (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). Additional sampling was conducted in 1999 during the Phase II RFI and the results are included in the Phase II RFI report. Subsequently, in 2010 additional soil samples were collected during the soil exposure unit supplemental soil investigation. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.21 SWMU 21 – Empty Barrel Storage Area

The empty drum storage area was located at the site of the old warehouse in the north process area. Empty drums were stacked to await shipment to a contractor for reconditioning. Storage was on a concrete pad. Barrel storage began in this area in the late 1970s. The VSI indicated this unit was not used, and no barrels remain.

There was no documentation or indication of release during the file review or the site visit conducted by EPA contractors (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987 and PRC, 1997).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended that no further sampling be performed at this unit (PRC, 1997). However, additional sampling was conducted in 1999 during the Phase II RFI and the results are included in the Phase II RFI report. In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 21 is in exposure unit PA-2.

16.3.22 SWMU 22 – Neutralization Pit

This concrete, below-grade tank had inside dimensions of about 16 feet long by 8 feet wide by 7 feet deep, with walls about 10 inches thick. The unit was generally kept about half full. It was located at the HF Alkylation unit, where spent acid was discharged to the two-stage pit. Lime was added to neutralize the acidic solution. About 100,000 gallons per day of neutralized acid

were generated and discharged to the No. 2 Oil Trap (SWMU 24). The unit generated a sludge that exhibited the RCRA characteristic of corrosivity (D003). Because of the alkaline nature of the sludge, it was applied to the land treatment unit (SWMU 48) to neutralize the pH in the soils at the unit as required under the RCRA permit for the LTU.

The unit operated from the early 1960s until the close of the refinery operations in 1996.

There are no documented releases to any media. Furthermore, any excessive pH levels would be neutralized by the buffering effects of the surrounding soils.

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended that no further sampling be performed at this unit (PRC, 1997). However, additional sampling was conducted in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

In 2003, the refinery was subject to decommissioning. The decommissioning eliminated above and below grade structures in the main process area including underground piping to six feet below ground surface. The main process area was then re-graded, resulting in movement of some area soils. SWMU 22 was located within the footprint of these site decommissioning and re-work activities.

In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 22 is in exposure unit PA-7. Subsequently, in 2010 additional soil samples were collected during the soil exposure unit supplemental soil investigation. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.23 SWMU 23 – No. 1 Oil Trap

Beginning in the 1930s, the No. 1 oil trap was used to manage oily wastewater. There is no documentation of how water and sludge in the unit were managed. More recently, before it was removed, the unit was only used to contain spills and storm water. The unit was removed from service in December of 1986. A storm water pond now occupies the previous location of the No. 1 Oil Trap.

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). Additional sampling was conducted in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

In 2003, the refinery was subject to decommissioning. The decommissioning eliminated above and below grade structures in the main process area including underground piping to six feet below ground surface. The main process area was then re-graded, resulting in movement of some area soils. SWMU 23 was located within the footprint of these site decommissioning and re-work activities.

In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 23 is in exposure unit PA-4. Subsequently, in 2010 additional soil samples were collected during the soil exposure unit supplemental soil investigation. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.24 SWMU 24 – No. 2 Oil Trap

The No. 2 Oil Trap is a mostly below-grade concrete pit used as the main collection point for wastewater generated in the main refinery process area. It is a flow-through device that was heated to avoid plugging. During the VSI the No. 2 oil trap was used to transfer wastewater by gravity feed to the new API Separator. In the past, the unit discharge directly to the No. 1 Settling Pond (SWMU 1). The unit measured about 8 feet by 8 feet by 8 feet deep. It was surrounded by a pipe rail and covered with a steel grating. Steam lines fed into the unit; while a waste feed line and valve were positioned at one corner outside the pit.

The date of construction is not known, though the unit was present prior to the 1950s. The unit was still used in the wastewater treatment system during the VSI.

Staining was identified around the unit during the VSI (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987). During Phase I of the RFI, soil samples were analyzed from a soil boring drilled at SWMU 24. PNAs, benzene, toluene, and ethyl benzene were detected in this boring at concentrations exceeding background concentrations. These data are summarized in Table 17 of the Final RFI Report (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997).

In 2003, the refinery was subject to decommissioning. The decommissioning eliminated above and below grade structures in the main process area including underground piping to six feet below ground surface. The main process area was then re-graded, resulting in movement of some area soils. SWMU 24 was located within the footprint of these site decommissioning and re-work activities.

In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 24 is in exposure unit PA-7. Subsequently, in 2010 additional soil samples were collected during the soil exposure unit supplemental soil investigation. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.25 SWMU 25 – No. 3 Oil Trap (Shell Trap)

The Shell Trap is a segmented concrete tank that had been used for nearly 50 years to handle oily wastewater and then treated wastewater. While the unit is mainly a flow-through device, Shell Oil Company originally constructed it to skim oil off wastewater. During the VSI it was used to pump treated wastewater from Settling Pond No. 3B (SWMU 3) to the remaining aeration/settling impoundments (oxidation ponds 1A, 1B, 2, 3, and 4). The unit measures 30 feet long by 15 feet wide by 6.5 feet deep. The unit it is mostly constructed below grade. A circulation pump handled gravity outflow through a set of four weirs. About 6 inches of freeboard were maintained at the unit. This unit continued service after the refinery shutdown as a component of the wastewater treatment system handling treated groundwater until modifications to the wastewater treatment system in 1999 bypassed the Shell Trap.

Based on the VSI, staining on soil and the outside surface of the unit's concrete wall were noted (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987). During Phase I of the RFI, soil samples were analyzed from a soil boring drilled at SWMU 25. PNAs and xylene were detected in this boring at concentrations exceeding background concentrations. These data are summarized in Table 18 of the Final RFI Report (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). This sampling was performed in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

16.3.26 SWMU 26 – Tank C-37

Tank C-37, later referred to as Tank 7131, was part of the groundwater collection and treatment system during the VSI. The tank was a 120,000-gallon (2,200 barrel) carbon steel tank. Groundwater was initially pumped to Tank 7131 from the voluntary interim corrective measure, and then the groundwater was fed from Tank 7131 to the treatment system. Tank 7131 did not handle phase separated hydrocarbon. Phase separated hydrocarbon and some mixed groundwater was pumped to Tank 7132 where it was allowed to separate.

The tank was built around 1973. The interior of this tank was cleaned and the tank was demolished during demolition activities.

The soils near Tank C-37 and Tank 104-B (SWMU 32) were stained. A release of phase separated hydrocarbon occurred on December 24, 1997. Tank 104-B (later referred to as Tank 7132) overflowed, and 214 barrels of recovered hydrocarbon were released onto the ground. It was raining at the time, and the hydrocarbon ponded on top of the rain water. A vacuum truck was used to immediately remove the recovered product from the surface of the ground.

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). This sampling was performed in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 26 is in exposure unit PA-11. Subsequently, in 2010 additional soil samples were collected during the soil exposure unit supplemental soil investigation. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.27 SWMU 27 – Tank C-106

This carbon steel, 100,000-gallon treatment tank handled the emulsion phase from Tank C-37 (SWMU 26). A chemical agent was added to break down the emulsion, with the oil returned to the refinery to reuse. Wastewater was discharged to Settling Pond No. 1 (SWMU 1), and emulsion solids were taken out for land treatment. Oil/water solutions were circulated through a heat element operated outside the tank to further break down the emulsion.

The date of construction of the tank is uncertain but is believed to be in the 1970s. The tank has been removed from service and is no longer present. When the tank was removed, it was cleaned out, the tank was dismantled, and the top foot of soil in the containing dike was removed.

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). This sampling was performed in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

In 2003, the refinery was subject to decommissioning. The decommissioning eliminated above and below grade structures in the main process area including underground piping to six feet below ground surface. The main process area was then re-graded, resulting in movement of some area soils. SWMU 27 was located within the footprint of these site decommissioning and re-work activities.

In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 27 is in exposure unit PA-11. Subsequently, in 2010 additional soil samples were collected during the soil exposure unit supplemental soil investigation. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.28 SWMU 28 – API Separator System

The API Separator System comprises a portion of the current waste water treatment system for the site. Storm water (and process waste water when the refinery was operating) flows by gravity to the influent lift station (Z-7101 and Z-7102). During the winter months, groundwater is also diverted into the system to prevent freezing of the lines. The lift station consists of the two bays of the existing API oil water separator. The separators were modified with baffles and were

covered to control the release of vapors. Screens had been placed on the influent to each bay to capture trash and solids that could foul downstream treatment processes. Sand and grit present in the incoming wastewater are removed in the lift station. Two sets of pumps can be used to transfer wastewater to downstream processes. The two dry weather pumps and four wet weather pumps can be used for pumping wastewater from the API separator to the two oil/water separator tanks (TK-7101 and TK-7102). The API separator is about 40 feet long, 20 feet wide, and 15 feet deep.

Tanks TK-7101 and TK-7102 were 5,000 barrel, heated, insulated tanks constructed to separate free floating oil from the wastewater. Floating oil was decanted using four different elevation draw off points on each tank. Decanted oil was removed from the wastewater treatment system. The remaining water was pumped to the bio-reactors prior to being discharged to the series of settling impoundments which started with Impoundment 3B (part of SWMU 3). (The induced air flotation, or IAF, unit is no longer in service.)

All the units are contained within a single dike on a paved location, except for Tanks 7101 and 7102, which are located within a dike on a paved area across the refinery access road leading to the API Separator System.

The system began operating in 1987 and continues to function as a lift station. During the VSI it was observed that the unit was relatively new, and no evidence of a release was observed or found by the EPA contractors during two portions of the RFA (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987 and PRC, 1997).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended that no further sampling be performed at this unit (PRC, 1997). However, additional sampling was performed adjacent to the unit in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 28 is in exposure unit PA-4. Subsequently, in 2010 additional soil samples were collected during the soil exposure

unit supplemental soil investigation. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.29 SWMU 29 – Road Oil Blender Area

The road oil blender was a process unit that blended free oil and heavy ends into an asphalt material and dispensed it into trucks.

This unit was constructed in 1974. The unit was removed from service when the refinery ceased operation in 1996.

Drips from the dispensing equipment were observed during the VSI (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987). During Phase I of the RFI, surface soil samples collected from SWMU 29 were analyzed for oil and grease. These data are summarized in Table 19 of the Final RFI Report (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). This sampling was performed in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 29 is in exposure unit PA-1. Subsequently, in 2010 additional soil samples were collected during the soil exposure unit supplemental soil investigation. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.30 SWMU 30 – Septic Tank

SWMU 30 is an old septic tank located near the warehouse. No other information is available. The age of the septic system is unknown. The nature of the tank is to discharge wastewater to a leach field. Solids are commonly pumped out. There were no visible signs of release observed by EPA contractors (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987 and PRC, 1997).

There is no record of hazardous waste being disposed of, or treated, in the septic system.

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended that no further sampling be performed at this unit (PRC, 1997). However, additional sampling was performed adjacent to the unit in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

16.3.31 SWMU 31 – Tank C-35

Tank C-35 is a horizontal, steel tank that was used for slop oil recovery. The tank was set on a saddle that was bordered on one side by a concrete wall; however, there was no other containment. The age of the tank is uncertain. The unit was no longer in use at the time the VSI was conducted. The tank is no longer present.

During the VSI, soil staining was observed near the manual feed station (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987). During Phase I of the RFI, surface soil samples collected from SWMU 31 were analyzed. Benzene, toluene, ethyl benzene, xylene, lead, and chromium were detected in some of these samples at concentrations exceeding background concentrations. These data are summarized in Table 20 of the Final RFI Report (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). This sampling was performed in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 31 is in exposure unit PA-11. Subsequently, in 2010 additional soil samples were collected during the soil exposure unit supplemental soil investigation. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.32 SWMU 32 – Tank 104-B

Tank 104-B (later identified as Tank 7132) was a 10,000-gallon steel tank that sat on soil adjacent to Tank C-37 (SWMU 26). It was used in conjunction with waste oil recovery. The unit was covered and fed by direct line. The date of construction was 1951.

The soils near Tank C-37 and Tank 104-B were stained during the VSI (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987). During Phase I of the RFI, surface soil samples collected from SWMU 32 were analyzed. Benzene, toluene, ethylbenzene, xylene, lead, and chromium were detected in some of these samples at concentrations exceeding background concentrations. These data are summarized in Table 21 of the Final RFI Report (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). This sampling was performed in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 32 is in exposure unit PA-11. Subsequently, in 2010 additional soil samples were collected during the soil exposure unit supplemental soil investigation. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.33 SWMU 33 – Oil Recovery Tank

SWMU 33 (T-7134) was a less than 5,000-gallon steel tank situated approximately 30 feet east of product storage tank T-133. The tank sat on the ground and was used to store recovered oil. The date of construction is unknown.

There are no documented past releases. During the VSI, there was no evidence of release to any media (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987). SWMU 33 was removed prior to March 2001.

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). This sampling was performed in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

16.3.34 SWMU 34 – Old API Separator

The unit was an oil/water separator. It was closed and removed in 1980.

The EPA found no information available to indicate a release had occurred to any media (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). This sampling was performed in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

In 2003, the refinery was subject to decommissioning. The decommissioning eliminated above and below grade structures in the main process area including underground piping to six feet below ground surface. The main process area was then re-graded, resulting in movement of some area soils. SWMU 34 was located within the footprint of these site decommissioning and re-work activities.

In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 34 is in exposure unit PA- 6. Subsequently, in 2010 additional soil samples were collected during the soil exposure unit supplemental soil investigation. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.35 SWMU 35 – Below-Grade Tank

SWMU 35 was a below-grade tank with a steel cover located next to product storage tank 120. SWMU 35 was used to manage water drawn off of the crude prior to sending the water into the waste water treatment system. The year of construction is not known.

Spillage around Tank 120 (see SWMU 50) and a filled barrel were observed during the VSI (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). This sampling was performed in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

16.3.36 SWMU 36 – Recovered Oil Tanks

Three identical carbon steel storage tanks were located in a contiguous series in a tank farm near the refinery warehouse. The three tanks, each with an estimated 10,000-gallon capacity, provided storage for recovered oil from Tank 37 and the former Tank 106. The area is unpaved and surrounded by a dike made of uncompacted soil. The tanks were built in 1927 and removed in 1990.

During the VSI, spillage was observed around the inlet piping to the recovered oil tanks, and there were no drip pans or other devices to catch seepage from the lines (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987). During Phase I of the RFI, surface soil samples collected from SWMU 36 were analyzed for oil and grease. These data are summarized in Table 22 of the Final RFI Report (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). This sampling was performed in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 39 is in exposure unit PA- 9. Subsequently, in 2010 additional soil samples were collected during the soil exposure unit supplemental soil investigation. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.37 SWMU 37 – Recovered Oil Tanks

Two recovered oil tanks (capacity estimated at 30,000 gallons each) were located north of the main refinery process area. These tanks were set on above-grade saddles. The units were constructed on unpaved surfaces in an area with a concrete dike.

There was no evidence of release during the site visit for the VSI (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further

sampling at this unit (PRC, 1997). This sampling was performed in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 37 is in exposure unit PA-3. Subsequently, in 2010 additional soil samples were collected during the soil exposure unit supplemental soil investigation. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.38 SWMU 38 – Truck Wash Tank

SWMU 38 is an underground tank approximately 40 feet long located near the truck wash station. Runoff from the truck wash operation is captured and diverted to this tank. The storm water is periodically pumped out of the unit through a lift station and discharged to the waste water treatment plant. The date the unit was constructed is unknown, but is probably in the early 1960's.

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended that no further sampling be performed at this unit (PRC, 1997). However, additional sampling was performed adjacent to the unit in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

16.3.39 SWMU 39 – Oily Wastes Sewer Lines

Waste water sewer lines were located within the general process areas for the facility. In the main refinery process area just south of the railroad tracks, these lines tied into the old No. 2 oil trap (SWMU 24) and were skimmed and pumped to the No. 1 oil trap (SWMU 23). North of the railroad tracks, these lines tied directly in to the No. 1 oil trap. North of the rail road tracks, these lines were installed beginning as early as the 1920s, and south of the railroad tracks these lines probably were installed beginning in the 1950s. A map showing the available information on the location of the sewer lines was presented in the Final RFI Report as Figure 3 (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). Because of the dispersed nature of the waste water sewers in

the process area, this recommended characterization was performed via the broad process area sampling included in the 1999 Phase II RFI and the results are included in the Phase II RFI report.

In 2003, the refinery was subject to decommissioning. The sewer lines were cleaned as part of the decommissioning process. The decommissioning eliminated above and below grade structures in the main process area including underground piping to six feet below ground surface. The main process area was then re-graded, resulting in movement of some area soils. SWMU 39 was located within the footprint of these site decommissioning and re-work activities.

In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 39 is in exposure units PA-5 through PA-11. Subsequently, in 2010 additional soil samples were collected during the soil exposure unit supplemental soil investigation. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.40 SWMU 40 – Sumps in North and South Process Areas

The sumps (SWMU 40) were partially buried concrete tanks with above-grade retaining walls and below-grade drains. Sumps ranged in size from 9 square feet to nearly 100 square feet. Sumps at the site included heated and ambient temperature sumps. Uses for sumps at the site included storage, flow-through devices, and heating points to soften solidified asphalt. The exact location of all sumps present during the entire life of the facility has not been determined.

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). Broad soil sampling of the process areas was conducted in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

The sumps in the Main Refinery Process Area (i.e., formerly referred to as the South Process Area) were located within the footprint of the 2003 site decommissioning and re-work activities, consequently, these sumps were removed.

In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 40 was extensively sampled in 2010 during the soil exposure unit supplemental soil investigation. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

Sumps in the Asphalt Unit area (i.e., formerly referred to as the North Process Area) still remain.

16.3.41 SWMU 41 – Hot Oil Sump

The hot oil sump was an open topped, concrete, below-grade sump with dual chambers. The sump accumulated oily sludge. Periodically the sludge in the sump was removed and applied to the LTU. The hot oil sump was removed from service when the refinery ceased operations.

During Phase I of the RFI, soil samples were analyzed from a soil boring drilled at SWMU 41. PNAs, benzene, ethyl benzene, and xylene were detected in this boring at concentrations exceeding background concentrations. These data are summarized in Table 23 of the Final RFI Report (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). This sampling was performed in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

In 2003, the refinery was subject to decommissioning. The decommissioning eliminated above and below grade structures in the main process area including underground piping to six feet below ground surface. The main process area was then re-graded, resulting in movement of some area soils. SWMU 41 was located within the footprint of these site decommissioning and re-work activities.

In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 41 is in exposure unit PA-10. Subsequently, in 2010 additional soil samples were collected during the soil exposure unit supplemental soil investigation. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.42 SWMU 42 – No. 6 Track Asphalt Trench and Drain System

When asphalt shipping was part of the facility's operations, asphalt was stored in this trench (SWMU 42) with steam lines to keep the material from solidifying. The trench was drained by a line that culminated in a sump leading to the No. 2 Oil Trap (SWMU 24).

The date of construction of the trench is unknown, and the trench has not been in use since about 1980.

During Phase I of the RFI, surface soil samples collected from near SWMU 42 were analyzed for oil and grease. These data are summarized in Table 24 of the Final RFI Report (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). Two process area locations were sampled near the track area in 1999 during the Phase II RFI and the results are included in the Phase II RFI report.

In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 42 was located in exposure units PA-6 and PA-7. Subsequently, in 2010 additional soil samples were collected during the soil exposure unit supplemental soil investigation. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.43 SWMU 43 – Truck Wash Drain Pad Sump

Near the entrance to the refinery is an unpaved truck wash station that consists of a steam outlet, hoses, and a collection sump. The collection sump feeds to a storage tank for wash water (SWMU 38). The truck wash area was used during the active operation of the refinery to wash vehicles prior to driving on public roadways.

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended that no further sampling be performed at this unit (PRC, 1997).

16.3.44 SWMU 44 – Sour Water Stripper

The sour water stripper was a tower unit that used steam to strip sulfide and ammonia from wastewater. This treated water was then discharged to the desalter units. The unit was constructed in 1977 and ceased operation in 1987.

There are no documented releases to any media. No releases were observed during the site visit (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended that no further sampling be performed at this unit (PRC, 1997). SWMU 44 was located within the Phase II RFI Process Area. This area was extensively sampled in 1999 during the Phase II RFI. The results of the sampling are included in the the Phase II RFI report.

In 2003, the refinery was subject to decommissioning. The decommissioning eliminated above and below grade structures in the main process area including underground piping to six feet below ground surface. The main process area was then re-graded, resulting in movement of some area soils. SWMU 44 was located within the footprint of these site decommissioning and re-work activities.

In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 44 is in exposure unit PA-6. Subsequently, in 2010 additional soil samples were collected during the soil exposure unit supplemental soil investigation. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.45 SWMU 45 – No. 2 Crude Desalter Units

The No. 2 crude oil desalter (SWMU 45) consisted of two identical, horizontal, tank-like units that were insulated and set on steel saddles. These units used electrolysis to desalt crude. Raised above the paved concrete slab, the units each had a curbed area to contain spillage.

This unit was constructed in 1980 and was active until the refinery ceased operation in 1996.

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further

sampling at this unit (PRC, 1997). Broad soil sampling of the process areas was conducted in 1999 during the Phase II RFI and the results of the sampling are included in the Phase II RFI report.

In 2003, the refinery was subject to decommissioning. The decommissioning eliminated above and below grade structures in the main process area including underground piping to six feet below ground surface. The main process area was then re-graded, resulting in movement of some area soils. SWMU 45 was located within the footprint of these site decommissioning and re-work activities.

In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 45 is in exposure unit PA-8. Subsequently, in 2010 additional soil samples were collected during the soil exposure unit supplemental soil investigation. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.46 SWMU 46 – No. 1 Crude Desalter Units

The No. 1 crude oil desalter (SWMU 46) was a chemical desalter. The unit was a tank approximately 40 feet long by 12 feet wide. The unit was used to remove salts from the crude oil.

This unit was constructed in 1957 and ceased operation 1986.

The totally enclosed units were raised on concrete saddles in a paved area with curbing. A sump collected and directed spillage to the waste water sewer. The RFA concluded that there is no documentation of releases to any media and no release was observed during the VSI (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). Broad soil sampling of the process areas was conducted in 1999 during the Phase II RFI and the results of the sampling are included in the Phase II RFI report.

In 2003, the refinery was subject to decommissioning. The decommissioning eliminated above and below grade structures in the main process area including underground piping to six feet

below ground surface. The main process area was then re-graded, resulting in movement of some area soils. SWMU 46 was located within the footprint of these site decommissioning and re-work activities.

In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 46 is in exposure unit PA-8. Subsequently, in 2010 additional soil samples were collected during the soil exposure unit supplemental soil investigation. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.47 SWMU 47 – Construction Demolition Landfill

SWMU 47 is a permitted construction demolition landfill (CDL) that covers approximately 14 acres. The CDL received permit number 523 through the solid waste division of KDHE for operating a solid waste disposal area. The area covered by SWMU 47 includes the areas covered by SWMUs 14 and 16. The unit started in 1982.

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended no further sampling at this unit (PRC, 1997). Extensive soil sampling was conducted in the CDL area during the fall of 2010 during the soil exposure unit supplemental soil investigation to characterize the soil impacts in the area occupied by SWMUs 14, 16, and 47. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.3.48 SWMU 48 – Land Treatment Unit

The Land Treatment Unit (LTU) is a RCRA-regulated land treatment unit. This unit is currently being addressed under the corrective action provisions of the facility's RCRA permit. Significant detail regarding this unit is included in other sections of this permit. The unit is described in Section 3.2.3; the closure plan is described in Section 12 and included as Appendix I; and the post closure plan is discussed in Section 13 and included as Appendix J.

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). This unit has been extensively sampled over several years in

compliance with the approved closure plan. The results of the LTU soil sampling have been submitted to KDHE and EPA in annual monitoring reports.

16.3.49 SWMU 49 – Shallow Waste Pit

A shallow pit measuring about 30 feet by 15 feet by less than 2 feet deep was found next to Tank 119 during the VSI (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987). This pit was used as a water draw pit that drew water out of the tank and the water was then removed by a vacuum truck. The best available sources indicate that the pit was taken out of service between 1988 and 1990.

During Phase I of the RFI, surface soil samples collected from SWMU 49 were analyzed for oil and grease. These data are summarized in Table 25 of the Final RFI Report (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further sampling at this unit (PRC, 1997). This sampling was performed in 1999 during the Phase II RFI and the results of the sampling are included in the Phase II RFI report.

16.3.50 SWMU 50 – Waste Pit and Bermed Area

A circular pit (SWMU 50) was observed next to SWMU 35 within the confines of the Tank T-120 berm during the VSI (A.T. Kearney, Inc. and Harding Lawson Associates, February 1987). This pit was used to draw water off from the crude prior to putting the water into the wastewater treatment plant.

During Phase I of the RFI, surface soil samples collected from SWMU 50 were analyzed for oil and grease. These data are summarized in Table 26 of the Final RFI Report (RSA, 1992).

The EPA contracted PRC to review the information available on this SWMU and recommend a strategy to sample this unit. After a review of this information, PRC recommended further

sampling at this unit (PRC, 1997). This sampling was performed in 1999 during the Phase II RFI and the results of the sampling are included in the Phase II RFI report.

16.3.51 SWMU 51 – Catalyst Staging Area

The SWMU consisted of refinery catalyst generated during the decommissioning of the process units in late 1996. The Waste Pile measured approximately 20 feet by 40 feet. The material was removed from the site during the refinery shutdown activities. SWMU 51 was sampled in 1999 during the Phase II RFI and the results of the sampling are included in the Phase II RFI report. Additional soil sampling was performed in 2010. The results of this sampling were included in the Exposure Unit Supplemental Soil Investigation Report submitted to KDHE and EPA on 4/21/11.

16.3.52 SWMU 52 – Tank Farm

The Tank Farm consists of 26 above ground product storage tanks. Products included crude oil, gasoline, jet fuel, naphtha, diesel, etc. The soils in the tank farm were broadly sampled in 1999 during the Phase II RFI. With the exception of Tank L-30, which is still utilized by the asphalt terminal operation, the tank farm was fully decommissioned in 2003 along with the Main Refinery Process Area.

16.3.53 SWMU 53 – Two Sumps

SWMU 53 consists of two former concrete basins or sumps, each with dimensions approximately 25 feet by 30 feet and 10 feet deep. The sumps were located just northwest of the land treatment area. Details regarding the construction and use of these two structures is uncertain; however, they are visible on a 1966 facility photo, requiring construction prior to that time. The two structures were discovered in 1999 while preparing to install SVE wells near the LTU. At the time, a small quantity of water and sludge was noted in the bottom. EPA and KDHE were informed of this SWMU during a meeting on April 28, 1999.

Two soil borings were conducted adjacent to SWMU 53 (i.e., one sample adjacent to each sump) in 1999 during the RFI Phase II investigation. The samples contained detections of semivolatile organic constituents, but at levels below the applicable KDHE non-residential Tier 2 Risk-based Standards for Kansas. Additional characterization of these two structures was conducted in 2001.

The residual soil and sludge was cleaned out of each sump, allowing for close visual inspection. A hole was created in the floor of each sump in order to observe and sample the underlying soils. The soils immediately underlying the two floors were found to be stained with petroleum hydrocarbons. The impacted soil/sludge observed in the sumps was characterized, removed, and disposed at an offsite permitted landfill. A technical memorandum detailing the 2001 activities and results was submitted to EPA and KDHE on June 12, 2001.

The SWMU 53 sumps were removed in 2003. The stained soil adjacent to and beneath the two sumps was excavated and disposed off-site. Confirmation samples collected from the remaining soils indicated that petroleum impacts were no longer present.

16.3.54 SWMU 54 – Spent Lime Area

SWMU 54 was identified in March 2002 during preparations for the installation of the LTU groundwater corrective action system. An area of powdery material was found on the ground beneath an overlying concrete support structure. Based on MRP's understanding of the refinery operations, the powdery material appeared to be spent lime. Water used in the refinery boilers was typically "softened" with lime in order to remove calcium and other minerals. MRP believes that the powdery material comprising SWMU 54 is spent lime generated during operation of the No. 6 Boiler. The No. 6 Boiler was shut down in about 1960; therefore, this material would have been placed in the area no later than this date.

There is no evidence that a release has occurred or is likely to occur.

This SWMU will be further evaluated within the framework of the Corrective Measures Study.

16.3.55 SWMU 55-Asphaltic Material

SWMU 55 was discovered at some point during the demolition of the Main Process Area. The SWMU was located approximately 100 feet southwest of SWMU No. 42- No. 6 Track Asphalt Trench and Drain System. During the Phase II RFI, sample number PA-39 was obtained near this SWMU. The analytical results from this sample do not indicate the presence of hazardous constituents at levels of concern.

Based on our understanding of former facility operations, the material is asphalt residual from historical asphalt blending and storing operations. These operations were conducted pre-1969.

In 2003, the refinery was subject to decommissioning. The decommissioning eliminated above and below grade structures in the main process area including underground piping to six feet below ground surface. The main process area was then re-graded, resulting in movement of some area soils. SWMU 55 was located within the footprint of these site decommissioning and re-work activities.

In 2010, the Process Area was subdivided into 11 soil exposure units. SWMU 55 is in exposure unit PA-6. Subsequently, in 2010 additional soil samples were collected during the soil exposure unit supplemental soil investigation. The results of the soil sampling were submitted to KDHE and EPA on 4/21/11.

16.4 Additional Subsurface Investigation

During 2004 and 2005 the facility investigated the entire site using a cone penetrometer tool (CPT) and a laser induced fluorescence (LIF) tool also know as a rapid optical screening technique (ROST). The CPT provided lithologic data across the site at 2 centimeter depth increments and the ROST tool provided fluorescence measurements to delineate petroleum hydrocarbon impacts as the same depth interval. The CPT/ROST device was used at 187 locations across the site. Over 7000 vertical feet was logged with these tools with over 100,000 individual CPT and ROST measurements. This data was compiled into a series of geologic cross-sections with delineation of hydrocarbon impacts. The report was submitted to KDHE and EPA in December 2008 (MWH, 2008).

16.5 Groundwater Corrective Action

A groundwater corrective action system is operating at the Site to provide boundary containment preventing off-site migration of impacted groundwater and to collect phase separated hydrocarbons (PSH) from the surface of the water table. The portion of the system along the downgradient boundary of the Waste Management Area is currently a required RCRA groundwater corrective action. The remaining portion of the system is a voluntary corrective action. Plate 3-1 depicts the full groundwater corrective action system and shows which wells are

part of the current RCRA groundwater corrective action. Groundwater and product recovery systems have been operating since 1981 and have been expanded at various times to facilitate boundary control and to address the PSH observed at the site.

The recovered groundwater is pumped directly to the NPDES permitted wastewater treatment system at the site, where it is treated and eventually discharged to the Walnut River through a NPDES permitted outfall. The PSH is collected and pumped to a separation tank (V-7106). The PSH is managed off-site as a useable product.

The facility installed a corrective action at the LTU in 2002. This corrective action consists of a soil vapor extraction system and a groundwater air sparging system. This system was installed as a requirement of Part I of the facility's RCRA permit. A second SVE/AS system was installed in 2000 at the #1 and #2 closed surface impoundments and the #3A aerated lagoon. This system was installed as a voluntary measure by the facility.

16.6 Ongoing and Proposed Activities

In September 2005, the EPA approved the proposed cleanup goals for the site. Initial development work on the Corrective Measures Study led to a decision to update and expand the available site soils characterization. This conclusion was in part due to the soil re-working that occurred during the 2003 facility decommissioning. Another driving factor was the need to obtain new polycyclic aromatic hydrocarbon (PAH) data utilizing improved analytical methods with lower reporting limits.

As noted in the SWMU descriptions of Section 16.3, many of the SWMU's, particularly around the process area, were decommissioned/removed and the surrounding soils were subjected to re-working. Because of this, many of the individual SWMU's have now been grouped into exposure units for purposes of evaluating site risk to support corrective action decisions. In July 2009, MRP submitted the document entitled, "Exposure Unit Supplemental Soil Investigation Work Plan". After receiving comments from KDHE and EPA on the work plan, field sampling plan, and quality assurance project plan, the final work plan was submitted on October 18, 2010 and approved by the KDHE on October 26, 2010.

In late October and November 2010, the facility conducted the supplemental soil sampling investigation. The investigation report was issued to KDHE and EPA on April 21, 2011.

16.7 Corrective Measures Study

Subsequent to achieving sufficient site characterization to properly understand site risks, the facility will prepare a corrective measures study (CMS) report. The CMS report will identify and develop corrective measures alternatives for the issues identified as posing an unacceptable risk. The report will evaluate these alternatives and provide justification for a recommended corrective measure.

SECTION 17

Other Federal Laws

17.0 OTHER FEDERAL REGULATIONS

By definition, permitted activities for the four regulated units are intended to ensure human and environmental protection from significant exposure to hazardous constituents potentially associated with the unit. In additional, federal law requires that such activities do not result in inadvertent damage to resources on or near the permitted unit. This section describes the unit's compliance with other federal regulations and responses that are required should non-compliance with such regulations occur.

17.1 Compliance with Other Federal Regulations 40 CFR 270.3

As mandated by 40 CFR 270.3, the permit for the LTU must ensure compliance with the following laws if they apply:

- The Wild and Scenic Rivers Act 16 U.S.C. 1273 et seq. (the WSR Act).
- The National Historic Preservation Act of 1966. 16 U.S.C. 470 et seq. (the NHP Act),
- The Coastal Zone Management Act. 16 U.S.C. 1451 et seq. (the CZM Act),
- The Fish and Wildlife Coordination Act. 16 U.S.C. 661 et seq. (the FWC Act), and
- The Endangered Species Act. 16 U.S.C. 1531 et seq. (the ES Act).

The WSR Act specifically requires that construction of a water resources project associated with a permit have no direct adverse effect on a nationally designated wild and scenic river. While KDHE has designated the Walnut River as a Class I fisheries resource, it is not a nationally designated wild and scenic river. In addition, a water resources project is not anticipated as part of the permitted activities for this unit. Thus, activities planned under the permit are in compliance with the WSR Act.

The NHP Act requires that activities licensed under the permit do not adversely affect properties listed or eligible for listing in the National Register of Historic Places. No such places exist within or proximal to the LTU. Thus, activities anticipated under the permit are in compliance with this regulation.

The CZM Act prohibits activities in the permitted unit from affecting the land or water in a coastal zone. The LTU is not in a state or federally designated coastal zone and thus compliance with the CZM Act exists.

The FWC Act requires coordination with state wildlife agencies before and during development of an impoundment, diversion, or any other modification of a water body. The permit for the LTU will not require any such development of an impoundment, diversion, or water body modification. Thus, the facility is in compliance with the FWC act.

Compliance with the ES Act requires that permit-related actions are "not likely to jeopardize the continued existence of any endangered or threatened species or adversely affect its critical habitat" (16 U.S.C. 1531 et seq.). A listing of the threatened and endangered species observed in Cowley County is provided in Appendix O. While threatened and endangered species occur in Cowley County, activities anticipated in the permit are not likely to jeopardize the existence of an entire species or its critical habitat. This is especially true, given relative abundance or high quality habitat for a variety of species near, but removed from the Site. Thus, the permit for the facility is fully compliant with the ES Act.

17.2 Response in the Event of Determined Non-Compliance

During the implementation of the permit, the facility will ensure continued compliance with the above regulations as required under 40 CFR 270.3. Changes made to activities associated with the permitted unit operation will be assessed for compliance with the above regulations. Any changes determined to affect the compliance status will be reported to KDHE within 180 days.

SECTION 18

References

18.0 REFERENCES

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REPORT

Tables

Table 4-1
Summary of Wastes Applied to the LTU

Year	Pounds[1]
1997	574,000
1996	371,348
1995	25,280
1994	621,510
1993	1,084,831
1992	1,452,800
1991	389,852
1990	4,895,229

(1) = Pounds of waste determined from operation records

TABLE 6-1 TYPICAL INSPECTION LOG
(NORTH AND SOUTH SECTIONS) LAND TREATMENT UNIT (LTU)

TIME _____ MONTH AND DATE _____ YEAR _____

Name of Inspector (printed) _____

Inspector's Signature _____

Instructions

Check the appropriate 'yes' or 'no' response and provide any additional comments necessary. This form is to be completed in black ink and filed in the Logbook located at the facility. This inspection form is required by Section 6.0 Inspection and Schedule of the Permit Application submitted to the Kansas Department of Environment.

Inspection Observations and Comments

Yes	No	Inspection Item	Comments or Follow-up Actions
		Has stormwater accumulated within the LTU?	
		Are transfer pumps to the wastewater treatment system operating properly?	
		Is there any evidence or erosion, animal burrowing or other physical damage to dikes surrounding the LTU?	
		Are the "Danger -Keep Out- Authorized Personnel Only" warning signs in place around the LTU?	
		Are outer components of WMA monitoring wells intact and in good condition?	
		Are locks present and locked on each WMA monitoring well?	
		Is standing water or evidence of erosion present around the WMA monitor well casing?	

Other Comments _____

_____

TABLE 6-2 TYPICAL INSPECTION LOG
CLOSED REGULATED UNITS (# 1, #2, AND 3A)

TIME _____ MONTH AND DATE _____ YEAR _____

Name of Inspector (printed) _____

Inspector's Signature _____

Instructions

Check the appropriate 'yes' or 'no' response and provide any additional comments necessary. This form is to be completed in black ink and filed in the Logbook located at the facility. This inspection form is required by Section 6.0 Inspection and Schedule of the Permit Application submitted to the Kansas Department of Environment.

Inspection Observations and Comments

Yes	No	Inspection Item	Comments or Follow-up Actions
		Does the clay cap (CSI#1) show signs of settlement, subsidence, surface erosion, standing water or other damage?	
		Does the cover (CSI #2 & 3A) show signs of settlement, subsidence, surface erosion, standing water or other damage?	
		Is there any damage from run-on?	
		Is the unit adequately drained?	
		Is there any surface erosion present at or adjacent to the unit?	
		Is the vegetative cover adequate and in good condition? Note stressed vegetation, if any, observed.	
		Does the vegetative cover require mowing or maintenance?	
		Is there any evidence of unauthorized use of the closed impoundments?	
		Are the "Danger -Keep Out- Authorized Personnel Only" warning signs in place around the units?	
		Are outer components of WMA monitoring wells intact and in good condition?	
		Are locks present and locked on each WMA monitoring well?	
		Is standing water or evidence of erosion present around the WMA monitor well casing?	

Other Comments _____

_____

Table 15-1 Summary of Water Wells and Surface Water Users Within Three Miles of the Site

Map Number	Location		Owner/ Tenant	Depth of Well Feet BGL	Use of Water**	Data Source
	Latitude	Longitude				
1	37.07166	-97.05666	---	34.00	IR	1
2	37.07166	-97.05666	---	44.00	IR	1
3	37.07166	-97.05666	---	35.00	LA	1
4	37.07164	-97.04092	---	44.00	IR	1
5	37.07166	-97.05666	HOFFHINES	38.00	LA	1
6	37.07166	-97.05216	Dubach, Kenneth	44.50	LA	1
7	37.07894	-97.04318	SANFORD ELECTRIC	50.00	LA	1
8	37.06446	-97.04976	PARMAN	100.00	LA	1
9	37.05914	-97.06311	City of Arkansas City	37.00	PU	1
10	37.05734	-97.06306	City of Arkansas City	35.00	PU	1
11	37.08076	-97.02786	---	30.00	DO	1
12	37.05531	-96.98481	---	50.00	IR	1
13	37.04085	-96.97781	KF&G COMM	38.00	OT	1
14	37.03529	-97.01357	MEADOWS	27.00	DO	1
15	37.03713	-97.02025	---	33.00	IN	1
16	37.03533	-97.02696	Cowley CO RWD #1	40.00	PU	1
17	37.03531	-97.02472	Cowley CO RWD #1	37.00	PU	1
18	37.07165	-97.04767	SWEETWOOD	52.00	LA	1
19	37.04280	-97.04938	BARTON	0.00	LA	1
20	37.06446	-97.04751	LONG	50.00	LA	1
21	37.07711	-97.03653	Cupples, C.B.	45.00	LA	1
22	37.07164	-97.04316	Nelson, Turk	55.00	LA	1
23	37.07713	-97.05672	Post, Steve and Cheryl	74.00	LA	1
24	37.07713	-97.05672	Post, Steve and Cheryl	80.00	LA	1
25	37.05711	-97.00511	Zeller, Ed	151.00	LA	1
26	37.05711	-97.00511	Zeller, Ed	150.00	LA	1
27	37.04548	-97.04384	Middle Creek Mining	35.00	DE	1
28	37.04272	-97.04048	Middle Creek Mining	35.00	DE	1
29	37.04274	-97.04271	Middle Creek Mining	35.00	DE	1
30	37.04276	-97.04492	Middle Creek Mining	35.00	DE	1
31	37.04821	-97.04498	Middlecreek Mining	30.00	DE	1
32	37.04538	-97.02599	City of Arkansas City	35.00	DE	1
33	37.04270	-97.03825	Cowley County College	43.00	LA	1
34	37.06640	-97.06779	City of Arkansas City	45.17	PU	1
35	37.06417	-97.06764	City of Arkansas City	---	PU	2
36	37.05964	-97.04436	City of Arkansas City	---	PU	2
37	37.05690	-97.02589	City of Arkansas City	---	SU	2
38	37.04519	-96.96589	Cowley CO RWD #3	---	PU	2
39	37.04453	-96.96834	Cowley CO RWD #3	---	PU	2
40	37.04341	-96.96513	Cowley CO RWD #3	---	PU	2
41	37.03728	-97.03851	Cowley CO RWD #1	---	PU	2

Table 15-1 Summary of Water Wells and Surface Water Users Within Three Miles of the Site

Map Number	Location		Owner/ Tenant	Depth of Well Feet BGL	Use of Water**	Data Source
	Latitude	Longitude				
42	37.03642	-97.02368	Cowley CO RWD #1	---	PU	2
43	37.03643	-97.02591	Cowley CO RWD #1	---	PU	2
44	37.03646	-97.03036	Cowley CO RWD #1	---	PU	2
45	37.03462	-97.02588	Cowley CO RWD #1	---	PU	2
46	37.03463	-97.02811	Cowley CO RWD #1	---	PU	2
47	37.02804	-97.02946	Cowley CO RWD #1	---	PU	2

NOTES:

1. BGL = BELOW GROUND LEVEL
2. RWD=RURAL WATER DISTRICT
3. ** USE OF WATER:
   DO: DOMESTIC
   IN: INDUSTRIAL
   IR: IRRIGATION
   OT: OTHER
   LA: LAWN AND GARDEN - DOMESTIC ONLY
   DE: DEWATERING
   SU: SURFACE WATER INTAKE
   PU: PUBLIC SUPPLY
4. --- NO DATA AVAILABLE

SOURCE:

1. WATER WELL COMPLETION RECORDS (WWC5) DATABASE, KANSAS GEOLOGICAL SURVEY, MARCH 11, 2011
2. PUBLIC WATER SUPPLY SITES, KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT (KDHE)

Table 15-2 Properties of Selected Petroleum Products

Chemical	Density (g/cm3)	Dynamlc Viscosity (cp)	Water Solubility (mg/l)	Vapor Pressure (mm Hg)	Henry's Law Constant (atm m3/mol)
Benzene	0.8765	0.6468	1.78 E+03	76	5.43 E-03[1]
Ethylbenzene	0.867	0.678	1.52 E+02	7	7.9 E-03[1]
Toluene	0.8669	0.58	5.15 E+02	22	6.61 E-03[1]
m-Xylene	0.8642[1]	0.608	2 E+02	9	6.91 E-03[1]
o-Xylene	0.88[1]	0.802	1.7 E+02	7	4.94 E-03[1]
p-Xylene	0.861[1]	0.635	1.98 E+02	9	7.01 E-03[1]
Common Petroleum Products					
Automotive gasoline	0.72-0.76[2]	0.36-0.49[2]	--	--	--
#2 Fuel Oil	0.87-0.95	1.15-1.97[4]	--	--	--
#6 Fuel Oil	0.87-0.95	14.5-493.5[3]	--	--	--
Jet Fuel (JP 4)	~0.75	~0.83[4]	--	--	--
Water	0.998[5]	1.14 [5]	--	--	--

Notes:

Values are given at 20°C unless noted.

(1) Value is at 25°C.

(2) Value is at 15.6°C.

(3) Value is at 38°C.

(4) Value is at 21°C.

(5) Value is at 15°C.

(Lyman and Noonan, 1990)

Table 15-3 Groundwater Monitoring Well Completion Data

Identification		Survey Data*			Well Completion							
Well ID	Compliance Well Association	Measuring Point. Elev (feet amsl)	Northing (feet)	Easting (feet)	Well Depth (feet btoc)	Screened Interval (feet bgs)	Pump Intake[1] (feet bgs)	Pump Type[2]	Casing DIA. (inch)	Alluvial Zone Monitored	Location	Avg. Depth to Water (feet bgs)
WN-1A	Background	1066.37	-2594.42	1161.17	44.42	30-45	37	B	2	Deep	Upgradient of LTU	15.12
WN-1B	Background	1066.39	-2589.15	1164.46	31.14	13-28	21	B	2	Shallow	Upgradient of LTU	15.32
WN-5B	CAP	1064.69	-2257.63	1428.19	27.04	11.6 -26.0	19	B	2	Shallow	Downgradient of LTU	13.74
WN-6A	CAP	1065.10	-1892.44	1417.60	44.93	29-44	37	B	2	Deep	Downgradient of LTU	13.86
WN-6B	CAP	1064.41	-1893.16	1425.30	29.95	13-28	21	B	2	Shallow	Downgradient of LTU	13.96
WN-7B	CAP	1064.76	-2252.46	1015.28	32.52	16-31	24	B	2	Shallow	Upgradient of LTU	12.61
WN-8B	CAP	1064.43	-1980.97	1029.39	32.53	15-30	23	B	2	Shallow	Crossgradient of LTU	12.68
MW-6	CAP	1062.28	-1303.38	1878.81	25.14	10.76-20.36	18	R	2	Shallow	Upgradient of CSI	13.69
MW-13	CAP	1062.90	-1310.79	1891.13	37.90	25-34.76	30	B	2	Deep	Upgradient of CSI	16.50
MW-17	CAP	1065.33	-1861.38	1172.48	34.90	14.05-31.55	25	B	2	Shallow	Downgradient of LTU	13.59
MW-12	SUPP	1071.79	-879.36	2211.01	48.77	35-44.73	40	B	2	Deep	Downgradient of CSI	26.13
RCRA-4	SUPP	1061.20	-1593.58	3414.62	24.23	6.5-21.5	18	B	4	Shallow	Down/Crossgradient	13.42
CMW-01	CPZ	1059.71	-574.50	2188.97	31.44	23-28	26[3]	R	2	Shallow	Downgradient of WMA	14.11
CMW-02	CPZ	1061.75	-704.03	2279.58	35.15	26.5-31.5	30[3]	R	2	Shallow	Downgradient of WMA	16.14
CMW-03	CPZ	1061.47	-963.38	2595.68	33.84	25-30	28[3]	R	2	Shallow	Downgradient of WMA	14.92
CMW-04	CPZ	1061.93	-1128.71	2770.58	35.42	26.4-31.4	26.5[3]	R	2	Shallow	Downgradient of WMA	13.28
RCRA-7	CPZ	1063.72	-647.73	2054.45	46.04	33.0-43.0	NA	B	2	Shallow	Downgradient of WMA	19.86
113	CPZ	1072.23	-770.86	2162.00	52.06	38.8-48.8	NA	B	2	Shallow	Downgradient of WMA	29.81
118	CPZ	1070.70	-1059.31	2453.93	46.43	36.2-43.7	NA	B	2	Shallow	Downgradient of WMA	29.27
MW-1002	CPZ	1072.11	-1169.29	2699.25	50.82	37.7-47.7	NA	B	2	Shallow	Downgradient of WMA	17.99

Notes:

Well coordinates are based on the plant coordinate system.
Average depth to groundwater is based on measurements between June 1999 and May 2000 inclusive. MW-17 data based on measurements between February 2002 and July 2003.
Monitor well 118 data based on measurements between December 2001 and September 2003.
LTU = land treatment unit
CSI = closed surface impoundments
WMA = waste management area
CAP = corrective action performance monitoring wells
SUPP = supplemental information wells
CPZ = capture zone monitoring wells

* Background, CAP, SUPP, and CPZ wells were surveyed April 23, 2010 by Smith & Oakes, Inc. of Arkansas City, KS
AMSL = above mean sea level
BTOC = below top of casing
BGS = below ground surface
NA = not available - new well with insufficient data or no pump.
1 = Pump depths may vary depending on water level and recharge rate
2 = B indicates bladder pump and R indicates bailer
3 = These wells may be sampled with a bailer

Table 15-4 Groundwater Protection Standards Analytes

Metals
Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Lead
Mercury
Nickel
Selenium
Silver
Vanadium
Zinc
Cyanide, Total

Volatile Organic Compounds
Benzene
2-Butanone (MEK)
Carbon disulfide
Chlorobenzene
Chloroform
1,2-Dibromoethane (EDB)
1,2-Dichlorobenzene
1,4-Dichlorobenzene
1,2-Dichloroethane
1,1-Dichloroethene
1,4-Dioxane
Ethylbenzene
Styrene
Tetrachloroethene (PCE)
Toluene
1,1,1-Trichloroethane
Trichloroethene (TCE)
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene
Xylenes (total)

Semi-Volatile Organic Compounds
Acenaphthene
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Bis(2-ethylhexyl) phthalate
Butyl benzyl phthalate
Chrysene
Dibenz(a,h)anthracene
7,12-Dimethylbenz(a)anthracene
2,4-Dimethylphenol
2,4-Dinitrotoluene
Di-n-butyl phthalate
Di-n-octyl phthalate
Fluoranthene
Fluorene
Indeno(1,2,3-cd)pyrene
1-Methylnaphthalene
2-Methylnaphthalene
2-Methylphenol
3-Methylphenol
4-Methylphenol
Naphthalene
Nitrobenzene
Phenanthrene
Phenol
Pyrene
Pyridine

Table 15-5 Appendix IX Analyte List

Inorganics	1,2,3,7,8-PeCDD	Ethyl methacrylate
Antimony	2,3,7,8-TCDD	Ethylbenzene
Arsenic	OCDD	Iodomethane
Barium	Total HpCDD	Isobutyl alcohol
Beryllium	Total HxCDD	Methacrylonitrile
Cadmium	Total PeCDD	Methyl methacrylate
Chromium	Total TCDD	Methyl tert-butyl ether
Cobalt	**Furans**	Methylene chloride
Copper	1,2,3,4,6,7,8-HpCDF	Propionitrile
Lead	1,2,3,4,7,8,9-HpCDF	Styrene
Mercury	1,2,3,4,7,8-HxCDF	tert-Butyl alcohol
Nickel	1,2,3,6,7,8-HxCDF	Tetrachloroethene
Selenium	1,2,3,7,8,9-HxCDF	Toluene
Silver	1,2,3,7,8-PeCDF	trans-1,2-Dichloroethene
Thallium	2,3,4,6,7,8-HxCDF	trans-1,3-Dichloropropene
Tin	2,3,4,7,8-PeCDF	trans-1,4-Dichloro-2-butene
Vanadium	2,3,7,8-TCDF	Trichloroethene
Zinc	OCDF	Trichlorofluoromethane
Total Cyanide	Total HpCDF	Vinyl acetate
Total Sulfide	Total HxCDF	Vinyl chloride
Organochlorine Pesticides	Total PeCDF	Xylenes (total)
4,4'-DDD	Total TCDF	**Semi-Volatile Organic Compounds**
4,4'-DDE	**Volatile Organic Compounds**	1,2,4,5-Tetrachlorobenzene
4,4'-DDT	1,1,1,2-Tetrachloroethane	1,2,4-Trichlorobenzene
Aldrin	1,1,1-Trichloroethane	1,2-Dichlorobenzene
alpha-BHC	1,1,2,2-Tetrachloroethane	1,3,5-Trinitrobenzene
beta-BHC	1,1,2-Trichloroethane	1,3-Dichlorobenzene
Chlordane (technical)	1,1-Dichloroethane	1,3-Dinitrobenzene
delta-BHC	1,1-Dichloroethene	1,4-Dichlorobenzene
Dieldrin	1,2,3-Trichloropropane	1,4-Dioxane
Endosulfan I	1,2,4-Trimethylbenzene	1,4-Naphthoquinone
Endosulfan II	1,2-Dibromo-3-chloropropane (DBCP)	1-Methylnaphthalene
Endosulfan sulfate	1,2-Dibromoethane (EDB)	1-Naphthylamine
Endrin	1,2-Dichloroethane	2,2'-oxybis(1-Chloropropane)
Endrin aldehyde	1,2-Dichloropropane	2,3,4,6-Tetrachlorophenol
gamma-BHC (Lindane)	1,3,5-Trimethylbenzene	2,4,5-Trichlorophenol
Heptachlor	2-Butanone (MEK)	2,4,6-Trichlorophenol
Heptachlor epoxide	2-Hexanone	2,4-Dichlorophenol
Kepone	4-Methyl-2-pentanone	2,4-Dimethylphenol
Methoxychlor	Acetone	2,4-Dinitrophenol
Toxaphene	Acetonitrile	2,4-Dinitrotoluene
Polychlorinated biphenyls (PCBs)	Acrolein	2,6-Dichlorophenol
Aroclor 1016	Acrylonitrile	2,6-Dinitrotoluene
Aroclor 1221	Allyl chloride	2-Acetylaminofluorene
Aroclor 1232	Benzene	2-Chloronaphthalene
Aroclor 1242	Bromodichloromethane	2-Chlorophenol
Aroclor 1248	Bromoform	2-Methylnaphthalene
Aroclor 1254	Bromomethane	2-Methylphenol
Aroclor 1260	Carbon disulfide	2-Naphthylamine
Chlorinated Herbicides	Carbon tetrachloride	2-Nitroaniline
2,4,5-T	Chlorobenzene	2-Nitrophenol
2,4,5-TP (Silvex)	Chloroethane	2-Picoline
2,4-D	Chloroform	3,3'-Dichlorobenzidine
Dinoseb	Chloromethane	3,3'-Dimethylbenzidine
Dioxins	Chloroprene	3-Methylcholanthrene
1,2,3,4,6,7,8-HpCDD	cis-1,3-Dichloropropene	3-Methylphenol & 4-Methylphenol
1,2,3,4,7,8-HxCDD	Dibromochloromethane	3-Nitroaniline
1,2,3,6,7,8-HxCDD	Dibromomethane	4,6-Dinitro-2-methylphenol
1,2,3,7,8,9-HxCDD	Dichlorodifluoromethane	4-Aminobiphenyl

Table 15-5 Appendix IX Analyte List

SVOCs (Cont.)
4-Bromophenyl phenyl ether
4-Chloro-3-methylphenol
4-Chloroaniline
4-Chlorophenyl phenyl ether
4-Dimethylaminoazobenzene
4-Nitroaniline
4-Nitrophenol
4-Nitroquinoline-1-oxide
4-Phenylenediamine
5-Nitro-o-toluidine
7,12-Dimethylbenz(a)anthracene
a,a-Dimethylphenethylamine
Acetophenone
Aniline
Aramite
Benzyl alcohol
bis(2-Chloroethoxy)methane
bis(2-Chloroethyl) ether
bis(2-Ethylhexyl) phthalate
Butyl benzyl phthalate
Chlorobenzilate
Diallate
Dibenzofuran
Diethyl phthalate
Dimethoate
Dimethyl phthalate
Di-n-butyl phthalate
Di-n-octyl phthalate
Diphenylamine
Disulfoton
Ethyl methanesulfonate
Famphur
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane *
Hexachlorophene
Hexachloropropene
Isodrin
Isophorone
Isosafrole
Methapyrilene
Methyl methanesulfonate
Methyl parathion
Nitrobenzene
N-Nitrosodiethylamine
N-Nitrosodimethylamine
N-Nitrosodi-n-butylamine
N-Nitrosodi-n-propylamine
N-Nitrosodiphenylamine
N-Nitrosomethylethylamine
N-Nitrosomorpholine
N-Nitrosopiperidine
N-Nitrosopyrrolidine
O,O,O-Triethyl phosphorothioate
o-Toluidine
Parathion
Pentachlorobenzene
Pentachloroethane
Pentachloronitrobenzene
Pentachlorophenol
Phenacetin
Phenol
Phorate
Pronamide
Pyridine
Safrole
Sulfotepp
Thionazin
Polycyclic Aromatic Hydrocarbons
Acenaphthene
Acenaphthylene
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(ghi)perylene
Benzo(k)fluoranthene
Chrysene
Dibenzo(a,h)anthracene
Fluoranthene
Fluorene
Indeno(1,2,3-cd)pyrene
Naphthalene
Phenanthrene
Pyrene

Table 15-6 Summary of Expanded Analytical Groundwater Monitoring Results for RCRA Wells - May 17-19, 2010

Location Identification	Tier 2 RSK Non-Residential Groundwater Pathway	Background WN-1A	Background WN-1B	CAP WN-5B	CAP WN-6A	CAP WN-6B	CAP WN-7B	CAP WN-7B (DUP)
Sample Name		WN-1A	WN-1B	WN-5B	WN-6A	WN-6B	WN-7B	RCRA-MW-5
Sample Date		5/17/2010	5/17/2010	5/18/2010	5/18/2010	5/18/2010	5/18/2010	5/18/2010
Field and Laboratory Analytes (Units)								
Field Parameters (Units)								
Depth to Water (feet btoc)	NA	17.94	17.97	17.57	19.22	18.74	16.87	--
Depth to Product (feet btoc)	NA	--	--	--	--	--	--	--
Specific Conductance (uS/cm)	NA	1780	1175	1119	1264	1296	1154	--
pH	NA	7.62	7.28	7.55	7.76	7.27	7.18	--
Temperature (°C)	NA	14.73	13.5	14.57	15.65	15.53	15.42	--
Dissolved Oxygen (mg/L)	NA	0.09	0.21	0.09	0.13	0.08	0.15	--
Oxidation Reduction Potential (mV)	NA	27.4	-77.5	-159.9	-138.1	-135.8	-150.4	--
Turbidity (NTU)	NA	2.17	4.1	0.45	0.29	0.55	1.46	--
Metals (µg/L)								
Antimony	6	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Arsenic	10	**1.5 J**	**2.7 J**	**0.37 J**	**1.8 J**	**0.47 J**	**6.6**	**6.9**
Barium	2000	**190**	**250**	**720**	**600**	**120**	**750**	**730**
Beryllium	4	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cadmium	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chromium	100	**27**	**53**	10 U	10 U	10 U	**0.7 J**	**1.6 J**
Lead	15	9 U	9 U	9 U	**0.55 J**	9 U	**1.2 J**	9 U
Mercury	2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	2040	**9.3 J**	**18 J**	40 U	40 U	40 U	**3.4 J**	**3.9 J**
Selenium	50	15 U	15 U	15 U	15 U	15 U	15 U	15 U
Silver	508	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Vanadium	NA	**5.9 J**	**1.4 J**	10 U	10 U	10 U	**2.2 J**	**1.6 J**
Zinc	30500	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Cyanide, Total (mg/L)	200	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Volatile Organic Compounds (µg/L)								
Benzene	5	1 U	1 U	1 U	1 U	**1.1**	**140**	**140**
2-Butanone (MEK)	11800	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Carbon disulfide	1660	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Chlorobenzene	100	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	80	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane (EDB)	0.05	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
1,2-Dichlorobenzene	600	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	75	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	7	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dioxane	259	19 U	19 U	19 U	19 U	19 U	19 U	20 U
Ethylbenzene	700	1 U	1 U	1 U	1 U	1 U	**2**	**1.9**
Methyl tert-butyl ether	262	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	100	1 U	1 U	1 U	1 U	1 U	**1.1**	**1.1**
tert-Butyl Alcohol	859	40 U	40 U	40 U	40 U	40 U	**5 J**	**6.1 J**
Tetrachloroethene (PCE)	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	1000	1 U	1 U	1 U	1 U	**0.48 J**	**15**	**14**
1,1,1-Trichloroethane	200	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene (TCE)	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trimethylbenzene	17.4	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3,5-Trimethylbenzene	88.4	1 U	1 U	1 U	1 U	1 U	**4.3**	**3.7**
Xylenes (total)	10000	2 U	2 U	2 U	2 U	**0.72 J**	**36**	**32**

Table 15-6 Summary of Expanded Analytical Groundwater Monitoring Results for RCRA Wells - May 17-19, 2010

Location Identification	Tier 2 RSK Non-Residential Groundwater Pathway	Background	Background	CAP	CAP	CAP	CAP	CAP
Sample Name		WN-1A	WN-1B	WN-5B	WN-6A	WN-6B	WN-7B	WN-7B (DUP)
		WN-1A	WN-1B	WN-5B	WN-6A	WN-6B	WN-7B	RCRA-MW-5
Sample Date		5/17/2010	5/17/2010	5/18/2010	5/18/2010	5/18/2010	5/18/2010	5/18/2010
Field and Laboratory Analytes (Units)								
Semi-Volatile Organic Compounds (µg/L)								
Acenaphthene	521	0.095 U	0.096 U	**0.39**	0.096 U	**0.5**	**2**	**2**
Anthracene	2500	0.095 U	0.096 U	**0.013 J**	0.096 U	**0.052 J**	**0.2**	**0.19**
Benzo(a)anthracene	0.75	**0.0071 J**	0.096 U	**0.004 J**	0.096 U	0.095 U	**0.0084 J**	**0.0056 J**
Benzo(a)pyrene	0.2	0.095 U	0.096 U	0.095 U	0.096 U	0.095 U	0.096 U	0.095 U
Benzo(b)fluoranthene	0.537	0.095 U	0.096 U	0.095 U	0.096 U	0.095 U	0.096 U	0.095 U
Benzo(k)fluoranthene	5.43	0.095 U	0.096 U	0.095 U	0.096 U	0.095 U	0.096 U	0.095 U
Bis(2-ethylhexyl) phthalate	6	**0.71 J**	*0.54 U*	*0.53 U*	*0.53 U*	*0.53 U*	*0.53 U*	*0.55 U*
Butyl benzyl phthalate	1120	3.8 U	3.9 U	3.8 U	3.8 U	3.8 U	3.8 U	3.9 U
Chrysene	75	**0.015 J**	**0.0033 J**	**0.0036 J**	0.096 U	0.095 U	**0.017 J**	**0.017 J**
Dibenz(a,h)anthracene	0.027	*0.0085 U*	*0.0086 U*	*0.0085 U*	*0.0086 U*	*0.0085 U*	**0.53 J**	*0.0085 U*
7,12-Dimethylbenz(a)anthracene	NA	19 U	19 U	19 U	19 U	19 U	19 U	20 U
2,4-Dimethylphenol	1860	9.5 U	9.7 U	9.5 U	9.5 U	9.5 U	9.5 U	9.8 U
2,4-Dinitrotoluene	8.98	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*
Di-n-butyl phthalate	8400	3.8 U	3.9 U	3.8 U	3.8 U	3.8 U	3.8 U	3.9 U
Di-n-octyl phthalate	89.4	3.8 U	3.9 U	3.8 U	3.8 U	3.8 U	3.8 U	3.9 U
Fluoranthene	1370	**0.0047 J**	0.096 U	**0.0043 J**	0.096 U	**0.0065 J**	**0.017 J**	**0.015 J**
Fluorene	341	0.095 U	0.096 U	**0.7**	0.096 U	**0.41**	**2**	**2**
Indeno(1,2,3-cd)pyrene	0.392	0.095 U	0.096 U	0.095 U	0.096 U	0.095 U	**0.53 J**	0.095 U
1-Methylnaphthalene	NA	0.095 U	0.096 U	**38**	0.096 U	**10**	**82**	**87**
2-Methylnaphthalene	34.6	**0.005 J**	0.096 U	**26**	0.096 U	**2.5**	**65**	**69**
2-Methylphenol	4780	9.5 U	9.7 U	9.5 U	9.5 U	9.5 U	9.5 U	9.8 U
3-Methylphenol	4770	9.5 U	9.7 U	9.5 U	9.5 U	9.5 U	**0.25 J**	9.8 U
4-Methylphenol	478	9.5 U	9.7 U	9.5 U	9.5 U	9.5 U	**0.25 J**	9.8 U
Naphthalene	2.11	0.095 U	0.096 U	**0.81**	0.096 U	0.095 U	**2.3**	**2.3**
Nitrobenzene	1.85	*0.77 U*	*0.78 U*	*0.77 U*	*0.77 U*	*0.77 U*	*0.77 U*	*0.79 U*
Phenanthrene	NA	**0.024 J**	**0.0059 J**	**0.29**	0.096 U	**0.046 J**	**1.2**	**1.2**
Phenol	29500	9.5 U	9.7 U	9.5 U	9.5 U	9.5 U	**2.6 J**	**2.8 J**
Pyrene	1090	**0.014 J**	**0.0031 J**	**0.0051 J**	0.096 U	**0.011 J**	**0.053 J**	**0.045 J**
Pyridine	9.28	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*	*1.7 U*
Total Petroleum Hydrocarbons (µg/L)								
Gasoline Range Organics (C6-C10)	500	**8.2 J**	**5.2 J**	**950**	**6.4 J**	**340 J**	**3400**	**4100**
Diesel Range Organics (C10-C24)	720	240 U	240 U	**420**	240 U	**210 J**	**1200**	**1100**
Motor Oil Range Organics (C24-C36)	720	470 U	490 U	480 U	480 U	480 U	480 U	510 U
TPH-DRO (C10-C36)	720	470 U	490 U	**420**	480 U	**210 J**	**1200**	**1100**

Notes: See last page for table notes explanation.

Table 15-6 Summary of Expanded Analytical Groundwater Monitoring Results for RCRA Wells - May 17-19, 2010

Location Identification	Tier 2 RSK Non-Residential Groundwater Pathway	CAP WN-8B	CAP MW-6	SUPP MW-12	CAP MW-13	CAP MW-13 (DUP)	CAP MW-17	SUPP RCRA-4
Sample Name		WN-8B	MW-6	MW-12	MW-13	RCRA-MW-6	MW-17	RCRA-4
Sample Date		5/18/2010	5/19/2010	5/19/2010	5/19/2010	5/19/2010	5/17/2010	5/17/2010
Field and Laboratory Analytes (Units)								
Field Parameters (Units)								
Depth to Water (feet btoc)	NA	17.31	20.69	37.08	21.29	--	19.04	16.20
Depth to Product (feet btoc)	NA	--	--	--	--	--	--	--
Specific Conductance (uS/cm)	NA	1113	1103	1255	1265	--	1227	892
pH	NA	7.35	6.71	7.16	7.76	--	7.71	6.94
Temperature (°C)	NA	15.24	14.96	16.7	15.63	--	16.07	14.83
Dissolved Oxygen (mg/L)	NA	0.07	0.18	1	0.07	--	0.19	0.15
Oxidation Reduction Potential (mV)	NA	-147.3	-135	-107.1	-133.1	--	-123.4	-93.1
Turbidity (NTU)	NA	0.4	229	10.4	0.33	--	0.71	16
Metals (µg/L)								
Antimony	6	2 U	4 U	4 U	4 U	4 U	2 U	2 U
Arsenic	10	**1.3 J**	**6.8 J**	**3 J**	10 U	10 U	**7.9**	**13**
Barium	2000	**540**	**1100**	**800**	**190**	**180**	**360**	**220**
Beryllium	4	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cadmium	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chromium	100	10 U	**7.4 J**	10 U	10 U	10 U	10 U	10 U
Lead	15	9 U	**7.8 J**	9 U	**0.93 J**	**0.27 J**	9 U	9 U
Mercury	2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	2040	40 U	**8.2 J**	**2.6 J**	40 U	40 U	40 U	40 U
Selenium	50	15 U	15 U	15 U	15 U	15 U	15 U	15 U
Silver	508	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Vanadium	NA	10 U	**10**	10 U	10 U	10 U	**1.9 J**	**3.2 J**
Zinc	30500	20 U	**16 J**	20 U	20 U	20 U	20 U	**5.7 J**
Cyanide, Total (mg/L)	200	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Volatile Organic Compounds (µg/L)								
Benzene	5	**33**	**1200**	1 U	1 U	1 U	1 U	1 U
2-Butanone (MEK)	11800	6 U	24 U	6 U	6 U	6 U	6 U	6 U
Carbon disulfide	1660	2 U	8 U	2 U	2 U	2 U	2 U	2 U
Chlorobenzene	100	1 U	4 U	1 U	1 U	1 U	1 U	1 U
Chloroform	80	1 U	4 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane (EDB)	0.05	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
1,2-Dichlorobenzene	600	1 U	3.8 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	NA	1 U	4 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	75	1 U	3.8 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	5	1 U	**54**	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	7	1 U	4 U	1 U	1 U	1 U	1 U	1 U
1,4-Dioxane	259	19 U	19 U	19 U	19 U	19 U	19 U	19 U
Ethylbenzene	700	**1**	**190**	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl ether	262	5 U	20 U	5 U	5 U	5 U	5 U	5 U
Styrene	100	1 U	4 U	1 U	1 U	1 U	1 U	1 U
tert-Butyl Alcohol	859	40 U	160 U	40 U	40 U	40 U	40 U	40 U
Tetrachloroethene (PCE)	5	1 U	4 U	1 U	1 U	1 U	1 U	1 U
Toluene	1000	**2.1**	**39**	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	200	1 U	4 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene (TCE)	5	1 U	4 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trimethylbenzene	17.4	1 U	**540**	1 U	1 U	1 U	1 U	1 U
1,3,5-Trimethylbenzene	88.4	**3.7**	**240**	1 U	1 U	1 U	1 U	1 U
Xylenes (total)	10000	**6**	**1700**	2 U	2 U	2 U	2 U	2 U

Table 15-6 Summary of Expanded Analytical Groundwater Monitoring Results for RCRA Wells - May 17-19, 2010

Location Identification	Tier 2 RSK Non-Residential Groundwater Pathway	CAP WN-8B	CAP MW-6	SUPP MW-12	CAP MW-13	CAP MW-13 (DUP)	CAP MW-17	SUPP RCRA-4
Sample Name		WN-8B	MW-6	MW-12	MW-13	RCRA-MW-6	MW-17	RCRA-4
Sample Date		5/18/2010	5/19/2010	5/19/2010	5/19/2010	5/19/2010	5/17/2010	5/17/2010
Field and Laboratory Analytes (Units)								
Semi-Volatile Organic Compounds (µg/L)								
Acenaphthene	521	**1.5**	**2.1**	**0.14**	**0.042 J**	**0.04 J**	**0.12**	0.095 U
Anthracene	2500	**0.34**	**4.5**	**0.1**	0.098 U	**0.074 J**	**0.041 J**	**0.013 J**
Benzo(a)anthracene	0.75	**0.027 J**	**8.6**	0.094 U	**0.016 J**	**0.013 J**	**0.0039 J**	**0.0047 J**
Benzo(a)pyrene	0.2	0.096 U	**2.1**	0.094 U	**0.013 J**	0.096 U	0.095 U	0.095 U
Benzo(b)fluoranthene	0.537	**0.0054 J**	**2.5 K**	0.094 U	**0.015 J**	0.096 U	0.095 U	0.095 U
Benzo(k)fluoranthene	5.43	0.096 U	0.096 UK	0.094 U	**0.0083 J**	0.096 U	0.095 U	0.095 U
Bis(2-ethylhexyl) phthalate	6	*0.54 U*	*0.53 U*	*0.53 U*	*0.54 U*	*0.53 U*	**0.87 J**	**0.57 J**
Butyl benzyl phthalate	1120	3.8 U	3.8 U	3.8 U	3.9 U	3.8 U	3.8 U	3.8 U
Chrysene	75	**0.071 J**	**20**	0.094 U	**0.04 J**	0.096 U	**0.0095 J**	**0.009 J**
Dibenz(a,h)anthracene	0.027	*0.0086 U*	**0.76**	*0.0084 U*	**0.011 J**	*0.0086 U*	*0.0085 U*	*0.0085 U*
7,12-Dimethylbenz(a)anthracene	NA	19 U	19 U	19 U	19 U	19 U	19 U	19 U
2,4-Dimethylphenol	1860	9.6 U	**19**	9.5 U	9.6 U	9.5 U	9.5 U	9.5 U
2,4-Dinitrotoluene	8.98	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*
Di-n-butyl phthalate	8400	3.8 U	3.8 U	3.8 U	3.9 U	3.8 U	3.8 U	3.8 U
Di-n-octyl phthalate	89.4	3.8 U	3.8 U	3.8 U	3.9 U	3.8 U	3.8 U	3.8 U
Fluoranthene	1370	**0.073 J**	**5.7**	0.094 U	0.098 U	0.096 U	**0.0062 J**	0.095 U
Fluorene	341	**1.1**	**7.2**	0.094 U	0.098 U	0.096 U	0.095 U	0.095 U
Indeno(1,2,3-cd)pyrene	0.392	0.096 U	**0.54**	0.094 U	**0.023 J**	0.096 U	0.095 U	0.095 U
1-Methylnaphthalene	NA	**34**	**130**	**0.11**	**0.012 J**	**0.014 J**	**0.011 J**	0.095 U
2-Methylnaphthalene	34.6	**23**	**130**	0.094 U	**0.018 J**	**0.02 J**	0.095 U	0.095 U
2-Methylphenol	4780	9.6 U	9.5 U	9.5 U	9.6 U	9.5 U	**1.4 J**	9.5 U
3-Methylphenol	4770	9.6 U	**5 J**	9.5 U	9.6 U	9.5 U	**15**	9.5 U
4-Methylphenol	478	9.6 U	**5 J**	9.5 U	9.6 U	9.5 U	**15**	9.5 U
Naphthalene	2.11	**0.74**	**71**	0.094 U	0.098 U	0.096 U	0.095 U	0.095 U
Nitrobenzene	1.85	**2.9 J**	*0.77 U*	*0.77 U*	*0.78 U*	*0.77 U*	*0.77 U*	*0.77 U*
Phenanthrene	NA	**0.81**	**48**	**0.03 J**	**0.048 J**	**0.044 J**	**0.012 J**	**0.011 J**
Phenol	29500	9.6 U	**9.2 J**	9.5 U	9.6 U	9.5 U	**58**	9.5 U
Pyrene	1090	**0.21**	**21**	**0.14**	**0.41**	**0.38**	**0.021 J**	**0.11**
Pyridine	9.28	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*	**650**	*1.6 U*
Total Petroleum Hydrocarbons (µg/L)								
Gasoline Range Organics (C6-C10)	500	**970 J**	**9600**	**340 J**	**310**	**300**	**69**	25 U
Diesel Range Organics (C10-C24)	720	**920 J**	**22000**	**580**	**120 J**	**120 J**	240 U	**260**
Motor Oil Range Organics (C24-C36)	720	**62 J**	**1800**	470 U	480 U	480 U	480 U	**150 J**
TPH-DRO (C10-C36)	720	**982 J**	**23800**	**580**	**120 J**	**120 J**	480 U	**410**

Notes: See last page for table notes explanation.

Table 15-7 Summary of 2010 Quarterly Bioreactor Influent Sampling Results

1st Quarter 2010 Bioreactor Influent Samples					
MEASUREMENTS	**Groundwater Protection Standard ***	**BIO-INF-A Sample**	**BIO-INF-B Sample**	**BIO-INF-C Sample**	**Flow-Weighted Average Bioreactor Influent Sample**
Field Measurements					
Sample Date		03/04/10	03/04/10	03/04/10	03/04/10
Flow (gpm)		1250	400	40	1690
pH		7.20	6.94	6.96	7.13
Temperature ^{o}C		15.64	14.13	13.04	15.22
Conductivity (µS/cm)		1022	970	1174	1013
Turbidity (NTU)		1.04	4.51	6.97	2.00
Dissolved Oxygen (mg/L)		3.21	2.27	1.95	2.96
Laboratory Analyses					
Benzene (µg/L)	5	2.8	**10**	**10**	4.7
Toluene (µg/L)	1000	1.0 U	1.1 U	1.6	0.04
Ethylbenzene (µg/L)	700	1.0 U	4.8	8.6	1.3
Xylenes (total) (µg/L)	10000	1.2 J	7.7	11	3.0
MTBE (µg/L)*	20	0.35 J	5.0 U	5.0 U	0.26 J

2nd Quarter 2010 Bioreactor Influent Samples					
MEASUREMENTS	**Groundwater Protection Standard ***	**BIO-INF-A Sample**	**BIO-INF-B Sample**	**BIO-INF-C Sample**	**Flow-Weighted Average Bioreactor Influent Sample**
Field Measurements					
Sample Date		05/24/10	05/24/10	05/24/10	05/24/10
Flow (gpm)		1550	425	125	2100
pH		7.64	7.12	7.11	7.50
Temperature ^{o}C		17.14	18.79	19.06	17.59
Conductivity (µS/cm)		1081	1101	1107	1087
Turbidity (NTU)		35.30	8.83	7.32	28.28
Dissolved Oxygen (mg/L)		0.63	1.23	0.92	0.77
Laboratory Analyses					
Benzene (µg/L)	5	0.95 J	**8.3**	**9.1**	2.9
Toluene (µg/L)	1000	1.0 U	0.4 J	0.45 J	0.11 J
Ethylbenzene (µg/L)	700	0.44 J	0.81 J	0.82 J	0.54 J
Xylenes (total) (µg/L)	10000	0.63 J	1.4 J	1.3 J	0.8 J
MTBE (µg/L)*	20	5.0 U	5.0 U	5.0 U	5.0 U

Notes:

gpm - gallons per minute
°C - degrees Celsius
µS/cm - micro siemens per centimeter
U - not detected above the method reporting limit shown
J - estimated value. Used primarily when the compound was detected
NTU - nephelometric turbidity units
mg/L - milligrams per liter
µg/L - micrograms per liter
MTBE - Methyl tert-butyl ether
* Tier 2 Residential Groundwater Pathway Risk-Based Standards for Kansas (RSK Manual, Oct. 2010).
BIO-INF-A sample collected from the East bioreactor influent line after combining flow from the East and West lines.
BIO-INF-B sample collected from the North Area influent line to the bioreactor.
BIO-INF-C sample collected from the Lift Station influent line to the bioreactor.

Table 15-7 Summary of 2010 Quarterly Bioreactor Influent Sampling Results

3rd Quarter 2010 Bioreactor Influent Samples					
MEASUREMENTS	**Groundwater Protection Standard ***	**BIO-INF-A Sample**	**BIO-INF-B Sample**	**BIO-INF-C Sample**	**Flow-Weighted Average Bioreactor Influent Sample**
Field Measurements					
Sample Date		08/19/10	08/19/10	08/19/10	08/19/10
Flow (gpm)		1650	450	100	2200
pH		7.26	7.01	7.01	7.20
Temperature ^{o}C		19.76	20.57	21.65	20.01
Conductivity (µS/cm)		972	983	984	975
Turbidity (NTU)		Slight	Slight	Very Slight	Slight
Dissolved Oxygen (mg/L)		1.98	1.70	1.82	1.92
Laboratory Analyses					
Benzene (µg/L)	5	1.0 U	**12**	**12**	3
Toluene (µg/L)	1000	0.26 J	0.6 J	0.71 J	0.36 J
Ethylbenzene (µg/L)	700	0.25 J	1.1	1.7	0.5
Xylenes (total) (µg/L)	10000	0.57 J	2.1	2.5	1.0
MTBE (µg/L)*	20	5.0 U	5.0 U	5.0 U	5.0 U

4th Quarter 2010 Bioreactor Influent Samples					
MEASUREMENTS	**Groundwater Protection Standard ***	**BIO-INF-A Sample**	**BIO-INF-B Sample**	**BIO-INF-C Sample**	**Flow-Weighted Average Bioreactor Influent Sample**
Field Measurements					
Sample Date		10/14/10	--	--	--
Flow (gpm)		1300	--	--	--
pH		7.15	--	--	--
Temperature ^{o}C		17.31	--	--	--
Conductivity (µS/cm)		1012	--	--	--
Turbidity (NTU)		3.78	--	--	--
Dissolved Oxygen (mg/L)		1.18	--	--	--
Laboratory Analyses					
Benzene (µg/L)	5	2.2	--	--	--
Toluene (µg/L)	1000	0.28 J	--	--	--
Ethylbenzene (µg/L)	700	0.21 J	--	--	--
Xylenes (total) (µg/L)	10000	0.94 J	--	--	--
MTBE (µg/L)*	20	5.0 U	--	--	--

Notes:

gpm - gallons per minute
°C - degrees Celsius
µS/cm - micro siemens per centimeter
U - not detected above the method reporting limit shown
J - estimated value. Used primarily when the compound was detected
NTU - nephelometric turbidity units
mg/L - milligrams per liter
µg/L - micrograms per liter
MTBE - Methyl tert-butyl ether
* Tier 2 Residential Groundwater Pathway Risk-Based Standards for Kansas (RSK Manual, Oct. 2010).
BIO-INF-A sample collected from the East bioreactor influent line after combining flow from the East and West lines.
BIO-INF-B sample collected from the North Area influent line to the bioreactor.
BIO-INF-C sample collected from the Lift Station influent line to the bioreactor.
-- BIO-INF-B and BIO-INF-C were not collected as there was no flow through these meters on October 14, 2010.

Table 15-8 Summary of Groundwater Monitoring Results for Appendix IX Constituents - October 26 and 28 2009

Appendix IX Constituent	Units	GWPS Basis						WN-1A	WN-7B	RCRA-MW-5	MW-6
		1	2	3	4	5	Concentration				
Inorganics											
Antimony	µg/L	1					6	10 U	10 U	10 U	10 U
Arsenic	µg/L	1					10	15 U	15 U	15 U	**6.8 J**
Barium	µg/L	1					2,000	**110**	**750**	**770**	**440**
Beryllium	µg/L	1					4	5 U	5 U	5 U	5 U
Cadmium	µg/L	1					5	5 U	5 U	5 U	5 U
Chromium	µg/L	1					100	**3.9 J**	10 U	10 U	10 U
Cobalt	µg/L						NA	10 U	10 U	10 U	10 U
Copper	µg/L						1,300	**4.5 J**	**1.8 J**	**1.6 J**	**1.8 J**
Lead	µg/L	1					15	3 U	3 U	3 U	3 U
Mercury	µg/L	1					2	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	µg/L						100	**4.2 J**	40 U	40 U	40 U
Selenium	µg/L	1					50	15 U	15 U	15 U	15 U
Silver	µg/L		1				100	10 U	10 U	10 U	10 U
Thallium	µg/L						NA	15 U	15 U	15 U	15 U
Tin	µg/L						NA	100 U	100 U	100 U	100 U
Vanadium	µg/L						NA	**1.5 J**	10 U	10 U	**1.2 J**
Zinc	µg/L		1				5,000	**14 J**	20 U	20 U	20 U
Total Cyanide	mg/L	1					0.2	0.01 U	**0.0025 J**	**0.0033 J**	**0.0025 J**
Total Sulfide	mg/L						NA	4 U	4 U	4 U	4 U
Organochlorine Pesticides											
4,4'-DDD	µg/L						3	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ
4,4'-DDE	µg/L						2	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ
4,4'-DDT	µg/L						2	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ
Aldrin	µg/L						0.2	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ
alpha-BHC	µg/L						NA	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ
beta-BHC	µg/L						NA	0.05 U	0.05 UJ	0.05 UJ	**0.078 J**
Chlordane (technical)	µg/L						2	0.5 U	0.5 UJ	0.5 UJ	0.5 UJ
delta-BHC	µg/L						NA	0.05 U	0.05 UJ	0.05 UJ	**0.0089 J**
Dieldrin	µg/L						0.2	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ
Endosulfan I	µg/L						590	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ
Endosulfan II	µg/L						NA	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ
Endosulfan sulfate	µg/L						NA	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ
Endrin	µg/L						2	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ
Endrin aldehyde	µg/L						NA	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ
gamma-BHC (Lindane)	µg/L						0.2	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ
Heptachlor	µg/L						0.4	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ
Heptachlor epoxide	µg/L						0.2	0.05 U	0.05 UJ	0.05 UJ	0.05 UJ
Kepone	µg/L						0.2	1 UJ	1 UJ	1 UJ	1 UJ
Methoxychlor	µg/L						40	0.1 U	0.1 UJ	0.1 UJ	0.1 UJ
Toxaphene	µg/L						3	5 U	5 UJ	5 UJ	5 UJ
Polychlorinated biphenyls (PCBs)											
Aroclor 1016	µg/L						0.5	1 U	1 UJ	1 UJ	1 UJ
Aroclor 1221	µg/L						0.5	1 U	1 UJ	1 UJ	1 UJ
Aroclor 1232	µg/L						0.5	1 U	1 UJ	1 UJ	1 UJ
Aroclor 1242	µg/L						0.5	1 U	1 UJ	1 UJ	1 UJ
Aroclor 1248	µg/L						0.5	1 U	1 UJ	1 UJ	1 UJ
Aroclor 1254	µg/L						0.5	1 U	1 UJ	1 UJ	1 UJ
Aroclor 1260	µg/L						0.5	1 U	1 UJ	1 UJ	1 UJ
Chlorinated Herbicides											
2,4,5-T	µg/L						940	1 U	1 U	1 U	1 U
2,4,5-TP (Silvex)	µg/L						50	1 U	1 U	1 U	1 U
2,4-D	µg/L						70	4 U	4 U	4 U	4 U
Dinoseb	µg/L						NA	0.6 U	0.6 U	0.6 U	0.6 U
Dioxins											
1,2,3,4,6,7,8-HpCDD	ng/L						NA	3.8 U	5.8 U	9.2 U	11 U
1,2,3,4,7,8-HxCDD	ng/L						NA	7.6 U	8.1 U	5 U	6.6 U

Table 15-8 Summary of Groundwater Monitoring Results for Appendix IX Constituents - October 26 and 28 2009

Appendix IX Constituent	Units	GWPS Basis						WN-1A	WN-7B	RCRA-MW-5	MW-6
		1	2	3	4	5	Concentration				
Dioxins											
1,2,3,6,7,8-HxCDD	ng/L						NA	7.6 U	8 U	5 U	7.7 U
1,2,3,7,8,9-HxCDD	ng/L						NA	5.3 U	6.1 U	5.7 U	6.4 U
1,2,3,7,8-PeCDD	ng/L						NA	5.5 U	5.1 U	5.3 U	7.7 U
2,3,7,8-TCDD	ng/L						0.03	2.1 U	4.6 U	3.6 U	4.7 U
OCDD	ng/L						NA	4.4 U	4 U	4.2 U	9.6 U
Total HpCDD	ng/L						NA	9.2 U	8.8 U	9.2 U	12 U
Total HxCDD	ng/L						NA	8.1 U	9.1 U	8.2 U	10 U
Total PeCDD	ng/L						NA	6.9 U	4.1 U	9.8 U	16 U
Total TCDD	ng/L						NA	15 U	17 U	16 U	23 U
Furans											
1,2,3,4,6,7,8-HpCDF	ng/L						NA	2.6 U	3.8 U	5.1 U	4.2 U
1,2,3,4,7,8,9-HpCDF	ng/L						NA	4 U	4.5 U	5.8 U	8.2 U
1,2,3,4,7,8-HxCDF	ng/L						NA	2.8 U	2.1 U	3.5 U	4.1 U
1,2,3,6,7,8-HxCDF	ng/L						NA	2.6 U	2.6 U	3.1 U	4 U
1,2,3,7,8,9-HxCDF	ng/L						NA	3.7 U	2.7 U	3.7 U	2.9 U
1,2,3,7,8-PeCDF	ng/L						NA	2.3 U	3.3 U	4.4 U	2.9 U
2,3,4,6,7,8-HxCDF	ng/L						NA	2 U	2.1 U	4.7 U	3.3 U
2,3,4,7,8-PeCDF	ng/L						NA	2.9 U	3.2 U	2.9 U	3.7 U
2,3,7,8-TCDF	ng/L						NA	1.8 U	1.7 U	2.3 U	2.9 U
OCDF	ng/L						NA	3.5 U	3.7 U	6.1 U	6.6 U
Total HpCDF	ng/L						NA	5.1 U	5 U	7.4 U	9.1 U
Total HxCDF	ng/L						NA	4 U	4.3 U	5.2 U	5.9 U
Total PeCDF	ng/L						NA	4.1 U	4.5 U	4.9 U	5.4 U
Total TCDF	ng/L						NA	2.8 U	2.2 U	2.9 U	5.9 U
Volatile Organic Compounds											
1,1,1,2-Tetrachloroethane	µg/L						10	1 U	10 U	1 U	4 U
1,1,1-Trichloroethane	µg/L	1					200	1 U	10 U	1 U	4 U
1,1,2,2-Tetrachloroethane	µg/L						1	1 U	10 U	1 U	4 U
1,1,2-Trichloroethane	µg/L						5	1 U	10 U	1 U	4 U
1,1-Dichloroethane	µg/L						1,300	1 U	10 U	1 U	4 U
1,1-Dichloroethene	µg/L	1					7	1 U	10 U	1 U	4 U
1,2,3-Trichloropropane	µg/L						0.04	2.5 U	25 U	2.5 U	10 U
1,2,4-Trimethylbenzene	µg/L				1		90	1 U	10 U	1 U	**880**
1,2-Dibromo-3-chloropropane (DBCP)	µg/L						NA	2 U	20 U	2 U	8 U
1,2-Dibromoethane (EDB)	µg/L						0.05	0.02 U	0.02 U	0.02 U	0.02 U
1,2-Dichloroethane	µg/L						5	1 U	10 U	1 U	4 U
1,2-Dichloropropane	µg/L						5	1 U	10 U	1 U	4 U
1,3,5-Trimethylbenzene	µg/L				1		60	1 U	10 U	1 U	**150**
2-Butanone (MEK)	µg/L			1			11,800	5 U	50 U	5 U	20 U
2-Hexanone	µg/L						NA	5 U	50 U	5 U	20 U
4-Methyl-2-pentanone	µg/L						NA	5 U	50 U	5 U	20 U
Acetone	µg/L						930	10 U	100 U	10 U	40 U
Acetonitrile	µg/L						NA	20 U	200 U	20 U	80 U
Acrolein	µg/L						0.058	20 U	20 U	20 U	80 UJ
Acrylonitrile	µg/L						1	20 U	20 U	20 U	80 UJ
Allyl chloride	µg/L						NA	2 U	20 U	2 U	8 U
Benzene	µg/L	1					5	**0.26 J**	**220**	**200**	**810**
Bromodichloromethane	µg/L						80	1 U	10 U	1 U	4 U
Bromoform	µg/L						80	1 U	10 U	1 U	4 U
Bromomethane	µg/L						10	2 U	20 U	2 U	8 U
Carbon disulfide	µg/L			1			1,660	1 U	10 U	1 U	4 U
Carbon tetrachloride	µg/L						5	1 U	10 U	1 U	4 U
Chlorobenzene	µg/L	1					100	1 U	10 U	1 U	4 U
Chloroethane	µg/L						89	2 U	20 U	2 U	8 U
Chloroform	µg/L			1			80	1 U	10 U	1 U	4 U
Chloromethane	µg/L						40	2 U	20 U	2 U	8 U

Table 15-8 Summary of Groundwater Monitoring Results for Appendix IX Constituents - October 26 and 28 2009

Appendix IX Constituent	Units	GWPS Basis						WN-1A	WN-7B	RCRA-MW-5	MW-6
		1	2	3	4	5	Concentration				
Chloroprene	µg/L						NA	1 U	10 U	1 U	4 U
cis-1,3-Dichloropropene	µg/L						2	1 U	10 U	1 U	4 U
Dibromochloromethane	µg/L						80	1 U	10 U	1 U	4 U
Dibromomethane	µg/L						NA	1 U	10 U	1 U	4 U
Dichlorodifluoromethane	µg/L						570	2 U	20 U	2 U	8 U
Ethyl methacrylate	µg/L						NA	1 U	10 U	1 U	4 U
Ethylbenzene	µg/L	1					700	1 U	**2 J**	**2.4**	**110**
Iodomethane	µg/L						NA	1 U	10 U	1 U	4 U
Isobutyl alcohol	µg/L						NA	50 U	500 U	**1700**	**48000**
Methacrylonitrile	µg/L						NA	10 U	100 U	10 U	40 U
Methyl methacrylate	µg/L						NA	4 U	40 U	4 U	16 U
Methyl tert-butyl ether	µg/L						20	5 U	50 U	5 U	20 U
Methylene chloride	µg/L						5	5 U	50 U	5 U	20 U
Propionitrile	µg/L						NA	20 U	200 U	20 U	80 U
Styrene	µg/L	1					100	1 U	10 U	1 U	4 U
tert-Butyl alcohol	µg/L						79	50 U	500 U	50 U	200 U
Tetrachloroethene	µg/L	1					5	1 U	10 U	1 U	4 U
Toluene	µg/L	1					1,000	1 U	**17**	**17**	**29**
trans-1,2-Dichloroethene	µg/L						100	1 U	10 U	1 U	4 U
trans-1,3-Dichloropropene	µg/L						2	1 U	10 U	1 U	4 U
trans-1,4-Dichloro-2-butene	µg/L						NA	1 U	10 U	1 U	4 U
Trichloroethene	µg/L	1					5	1 U	10 U	1 U	4 U
Trichlorofluoromethane	µg/L						NA	2 U	20 U	2 U	8 U
Vinyl acetate	µg/L						NA	2 U	20 U	2 U	8 U
Vinyl chloride	µg/L						2	1 U	10 U	1 U	4 U
Xylenes (total)	µg/L	1					10,000	2 U	**37**	**44**	**1500**
Semi-Volatile Organic Compounds											
1,2,4,5-Tetrachlorobenzene	µg/L						NA	10 U	10 U	10 U	80 U
1,2,4-Trichlorobenzene	µg/L						70	10 U	10 U	10 U	80 U
1,2-Dichlorobenzene	µg/L	1					600	**0.46 J**	**0.47 J**	**0.45 J**	80 U
1,3,5-Trinitrobenzene	µg/L						NA	50 U	50 U	50 U	400 U
1,3-Dichlorobenzene	µg/L						NA	10 U	10 U	10 U	80 U
1,3-Dinitrobenzene	µg/L						NA	10 U	10 U	10 U	80 U
1,4-Dichlorobenzene	µg/L	1					75	10 U	10 U	10 U	80 U
1,4-Dioxane	µg/L			1			259	10 U	10 U	10 U	80 U
1,4-Naphthoquinone	µg/L						NA	50 U	50 U	50 U	400 U
1-Methylnaphthalene	µg/L				1		10	10 U	**67**	**72**	**260**
1-Naphthylamine	µg/L						NA	10 U	10 U	10 U	80 U
2,2'-oxybis(1-Chloropropane)	µg/L						NA	10 U	10 U	10 U	80 U
2,3,4,6-Tetrachlorophenol	µg/L						1,500	50 U	50 U	50 U	400 U
2,4,5-Trichlorophenol	µg/L						6,700	10 U	10 U	10 U	80 U
2,4,6-Trichlorophenol	µg/L						170	10 U	10 U	10 U	80 U
2,4-Dichlorophenol	µg/L						250	10 U	10 U	10 U	80 U
2,4-Dimethylphenol	µg/L			1			1,860	10 U	10 U	10 U	80 U
2,4-Dinitrophenol	µg/L						200	50 U	50 U	50 U	400 U
2,4-Dinitrotoluene	µg/L			1			8.98	10 U	10 U	10 U	80 U
2,6-Dichlorophenol	µg/L						NA	10 U	10 U	10 U	80 U
2,6-Dinitrotoluene	µg/L						4	10 U	10 U	10 U	80 U
2-Acetylaminofluorene	µg/L						NA	100 U	100 U	100 U	800 U
2-Chloronaphthalene	µg/L						665	10 U	10 U	10 U	80 U
2-Chlorophenol	µg/L						NA	10 U	10 U	10 U	80 U
2-Methylnaphthalene	µg/L				1		10	10 U	**46**	**51**	**320**
2-Methylphenol	µg/L				1		10	10 U	10 U	10 U	80 U
2-Naphthylamine	µg/L						NA	10 U	10 U	10 U	80 U
2-Nitroaniline	µg/L						NA	50 U	50 U	50 U	400 U
2-Nitrophenol	µg/L						NA	10 U	10 U	10 U	80 U
2-Picoline	µg/L						NA	20 U	20 U	20 U	160 U

Table 15-8 Summary of Groundwater Monitoring Results for Appendix IX Constituents - October 26 and 28 2009

Appendix IX Constituent	Units	GWPS Basis						WN-1A	WN-7B	RCRA-MW-5	MW-6
		1	2	3	4	5	Concentration				
3,3'-Dichlorobenzidine	µg/L						NA	50 U	50 U	50 U	400 U
3,3'-Dimethylbenzidine	µg/L						NA	20 U	20 U	20 U	160 U
3-Methylcholanthrene	µg/L						NA	20 U	20 U	20 U	160 U
3-Methylphenol & 4-Methylphenol	µg/L				1		10	10 U	10 U	10 U	80 U
3-Nitroaniline	µg/L						NA	50 U	50 U	50 U	400 U
4,6-Dinitro-2-methylphenol	µg/L						NA	50 U	50 U	50 U	400 U
4-Aminobiphenyl	µg/L						NA	50 U	50 U	50 U	400 U
4-Bromophenyl phenyl ether	µg/L						NA	10 U	10 U	10 U	80 U
4-Chloro-3-methylphenol	µg/L						NA	10 U	10 U	10 U	80 U
4-Chloroaniline	µg/L						NA	10 U	10 U	10 U	80 U
4-Chlorophenyl phenyl ether	µg/L						NA	10 U	10 U	10 U	80 U
4-Dimethylaminoazobenzene	µg/L						NA	20 U	20 U	20 U	160 U
4-Nitroaniline	µg/L						NA	50 U	50 U	50 U	400 U
4-Nitrophenol	µg/L						NA	50 U	50 U	50 U	400 U
4-Nitroquinoline-1-oxide	µg/L						NA	100 U	100 U	100 U	800 U
4-Phenylenediamine	µg/L						NA	100 U	100 U	100 U	800 U
5-Nitro-o-toluidine	µg/L						NA	20 U	20 U	20 U	160 U
7,12-Dimethylbenz(a)anthracene	µg/L				1		10	20 U	20 U	20 U	160 U
a,a-Dimethylphenethylamine	µg/L						NA	50 U	50 U	50 U	400 U
Acetophenone	µg/L						0.06	10 U	10 U	10 U	80 U
Aniline	µg/L						NA	10 U	10 U	10 U	80 U
Aramite	µg/L						NA	20 U	20 U	20 U	160 U
Benzyl alcohol	µg/L						NA	10 U	10 U	10 U	80 U
bis(2-Chloroethoxy)methane	µg/L						NA	10 U	10 U	10 U	80 U
bis(2-Chloroethyl) ether	µg/L						0.2	10 U	10 U	10 U	80 U
bis(2-Ethylhexyl) phthalate	µg/L			1			6	10 U	10 U	10 U	80 U
Butyl benzyl phthalate	µg/L			1			1,120	10 U	10 U	10 U	80 U
Chlorobenzilate	µg/L						NA	10 U	10 U	10 U	80 U
Diallate	µg/L						NA	20 U	20 U	20 U	160 U
Dibenzofuran	µg/L						32	10 U	**0.83 J**	**0.96 J**	**7.2 J**
Diethyl phthalate	µg/L						78,000	10 U	10 U	10 U	80 U
Dimethoate	µg/L						NA	20 U	20 U	20 U	160 U
Dimethyl phthalate	µg/L						1,000,500	10 U	10 U	10 U	80 U
Di-n-butyl phthalate	µg/L			1			8,400	10 U	10 U	10 U	80 U
Di-n-octyl phthalate	µg/L			1			89.4	10 U	10 U	10 U	80 U
Diphenylamine	µg/L						NA	10 U	10 U	10 U	80 U
Disulfoton	µg/L						NA	50 U	50 U	50 U	400 U
Ethyl methanesulfonate	µg/L						NA	10 U	10 U	10 U	80 U
Famphur	µg/L						NA	200 U	200 U	200 U	1600 U
Hexachlorobenzene	µg/L						1	10 U	10 U	10 U	80 U
Hexachlorobutadiene	µg/L						9	10 U	10 U	10 U	80 U
Hexachlorocyclopentadiene	µg/L						50	50 U	50 U	50 U	400 U
Hexachloroethane *	µg/L						70	10 U	10 U	10 U	80 U
Hexachlorophene	µg/L						NA	U	U	U	U
Hexachloropropene	µg/L						NA	100 U	100 U	100 U	800 U
Isodrin	µg/L						NA	10 U	10 U	10 U	80 U
Isophorone	µg/L						NA	10 U	10 U	10 U	80 U
Isosafrole	µg/L						NA	20 U	20 U	20 U	160 U
Methapyrilene	µg/L						NA	50 U	50 U	50 U	400 U
Methyl methanesulfonate	µg/L						NA	10 U	10 U	10 U	80 U
Methyl parathion	µg/L						NA	50 U	50 U	50 U	400 U
Nitrobenzene	µg/L			1			1.85	10 U	10 U	10 U	80 U
N-Nitrosodiethylamine	µg/L						NA	10 U	10 U	10 U	80 U
N-Nitrosodimethylamine	µg/L						NA	10 U	10 U	10 U	80 U
N-Nitrosodi-n-butylamine	µg/L						NA	10 U	10 U	10 U	80 U
N-Nitrosodi-n-propylamine	µg/L						NA	10 U	**0.72 J**	**0.82 J**	80 U
N-Nitrosodiphenylamine	µg/L						NA	10 U	10 U	10 U	80 U

Table 15-8 Summary of Groundwater Monitoring Results for Appendix IX Constituents - October 26 and 28 2009

Appendix IX Constituent	Units	GWPS Basis						WN-1A	WN-7B	RCRA-MW-5	MW-6
		1	2	3	4	5	Concentration				
N-Nitrosomethylethylamine	µg/L						NA	10 U	10 U	10 U	80 U
N-Nitrosomorpholine	µg/L						NA	10 U	10 U	10 U	80 U
N-Nitrosopiperidine	µg/L						NA	10 U	10 U	10 U	80 U
N-Nitrosopyrrolidine	µg/L						NA	10 U	10 U	10 U	80 U
O,O,O-Triethyl phosphorothioate	µg/L						NA	50 U	50 U	50 U	400 U
o-Toluidine	µg/L						NA	10 U	10 U	10 U	80 U
Parathion	µg/L						520	50 U	50 U	50 U	400 U
Pentachlorobenzene	µg/L						NA	10 U	10 U	10 U	80 U
Pentachloroethane	µg/L						NA	50 U	50 U	50 U	400 U
Pentachloronitrobenzene	µg/L						NA	50 U	50 U	50 U	400 U
Pentachlorophenol	µg/L						1	50 U	50 U	50 U	400 U
Phenacetin	µg/L						NA	20 U	20 U	20 U	160 U
Phenol	µg/L			1			29,500	10 U	**3.2 J**	**2.6 J**	80 U
Phorate	µg/L						NA	50 U	50 U	50 U	400 U
Pronamide	µg/L						NA	20 U	20 U	20 U	160 U
Pyridine	µg/L			1			9.28	20 U	20 U	20 U	160 U
Safrole	µg/L						NA	50 U	50 U	50 U	400 U
Sulfotepp	µg/L						NA	50 U	50 U	50 U	400 U
Thionazin	µg/L						NA	10 U	10 U	10 U	80 U
Polycyclic Aromatic Hydrocarbons											
Acenaphthene	µg/L			1			521	10 U	**2.1 J**	**2.4 J**	80 U
Acenaphthylene	µg/L						NA	10 U	10 U	10 U	80 U
Anthracene	µg/L						2,300	10 U	10 U	10 U	**16 J**
Benzo(a)anthracene	µg/L			1			0.75	0.1 U	**0.0066 J**	**0.005 J**	**23**
Benzo(a)pyrene	µg/L			1			0.2	0.1 U	0.1 U	0.1 U	**7.4**
Benzo(b)fluoranthene	µg/L			1			0.537	0.1 U	0.1 U	0.1 U	**8.6**
Benzo(ghi)perylene	µg/L						NA	10 U	10 U	10 U	**4.4 J**
Benzo(k)fluoranthene	µg/L						3	10 U	10 U	10 U	**10 J**
Chrysene	µg/L			1			75	**0.57 J**	**0.63 J**	**0.55 J**	**61 J**
Dibenzo(a,h)anthracene	µg/L			1			0.027	0.1 U	0.1 U	0.1 U	**1.8 J**
Fluoranthene	µg/L			1			1,370	10 U	10 U	10 U	**22 J**
Fluorene	µg/L			1			341	10 U	**1.8 J**	**2 J**	**19 J**
Indeno(1,2,3-cd)pyrene	µg/L			1			0.2	0.1 U	0.1 U	0.1 U	**1.3 J**
Naphthalene	µg/L			1			2.11	10 U	**1.8 J**	**2 J**	**150**
Phenanthrene **	µg/L					1	0.0311	0.1 U	**0.99**	**0.96**	**110**
Pyrene	µg/L			1			1,090	10 U	10 U	10 U	**64 J**

Notes:

RCRA-MW-5 is a duplicate of WN-7B

* The result for (SVOC) hexachlorophene is a presence/absence analysis. The estimated detection limits range from 30-330 µg/L.

** Using the Toxicity Equivalency Factor approach with phenanthrene's TEF of 0.001 relative to benzo(a)pyrene's TEF of 1, the risk based concentration should

1 = constituent is listed with a GWPS in Permit Attachment B; basis for standard indicated by column location.

BOLD indicates a detected result.

SHADED indicates that the compound was detected at a level above the listed standard.

NA = No applicable standard.

U Indicates compound was analyzed for but not detected. Reporting limit shown.

J Indicates an estimated value. Used primarily when the compound was detected between the minimum detection level and the reporting level.

UJ Indicates compound was analyzed for but not detected; the reporting limit shown is an estimated value.

µg/L = micrograms per liter

ng/L = nanograms per liter

mg/L = milligrams per liter

1 = MCL - Maximum Contaminant Level, established under the National Primary Drinking Water Regulations

2 = Secondary Maximum Contaminant Level, established under the National Secondary Drinking Water Regulations

3 = KDHE Risk-Based Standards for Kansas, October 2010

4 = 40 CFR 264, Appendix IX PQL

5 = Kansas Surface Water Quality Standard

Table 15-9 Summary of Expanded Analytical Groundwater Monitoring Results for Site-Wide Wells - May 19-24, 2010

Location Identification	Tier 2 RSK Non-Residential Groundwater Pathway	5	49	72	75	93	103	106
Sample Name		5	49	72	75	93	103	106
Sample Date		5/20/2010	5/21/2010	5/20/2010	5/20/2010	5/21/2010	5/24/2010	5/21/2010
Field and Laboratory Analytes (Units)								
Field Parameters (Units)								
Depth to Water (feet btoc)	NA	18.44	20.30	16.80	15.21	18.46	25.40	26.83
Depth to Product (feet btoc)	NA	--	--	--	--	--	--	--
Specific Conductance (uS/cm)	NA	1028	1297	1170	1053	1086	911	1365
pH	NA	6.76	6.86	7.44	6.76	6.87	7.11	7.87
Temperature (°C)	NA	15.91	15.96	13.11	15.53	15.84	18.06	17.16
Dissolved Oxygen (mg/L)	NA	0.19	0.2	0.18	0.27	0.47	0.49	0.28
Oxidation Reduction Potential (mV)	NA	-137.1	-85.9	-230.1	-134.8	-104.7	-47.7	-74.5
Turbidity (NTU)	NA	52.8	48.9	1.98	50.2	4.9	18.8	179
Metals (µg/L)								
Antimony	6	4 U	4 U	4 U	4 U	4 U	2 U	4 U
Arsenic	10	**13**	**9.9 J**	10 U	**7.9 J**	**9.1 J**	**6.2**	**3.5 J**
Barium	2000	**1000**	**580**	**280**	**600**	**920**	**470**	**150**
Beryllium	4	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cadmium	5	**0.66 J**	5 U	5 U	5 U	5 U	5 U	5 U
Chromium	100	10 U	10 U	10 U	**0.72 J**	10 U	**6 J**	**2 J**
Lead	15	**0.48 J**	9 U	9 U	**7.5 J**	9 U	**1.2 J**	**1.2 J**
Mercury	2	0.2 U	0.2 U	0.2 U	**0.072 J**	0.2 U	0.2 U	0.2 U
Nickel	2040	**1.8 J**	**2.3 J**	40 U	**3.4 J**	**2.6 J**	**2.4 J**	**4.8 J**
Selenium	50	15 U	**5 J**	15 U	15 U	15 U	15 U	15 U
Silver	508	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Vanadium	NA	**11**	**9.8 J**	**2.8 J**	**11**	**3.9 J**	**48**	**9.2 J**
Zinc	30500	**7.2 J**	**5.2 J**	20 U	**9.7 J**	**5.1 J**	20 U	**14 J**
Cyanide, Total (mg/L)	200	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	**0.005 J**	0.01 U
Volatile Organic Compounds (µg/L)								
Benzene	5	**380**	1 U	1 U	**4900**	1 U	**0.28 J**	1 U
2-Butanone (MEK)	11800	6 U	6 U	6 U	120 U	6 U	6 U	6 U
Carbon disulfide	1660	2 U	2 U	2 U	40 U	2 U	**0.58 J**	2 U
Chlorobenzene	100	1 U	1 U	1 U	20 U	1 U	1 U	1 U
Chloroform	80	1 U	1 U	1 U	20 U	1 U	1 U	1 U
1,2-Dibromoethane (EDB)	0.05	0.019 U	0.019 U	0.019 U	**0.0038 J**	0.019 U	0.019 U	0.019 U
1,2-Dichlorobenzene	600	1 U	1 U	1 U	3.9 U	1 U	1 U	1 U
1,3-Dichlorobenzene	NA	1 U	1 U	1 U	9.8 U	1 U	1 U	1 U
1,4-Dichlorobenzene	75	1 U	1 U	1 U	3.9 U	1 U	1 U	1 U
1,2-Dichloroethane	5	1 U	1 U	1 U	*2.6 U*	1 U	1 U	1 U
1,1-Dichloroethene	7	1 U	1 U	1 U	*4.6 U*	1 U	1 U	1 U
1,4-Dioxane	259	19 U	20 U	19 U	20 U	19 U	19 U	19 U
Ethylbenzene	700	**3.2**	1 U	1 U	**190**	1 U	1 U	1 U
Methyl tert-butyl ether	262	5 U	5 U	5 U	100 U	5 U	5 U	5 U
Styrene	100	1 U	1 U	1 U	20 U	1 U	1 U	1 U
tert-Butyl Alcohol	859	40 U	40 U	40 U	800 U	40 U	40 U	40 U
Tetrachloroethene (PCE)	5	1 U	1 U	1 U	*4 U*	1 U	1 U	1 U
Toluene	1000	**18**	1 U	1 U	**37**	1 U	1 U	1 U
1,1,1-Trichloroethane	200	1 U	1 U	1 U	20 U	1 U	1 U	1 U
Trichloroethene (TCE)	5	1 U	1 U	1 U	*3.2 U*	1 U	1 U	1 U
1,2,4-Trimethylbenzene	17.4	**0.78 J**	1 U	1 U	**31**	1 U	1 U	1 U
1,3,5-Trimethylbenzene	88.4	1 U	1 U	1 U	**34**	1 U	1 U	1 U
Xylenes (total)	10000	**56**	2 U	2 U	**220**	2 U	2 U	2 U

Table 15-9 Summary of Expanded Analytical Groundwater Monitoring Results for Site-Wide Wells - May 19-24, 2010

Location Identification	Tier 2 RSK Non-Residential Groundwater Pathway	5	49	72	75	93	103	106
Sample Name		5	49	72	75	93	103	106
Sample Date		5/20/2010	5/21/2010	5/20/2010	5/20/2010	5/21/2010	5/24/2010	5/21/2010
Field and Laboratory Analytes (Units)								
Semi-Volatile Organic Compounds (µg/L)								
Acenaphthene	521	**1.4**	**0.18**	0.1 U	**0.96**	**0.71**	**0.2**	0.096 U
Anthracene	2500	**0.34**	**0.2**	**0.0072 J**	**0.75**	**0.22**	**0.32**	0.096 U
Benzo(a)anthracene	0.75	**0.043 J**	**0.11**	**0.0057 J**	**0.92**	0.094 U	**0.1**	**0.0079 J**
Benzo(a)pyrene	0.2	**0.012 J**	**0.031 J**	0.1 U	**0.48**	0.094 U	**0.017 J**	**0.0059 J**
Benzo(b)fluoranthene	0.537	**0.018 JK**	**0.048 JK**	**0.006 JK**	**0.52 K**	0.094 U	**0.013 JK**	**0.0081 JK**
Benzo(k)fluoranthene	5.43	0.096 UK	0.1 UK	0.1 UK	0.096 UK	0.094 U	0.095 UK	0.096 UK
Bis(2-ethylhexyl) phthalate	6	*0.54 U*	**0.97 J**	*0.54 U*	*0.55 U*	**0.75 J**	**0.54 J**	**0.78 J**
Butyl benzyl phthalate	1120	3.8 U	4 U	3.8 U	3.9 U	3.8 U	3.8 U	3.8 U
Chrysene	75	**0.1**	**0.23**	**0.011 J**	**6.4**	0.094 U	**0.18**	**0.017 J**
Dibenz(a,h)anthracene	0.027	*0.0086 U*	*0.0089 U*	*0.0092 U*	**0.17**	*0.0084 U*	*0.0085 U*	*0.0086 U*
7,12-Dimethylbenz(a)anthracene	NA	19 U	20 U	19 U	20 U	19 U	19 U	19 U
2,4-Dimethylphenol	1860	9.6 U	9.9 U	9.6 U	**1.7 J**	9.5 U	9.6 U	9.6 U
2,4-Dinitrotoluene	8.98	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*
Di-n-butyl phthalate	8400	3.8 U	4 U	3.8 U	3.9 U	3.8 U	3.8 U	3.8 U
Di-n-octyl phthalate	89.4	3.8 U	4 U	3.8 U	3.9 U	3.8 U	3.8 U	3.8 U
Fluoranthene	1370	**0.12**	0.1 U	**0.0078 J**	**0.59**	**0.038 J**	0.095 U	**0.0046 J**
Fluorene	341	**1.2 J**	0.1 U	**0.0063 J**	**0.9**	**2.6**	**0.21**	**0.009 J**
Indeno(1,2,3-cd)pyrene	0.392	0.096 U	**0.0083 J**	0.1 U	**0.15**	0.094 U	0.095 U	0.096 U
1-Methylnaphthalene	NA	**33**	**1.4**	**0.013 J**	**30**	**24**	**0.19**	**0.0089 J**
2-Methylnaphthalene	34.6	**26**	**1**	**0.021 J**	**34**	**17**	**0.068 J**	**0.0091 J**
2-Methylphenol	4780	9.6 U	9.9 U	9.6 U	9.8 U	9.5 U	9.6 U	9.6 U
3-Methylphenol	4770	**0.26 J**	9.9 U	9.6 U	**0.44 J**	9.5 U	9.6 U	9.6 U
4-Methylphenol	478	**0.26 J**	9.9 U	9.6 U	**0.44 J**	9.5 U	9.6 U	9.6 U
Naphthalene	2.11	**0.87 J**	0.1 U	0.1 U	**18**	0.094 U	0.095 U	0.096 U
Nitrobenzene	1.85	*0.78 U*	*0.8 U*	*0.78 U*	*0.79 U*	*0.77 U*	*0.78 U*	*0.78 U*
Phenanthrene	NA	**1.8**	**0.13**	**0.021 J**	**8.2**	**2.4**	**0.11**	**0.021 J**
Phenol	29500	**6.3 J**	9.9 U	9.6 U	**79**	9.5 U	9.6 U	9.6 U
Pyrene	1090	**0.33**	**0.48**	**0.024 J**	**4.7 J**	**0.059 J**	**1.7**	**0.012 J**
Pyridine	9.28	*1.6 U*	*1.7 U*	*1.6 U*	*1.7 U*	*1.6 U*	*1.6 U*	*1.6 U*
Total Petroleum Hydrocarbons (µg/L)								
Gasoline Range Organics (C6-C10)	500	**5200**	**53**	**43**	**16000**	**120**	**44**	25 U
Diesel Range Organics (C10-C24)	720	**4200**	**2300**	260 U	**5800**	**3200**	**420**	**45 J**
Motor Oil Range Organics (C24-C36)	720	490 U	480 U	520 U	**1500**	480 U	490 U	480 U
TPH-DRO (C10-C36)	720	**4200**	**2300**	520 U	**7300**	**3200**	**420**	**45 J**

Notes: See last page for table notes explanation.

Table 15-9 Summary of Expanded Analytical Groundwater Monitoring Results for Site-Wide Wells - May 19-24, 2010

Location Identification	Tier 2 RSK Non-Residential Groundwater Pathway	AP-4	RFI2-2C	RFI2-4C	RFI2-7C	MW-14	NARW-1	NARW-2
Sample Name		AP-4	RFI2-2C	RFI2-4C	RFI2-7C	MW-14	NARW-1	NARW-2
Sample Date		5/24/2010	5/24/2010	5/21/2010	5/21/2010	5/20/2010	5/19/2010	5/19/2010
Field and Laboratory Analytes (Units)								
Field Parameters (Units)								
Depth to Water (feet btoc)	NA	17.20	30.76	32.18	17.39	21.25	--	--
Depth to Product (feet btoc)	NA	--	--	--	--	--	--	--
Specific Conductance (uS/cm)	NA	1337	1340	1105	770	1100	1104	1130
pH	NA	6.83	6.91	6.84	7.13	6.98	7.18	7.07
Temperature (°C)	NA	15.1	17.12	16.68	16.19	16.66	17.21	16.43
Dissolved Oxygen (mg/L)	NA	0.33	0.48	0.67	0.41	0.63	1.35	0.88
Oxidation Reduction Potential (mV)	NA	-80.8	-70.2	-68.2	-87.8	13.1	-160.2	-146.4
Turbidity (NTU)	NA	4.91	2.3	23.8	10.6	28.4	1.73	2.48
Metals (µg/L)								
Antimony	6	2 U	4 U	4 U	4 U	4 U	4 U	4 U
Arsenic	10	**9.6**	**16**	**3.8 J**	**19**	**0.8 J**	**1.6 J**	**0.86 J**
Barium	2000	**830**	**1200**	**780**	**210**	**75**	**830**	**250**
Beryllium	4	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cadmium	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chromium	100	10 U	10 U	**2.3 J**	10 U	**4.9 J**	10 U	10 U
Lead	15	9 U	9 U	**2.1 J**	9 U	9 U	9 U	**0.46 J**
Mercury	2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	2040	**2.4 J**	40 U	40 U	40 U	**3.3 J**	40 U	**1.3 J**
Selenium	50	**5 J**	15 U	15 U	15 U	15 U	15 U	15 U
Silver	508	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Vanadium	NA	**8.8 J**	**5.7 J**	**7.2 J**	**5.1 J**	**8.3 J**	10 U	**1.1 J**
Zinc	30500	**5.6 J**	20 U	**22**	20 U	**5.1 J**	**9.6 J**	**8.6 J**
Cyanide, Total (mg/L)	200	**0.0039 J**	**0.0029 J**	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Volatile Organic Compounds (µg/L)								
Benzene	5	**11**	**8.6**	1 U	1 U	1 UJ	**10**	1 U
2-Butanone (MEK)	11800	6 U	6 U	6 U	6 U	6 UJ	6 U	6 U
Carbon disulfide	1660	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U
Chlorobenzene	100	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U
Chloroform	80	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U
1,2-Dibromoethane (EDB)	0.05	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
1,2-Dichlorobenzene	600	1 U	1 U	1 U	1 U	3.8 U	1 U	1 U
1,3-Dichlorobenzene	NA	1 U	1 U	1 U	1 U	9.6 U	1 U	1 U
1,4-Dichlorobenzene	75	1 U	1 U	1 U	1 U	3.8 U	1 U	1 U
1,2-Dichloroethane	5	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U
1,1-Dichloroethene	7	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U
1,4-Dioxane	259	20 U	19 U	19 U	19 U	19 U	19 U	19 U
Ethylbenzene	700	**1.5**	**0.29 J**	1 U	1 U	1 UJ	**0.86 J**	1 U
Methyl tert-butyl ether	262	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
Styrene	100	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U
tert-Butyl Alcohol	859	40 U	40 U	40 U	40 U	40 UJ	40 U	40 U
Tetrachloroethene (PCE)	5	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U
Toluene	1000	**11**	**1.9**	**0.2 J**	1 U	1 UJ	**0.43 J**	1 U
1,1,1-Trichloroethane	200	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U
Trichloroethene (TCE)	5	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U
1,2,4-Trimethylbenzene	17.4	**0.44 J**	**0.16 J**	1 U	1 U	1 UJ	**0.23 J**	1 U
1,3,5-Trimethylbenzene	88.4	**8.6**	**1.6**	**0.27 J**	1 U	1 UJ	**0.82 J**	1 U
Xylenes (total)	10000	**70**	**3.6**	**0.8 J**	2 U	2 UJ	**0.8 J**	2 U

Table 15-9 Summary of Expanded Analytical Groundwater Monitoring Results for Site-Wide Wells - May 19-24, 2010

Location Identification	Tier 2 RSK Non-Residential Groundwater Pathway	AP-4	RFI2-2C	RFI2-4C	RFI2-7C	MW-14	NARW-1	NARW-2
Sample Name		AP-4	RFI2-2C	RFI2-4C	RFI2-7C	MW-14	NARW-1	NARW-2
Sample Date		5/24/2010	5/24/2010	5/21/2010	5/21/2010	5/20/2010	5/19/2010	5/19/2010
Field and Laboratory Analytes (Units)								
Semi-Volatile Organic Compounds (µg/L)								
Acenaphthene	521	**0.84**	**0.66**	**1.3**	**0.008 J**	0.11 U	**0.57**	**0.37**
Anthracene	2500	**0.14 J**	**0.056 J**	**0.24**	**0.048 J**	0.11 U	**0.19**	**0.044 J**
Benzo(a)anthracene	0.75	**0.054 J**	**0.0096 J**	**0.074 J**	**0.081 J**	0.11 U	**0.02 J**	0.095 U
Benzo(a)pyrene	0.2	**0.016 J**	0.096 U	**0.033 J**	**0.046 J**	0.11 U	0.095 U	0.095 U
Benzo(b)fluoranthene	0.537	**0.019 J**	**0.0052 J**	**0.051 JK**	**0.057 JK**	0.11 U	**0.0036 J**	0.095 U
Benzo(k)fluoranthene	5.43	0.2 U	0.096 U	0.1 UK	0.096 UK	0.11 U	0.095 U	0.095 U
Bis(2-ethylhexyl) phthalate	6	**0.82 J**	**0.63 J**	**1.2 J**	**1.2 J**	*0.53 U*	*0.53 U*	*0.54 U*
Butyl benzyl phthalate	1120	3.9 U	3.9 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U
Chrysene	75	**0.13 J**	**0.018 J**	**0.16**	**0.24**	0.11 U	**0.045 J**	**0.01 J**
Dibenz(a,h)anthracene	0.027	*0.018 U*	**0.013 J**	**0.012 J**	**0.018 J**	*0.0096 U*	*0.0085 U*	*0.0085 U*
7,12-Dimethylbenz(a)anthracene	NA	20 U	19 U	19 U	19 U	19 U	19 U	19 U
2,4-Dimethylphenol	1860	9.9 U	9.7 U	9.6 U	9.5 U	9.6 U	9.5 U	9.6 U
2,4-Dinitrotoluene	8.98	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*
Di-n-butyl phthalate	8400	3.9 U	3.9 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U
Di-n-octyl phthalate	89.4	**2 J**	3.9 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U
Fluoranthene	1370	**0.056 J**	**0.019 J**	**0.052 J**	0.096 U	0.11 U	0.095 U	**0.0081 J**
Fluorene	341	**1.3**	**0.36**	**0.73**	0.096 U	0.11 U	**0.5 J**	**0.38**
Indeno(1,2,3-cd)pyrene	0.392	0.2 U	**0.013 J**	**0.019 J**	**0.016 J**	0.11 U	0.095 U	0.095 U
1-Methylnaphthalene	NA	**71**	**27**	**24**	0.096 U	0.11 U	**7.4**	**10**
2-Methylnaphthalene	34.6	**54**	**10**	**18**	**0.0086 J**	0.11 U	**10**	**4.8**
2-Methylphenol	4780	9.9 U	9.7 U	9.6 U	9.5 U	9.6 U	9.5 U	9.6 U
3-Methylphenol	4770	9.9 U	9.7 U	9.6 U	9.5 U	9.6 U	9.5 U	9.6 U
4-Methylphenol	478	9.9 U	9.7 U	9.6 U	9.5 U	9.6 U	9.5 U	9.6 U
Naphthalene	2.11	**2**	**0.76**	**0.47 J**	0.096 U	**0.0061 J**	**0.46**	0.095 U
Nitrobenzene	1.85	*0.8 U*	*0.78 U*	*0.78 U*	*0.77 U*	*0.77 U*	*0.77 U*	*0.78 U*
Phenanthrene	NA	**0.71**	**0.17**	**1.2**	**0.032 J**	**0.0065 J**	**1.1**	**0.41**
Phenol	29500	9.9 U	9.7 U	9.6 U	9.5 U	9.6 U	9.5 U	9.6 U
Pyrene	1090	**0.16 J**	**0.025 J**	**0.3**	**0.44**	0.11 U	**0.18**	**0.023 J**
Pyridine	9.28	*1.7 U*	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*	*1.6 U*
Total Petroleum Hydrocarbons (µg/L)								
Gasoline Range Organics (C6-C10)	500	**3100**	**750 J**	**470 J**	25 U	25 U	**600**	**230 J**
Diesel Range Organics (C10-C24)	720	**9600**	**870**	**3000**	**370**	240 U	**1500**	**390**
Motor Oil Range Organics (C24-C36)	720	490 U	480 U	480 U	480 U	480 U	480 U	480 U
TPH-DRO (C10-C36)	720	**9600**	**870**	**3000**	**370**	480 U	**1500**	**390**

Notes: See last page for table notes explanation.

Table 15-9 Summary of Expanded Analytical Groundwater Monitoring Results for Site-Wide Wells - May 19-24, 2010

Location Identification Sample Name Sample Date	Tier 2 RSK Non-Residential Groundwater Pathway	NARW-3 NARW-3 5/24/2010	PARW-1 PARW-1 5/24/2010
Field and Laboratory Analytes (Units)			
Field Parameters (Units)			
Depth to Water (feet btoc)	NA	--	--
Depth to Product (feet btoc)	NA	--	--
Specific Conductance (uS/cm)	NA	1043	1115
pH	NA	7.18	7.12
Temperature (°C)	NA	20.67	18.41
Dissolved Oxygen (mg/L)	NA	2.55	2.79
Oxidation Reduction Potential (mV)	NA	-67.8	-45.1
Turbidity (NTU)	NA	1.22	1.15
Metals (µg/L)			
Antimony	6	2 U	2 U
Arsenic	10	**3 J**	**0.69 J**
Barium	2000	**310**	**460**
Beryllium	4	1 U	1 U
Cadmium	5	5 U	5 U
Chromium	100	10 U	10 U
Lead	15	9 U	9 U
Mercury	2	0.2 U	0.2 U
Nickel	2040	**2.6 J**	**5.5 J**
Selenium	50	15 U	15 U
Silver	508	10 U	10 U
Vanadium	NA	**5.9 J**	**6.1 J**
Zinc	30500	**7 J**	20 U
Cyanide, Total (mg/L)	200	**0.0031 J**	**0.0036 J**
Volatile Organic Compounds (µg/L)			
Benzene	5	**28**	**10**
2-Butanone (MEK)	11800	6 U	**18 J**
Carbon disulfide	1660	2 U	2 U
Chlorobenzene	100	1 U	1 U
Chloroform	80	1 U	1 U
1,2-Dibromoethane (EDB)	0.05	0.019 U	0.019 U
1,2-Dichlorobenzene	600	1 U	1 U
1,3-Dichlorobenzene	NA	1 U	1 U
1,4-Dichlorobenzene	75	1 U	1 U
1,2-Dichloroethane	5	1 U	1 U
1,1-Dichloroethene	7	1 U	1 U
1,4-Dioxane	259	19 U	19 U
Ethylbenzene	700	**4.7**	**1.3**
Methyl tert-butyl ether	262	5 U	5 U
Styrene	100	1 U	1 U
tert-Butyl Alcohol	859	40 U	40 U
Tetrachloroethene (PCE)	5	1 U	1 U
Toluene	1000	**1.3**	**0.4 J**
1,1,1-Trichloroethane	200	1 U	1 U
Trichloroethene (TCE)	5	1 U	1 U
1,2,4-Trimethylbenzene	17.4	**2.3**	**0.22 J**
1,3,5-Trimethylbenzene	88.4	**1.6**	**0.57 J**
Xylenes (total)	10000	**6.4**	**1.6 J**

Table 15-9 Summary of Expanded Analytical Groundwater Monitoring Results for Site-Wide Wells - May 19-24, 2010

Location Identification Sample Name Sample Date	Tier 2 RSK Non-Residential Groundwater Pathway	NARW-3 NARW-3 5/24/2010	PARW-1 PARW-1 5/24/2010
Field and Laboratory Analytes (Units)			
Semi-Volatile Organic Compounds (µg/L)			
Acenaphthene	521	**0.42**	**0.27**
Anthracene	2500	**0.041 J**	**0.067 J**
Benzo(a)anthracene	0.75	0.096 U	**0.0089 J**
Benzo(a)pyrene	0.2	0.096 U	**0.0052 J**
Benzo(b)fluoranthene	0.537	0.096 U	**0.0068 J**
Benzo(k)fluoranthene	5.43	0.096 U	**0.0059 J**
Bis(2-ethylhexyl) phthalate	6	*0.54 U*	**0.55 J**
Butyl benzyl phthalate	1120	3.9 U	3.8 U
Chrysene	75	0.096 U	**0.01 J**
Dibenz(a,h)anthracene	0.027	*0.0086 U*	*0.0086 U*
7,12-Dimethylbenz(a)anthracene	NA	19 U	19 U
2,4-Dimethylphenol	1860	9.6 U	9.5 U
2,4-Dinitrotoluene	8.98	*1.6 U*	*1.6 U*
Di-n-butyl phthalate	8400	3.9 U	3.8 U
Di-n-octyl phthalate	89.4	3.9 U	3.8 U
Fluoranthene	1370	**0.0085 J**	**0.012 J**
Fluorene	341	**0.32**	**0.33**
Indeno(1,2,3-cd)pyrene	0.392	0.096 U	0.097 U
1-Methylnaphthalene	NA	**25**	**4.8**
2-Methylnaphthalene	34.6	**18**	**4.4**
2-Methylphenol	4780	9.6 U	9.5 U
3-Methylphenol	4770	9.6 U	9.5 U
4-Methylphenol	478	9.6 U	9.5 U
Naphthalene	2.11	**1.9**	**0.18**
Nitrobenzene	1.85	*0.78 U*	*0.77 U*
Phenanthrene	NA	**0.27**	**0.32**
Phenol	29500	9.6 U	9.5 U
Pyrene	1090	**0.025 J**	**0.034 J**
Pyridine	9.28	*1.6 U*	*1.6 U*
Total Petroleum Hydrocarbons (µg/L)			
Gasoline Range Organics (C6-C10)	500	**620**	**250**
Diesel Range Organics (C10-C24)	720	**500**	**170 J**
Motor Oil Range Organics (C24-C36)	720	470 U	480 U
TPH-DRO (C10-C36)	720	**500**	**170 J**

Notes: See last page for table notes explanation.

Table 15-9 Summary of Expanded Analytical Groundwater Monitoring Results for Site-Wide Wells - May 19-24, 2010

Notes:

(DUP)	Indicates a duplicate sample
btoc	Below Top of Casing
µS/cm	Microsiemens per centimeter
°C	Degrees Celsius
mV	Millivolts
NTU	Nephelometric turbidity units
mg/L	Milligrams per liter
µg/L	Micrograms per liter
NA	No applicable standard
--	Not analyzed
RL	Reporting level
MDL	Method detection level
Bolded	Bolded result indicates a detected result.
U	Not detected above the RL shown. Italicized number indicates MDL, used when the RL is greater than the RSK.
J	Estimated value; used when the analyte was detected between the MDL and RL.
K	Laboratory could not resolve benzo(b)fluoranthene and benzo(k)fluoranthene.
**	3-Methylphenol and 4-Methylphenol cannot be resolved; the same results are reported by the laboratory for both compounds.

Tier 2 Non-Residential Groundwater Pathway Standards from the Risk-Based Standards for Kansas RSK Manual - 5th Version (KDHE, October 2010).

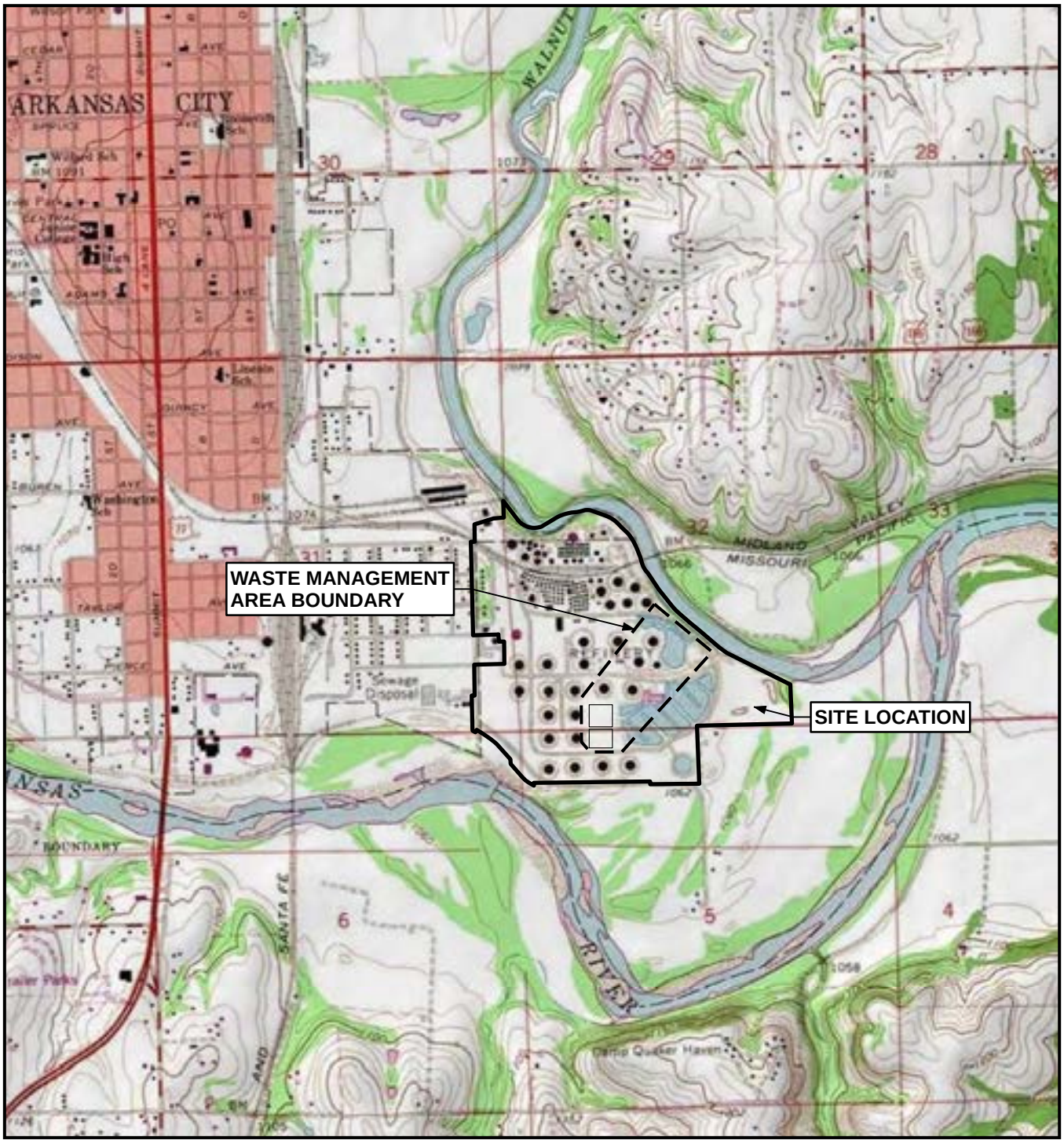
Shaded	Vertical line shading indicates a not detected (U) result with an RL or MDL greater than the KDHE Tier 2 Non-Residential Groundwater Pathway Standard.
Shaded	Shading and bolding indicates a detected result greater than or equal to the KDHE Tier 2 Non-Residential Groundwater Pathway Standard.

REPORT

Figures

N:\GIS\Part_B_2011\MXD\FIG01_SiteLocationUTM_Arc10.mxd

R 4 E



T 34 S

T 35 S

EXPLANATION

SITE BOUNDARIES ARE APPROXIMATE.
SOURCE: USDA-NRCS-NCGC DIGITAL RASTER GRAPHIC (DRG) MrSID MOSAIC.
CONTOUR INTERVAL: 10 FEET.
NATIONAL GEODETIC VERTICAL DATUM OF 1929.
NORTH AMERICAN HORIZONTAL DATUM OF 1983 (NAD83).
ARKANSAS CITY, KANSAS. N3700-W9700/7.5. 1965; PHOTOREVISED 1979.
AMS 6558 II SE-SERIES V878

SCALE 1: 24,000

0 0.5 1 MILE

0 2,000 4,000 FEET

N W E S

DATE	DESIGN BY	DRAWN BY	REVIEWED BY
5/11/2011	RPH	RPH	JFM

TITLE:

SITE LOCATION MAP

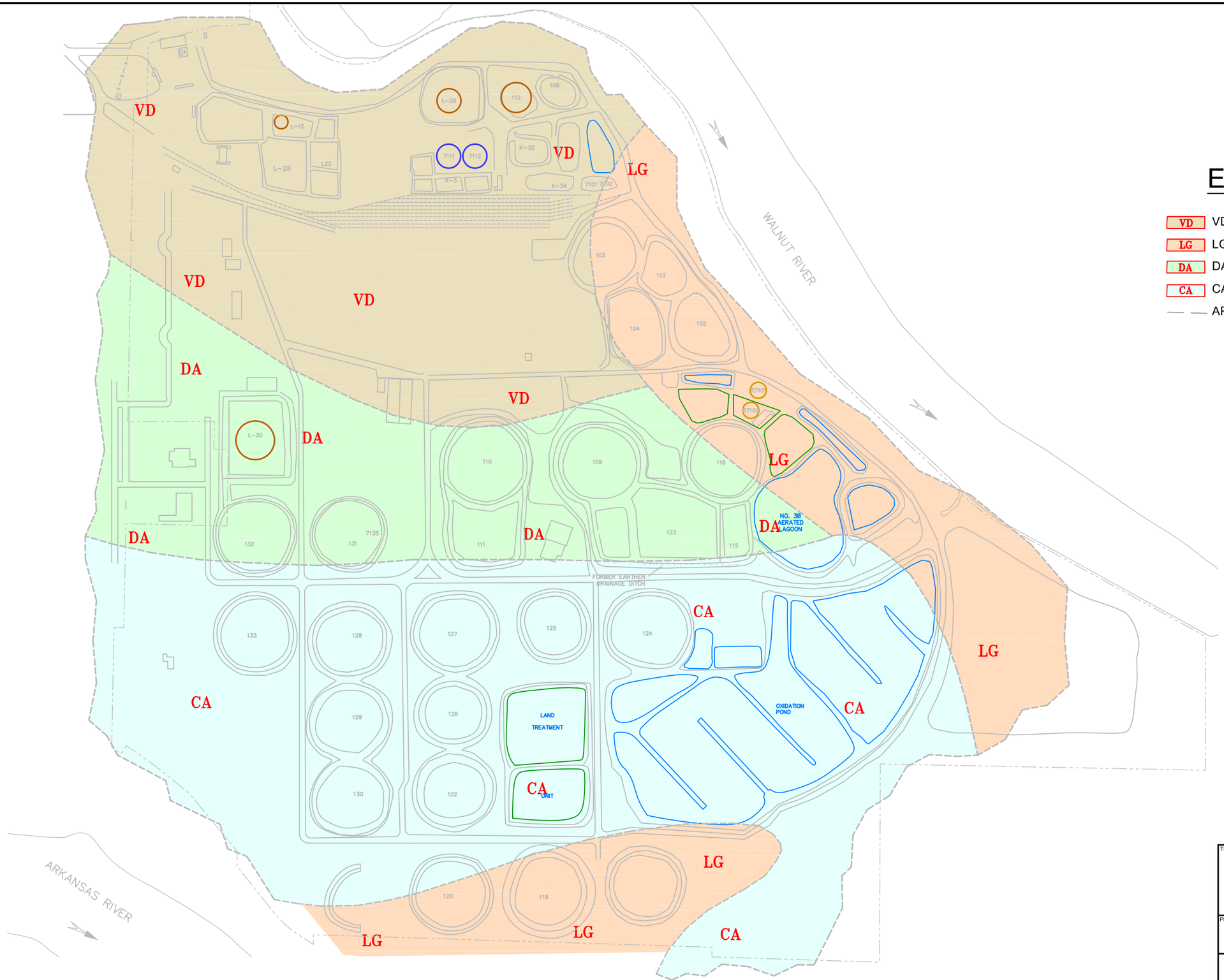
PROJECT:

MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:

3-1



EXPLANATION

- VD - VERDIGRIS SILT LOAM
- LG - LINCOLN-TIVOLI COMPLEX (FINE SANDY LOAM)
- DA - DALE SILT LOAM
- CA - CANADIAN FINE SANDY LOAM
- APPROXIMATE BOUNDARY OF SOIL TYPE

SOURCE: ROBERTS / SCHORNICK & ASSOCIATES, INC. 1992

N
W E
S

SCALE IN FEET

0 400 800

TITLE

SURFACE SOIL TYPE MAP

PROJECT

MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

FIGURE

15-1

N:\GIS\Part_B_2011\MXD\PlanB_2011_005_FIG15_2_FEMA_Arc10.mxd

EXPLANATION

SITE PROPERTY BOUNDARY

FLOOD HAZARD ZONE

0.2% ANNUAL CHANCE FLOODING.

A - 1% ANNUAL CHANCE OF FLOODING. NO BFE DETERMINED.

AE - 1% ANNUAL CHANCE OF FLOODING. BFE's DETERMINED.

BFE BASE FLOOD ELEVATIONS

SOURCE:
FLOOD HAZARD ZONE- Final Flood Insurance Rate Map (FIRM)- August 5, 1991 FEMA
AERIAL PHOTO: NATIONAL AGRICULTURE IMAGERY PROGRAM (NAIP) 2008

N
W E
S

Feet
0 1,000 2,000

DATE	DESIGN BY	DRAWN BY	REVIEWED BY
5/11/2011	GEE	GEE	JFM

TITLE:

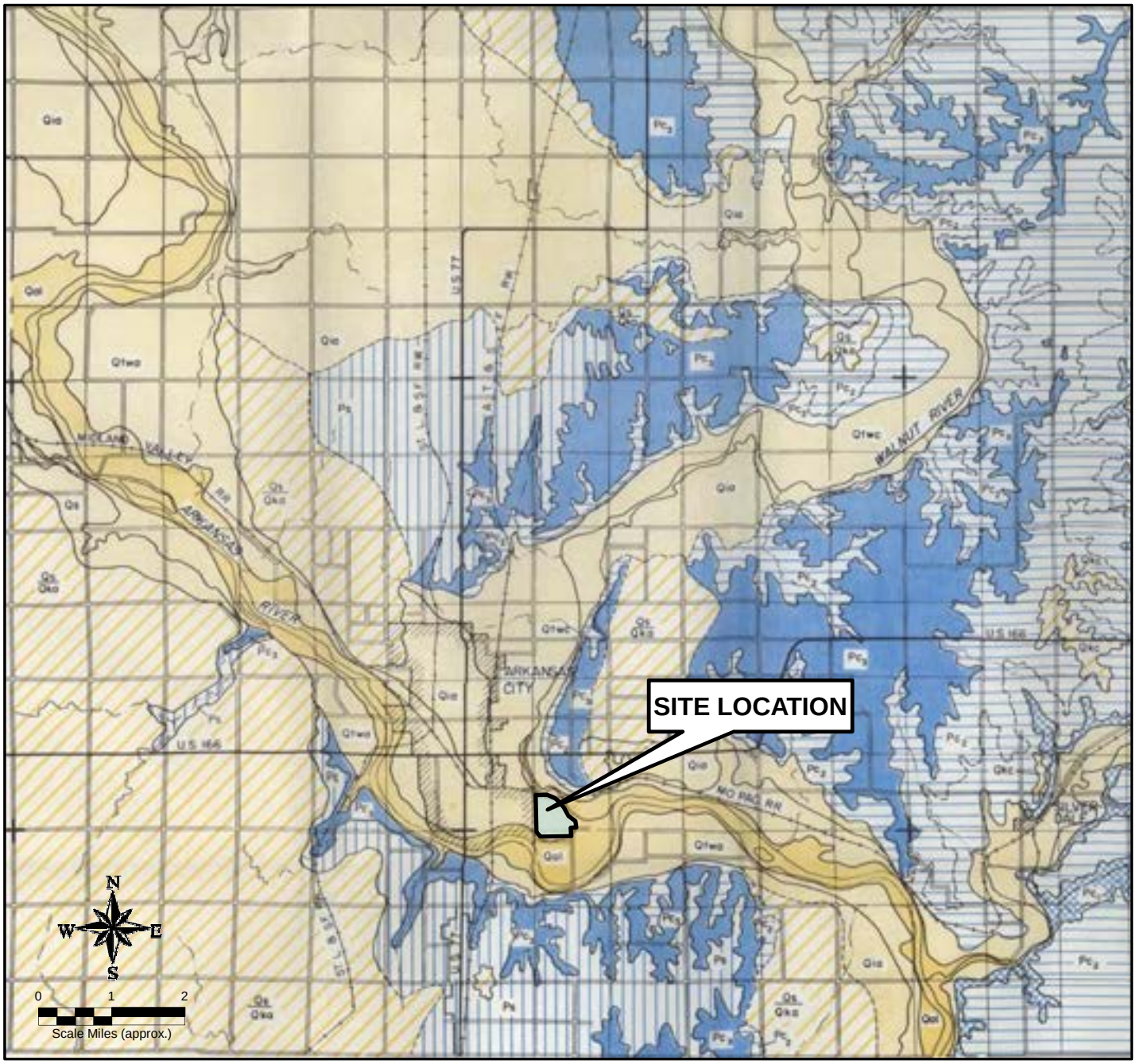
FEMA FLOOD AREA MAP

PROJECT:
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:
15-2

DATE: 3/28/2011 FILENAME: Figure15-3.pptx



EXPLANATION

Source, Bayne, C.K., 1962, Geology and ground-water resources of Cowley County, Kansas: Kansas Geological Survey, Bulletin 158, 219 p.

REGIONAL GEOLOGIC MAP

PROJECT:

MPR PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:

15-3

System	Series	Subseries	Stage	Formation or Rock Unit	Map Symbol	Thickness (feet)	Character
Quaternary	Pleistocene	Upper Pleistocene	Recent	Alluvium	Qal		Silt, clay, and arkosic sand and gravel in Arkansas River valley. Silt, clay, sand and chert gravel in other stream valleys.
			Wisconsinan	Eolian Silts	Qs	0-30	Wind-deposited silt generally in upland position. Locally may contain silt older than Wisconsinan age.
				Terrace Deposits	Qtwa / Qtwc	0-55	Silt, clay, and arkosic sand and gravel in Arkansas River valley. Silt, clay, sand, and chert gravel in other major stream valleys.
			Sangamonian and Illinoisan	Crete and Loveland Formations	Qia / Qic	0-55	Upper part principally silt and sandy silt. Lower part silt, clay, and arkosic sand, and some gravel in Arkansas River valley. Locally in Walnut River valley these deposits contain chert gravel.
		Lower Pleistocene	Yarmouthian and Kansan	Sappa and Grand Island Formations	Qka / Qkc	0-40	Upper part silt and sandy silt. Lower part silt, clay, and arkosic sand and gravel in deposits associated with Arkansas River valley. In Walnut River valley and other major streams these deposits contain silt, clay, and chert gravel.
System	**Series**	**Group**	**Formation**	**Member**	**Map Symbol**	**Thickness (feet)**	**Character**
Permian	Middle Permian	Sumner	Wellington	Hollenberg Limestone	Ps	0-80	Light-gray, green, and some red silty calcareous shale. Contains a few discontinuous limestone beds of which the Hollenberg Limestone seems to be fairly persistent. Locally, thin seams of gypsum occur in lower part.
	Lower Permian	Chase	Nolans Limestone	Herington Limestone	Pc_3	10-15	Light-buff limestone and dolomite in upper part. Dolomitic and sandy in appearance; contains calcite geodes. Locally, limestone contains chert.
				Paddock Shale		7-10	Blue and gray calcareous shale; contains some impure limestone.
				Krider Limestone		4-9	An upper and a lower, thinner, more dense limestone separated by gray and buff calcareous shale.
			Odell Shale			30-38	Chiefly gray and green calcareous shale. Locally, dolomitic zones occur in upper and middle parts.
			Winfield Limestone	Cresswell Limestone		30±	Upper part light-blue limestone, thin bedded, weathers white; shaly in part. Lower part of Cresswell Member massive light-buff limestone generally in two beds with very thin shale parting, but may be one massive bed 12-15 feet thick; weathers light gray to gray. Locally may contain some chert.
			Doyle Shale	Gage Shale	Pc_2	40-50	Gray, green, and maroon clay shale, limy and concretionary in upper few feet.
				Towanda Limestone		2-15	Buff to gray limestone, in part platy to slabby. Resistant bed near base. Locally forms bench on Doyle slope. Not well exposed.
				Holmesville Shale		25-35	Light-gray to green shale containing thin limestone beds in lower part.
			Barneston Limestone	Fort Riley Limestone		45-55	Light-buff limestone weathering light gray, thin bedded in upper part, shaly near middle part, and thick bedded in lower part. A few thick beds occur just above shaly middle part.
				Florence Limestone		12-35	Thick-bedded buff limestone interbedded with gray and blue chert. Lower part contains more limestone and some limy shale. Chert is nodular and occurs in bands separated by limestone containing little chert.
			Matfield Shale	Blue Springs Shale	Pc_1	20-30	Buff limy shale containing thin limestone bed in upper part.
				Kinney Limestone		13-18	Two limestones separated by 8 to 10 feet of gray limy shale. Upper limestone variable in thickness; lower limestone hard, massive, and almost uniform in thickness.
				Wymore Shale		10-15	Gray and maroon shale, in part limy.
			Wreford Limestone	Schroyer Limestone		6	Limestone: an upper algal zone, which weathers to a pitted surface, a shaly limestone zone, and a lower cherty limestone.
			Wreford Limestone	Havensville Shale		5-8	Limy shale, including a persistent cherty limestone near the middle, which weathers to a pitted surface.

EXPLANATION

Source, Bayne, C.K., 1962, Geology and ground-water resources of Cowley County, Kansas: Kansas Geological Survey, Bulletin 158, 219 p.

REGIONAL STRATIGRAPHIC COLUMN COWLEY COUNTY, KANSAS

PROJECT:

MPR PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.: 15-4

Formation or Rock Unit	Map Symbol	Thickness (feet)	Water supply
Alluvium	Qal		Large quantities of water of good to poor quality available in Arkansas River valley. Moderate to small quantities of water in other stream valleys.
Eolian Silts	Qs	0-30	Lies above water table and yields no water to wells.
Terrace Deposits	Qtwa / Qtwc	0-55	Large quantities of water of good to poor quality available in Arkansas River valley. Small to moderate supplies of hard water available in other major stream valleys.
Crete and Loveland Formations	Qia / Qic	0-55	In Walnut River valley these deposits are above the water table and yield no water. In Arkansas River valley moderate supplies of water of good quality are available.
Sappa and Grand Island Formations	Qka / Qkc	0-40	Chert gravel deposits lie above water table. Arkosic deposits yield small to moderate quantities of water of good quality. Locally these deposits are above the water table and yield no water to wells.
Member	**Map Symbol**	**Thickness (feet)**	**Water supply**
Hollenberg Limestone	Ps	0-80	Generally a poor aquifer, but some hard water may be obtained from the upper, weathered part near the outcrop. Locally, some water is obtained from the Hollenberg bed and from solution channels in gypsum.
Herington Limestone	Pc_3	10-15	Locally yields small to large quantities of water of good to poor quality from the upper part, which locally contains solution channels. Little, if any, water is obtained from the middle and lower members.
Paddock Shale		7-10	
Krider Limestone		4-9	
		30-38	Yields little water to wells in the area.
Cresswell Limestone		30±	Locally yields small to moderate quantities of water to wells from weathered upper part.
Gage Shale	Pc_2	40-50	Locally, in subsurface, large to moderate supplies of water of good to poor quality are available from solution channels in uppermost few feet. Some water is available from limestone beds near base and from the Towanda. Quality of water ranges from good to poor.
Towanda Limestone		2-15	
Holmesville Shale		25-35	
Fort Riley Limestone		45-55	Upper weathered zone of Fort Riley yields small to moderate supplies of hard water to wells. Middle and lower zones yield small to large quantities of water to wells and springs from solution channels in local areas. Florence yields small to large supplies of water to wells and springs unless drained near outcrop area.
Florence Limestone		12-35	
Blue Springs Shale	Pc_1	20-30	Yields small supplies of water to wells from Kinney Limestone Member in local area.
Kinney Limestone		13-18	
Wymore Shale		10-15	
Schroyer Limestone		6	Yields small to moderate quantities of hard water to wells in and west of outcrop area. Water principally from weathered and fractured zones
Havensville Shale		5-8	

EXPLANATION

Map Symbols refer to Figure 15-3
Source, Bayne, C.K., 1962, Geology and ground-water resources of Cowley County, Kansas: Kansas Geological Survey, Bulletin 158, 219 p.

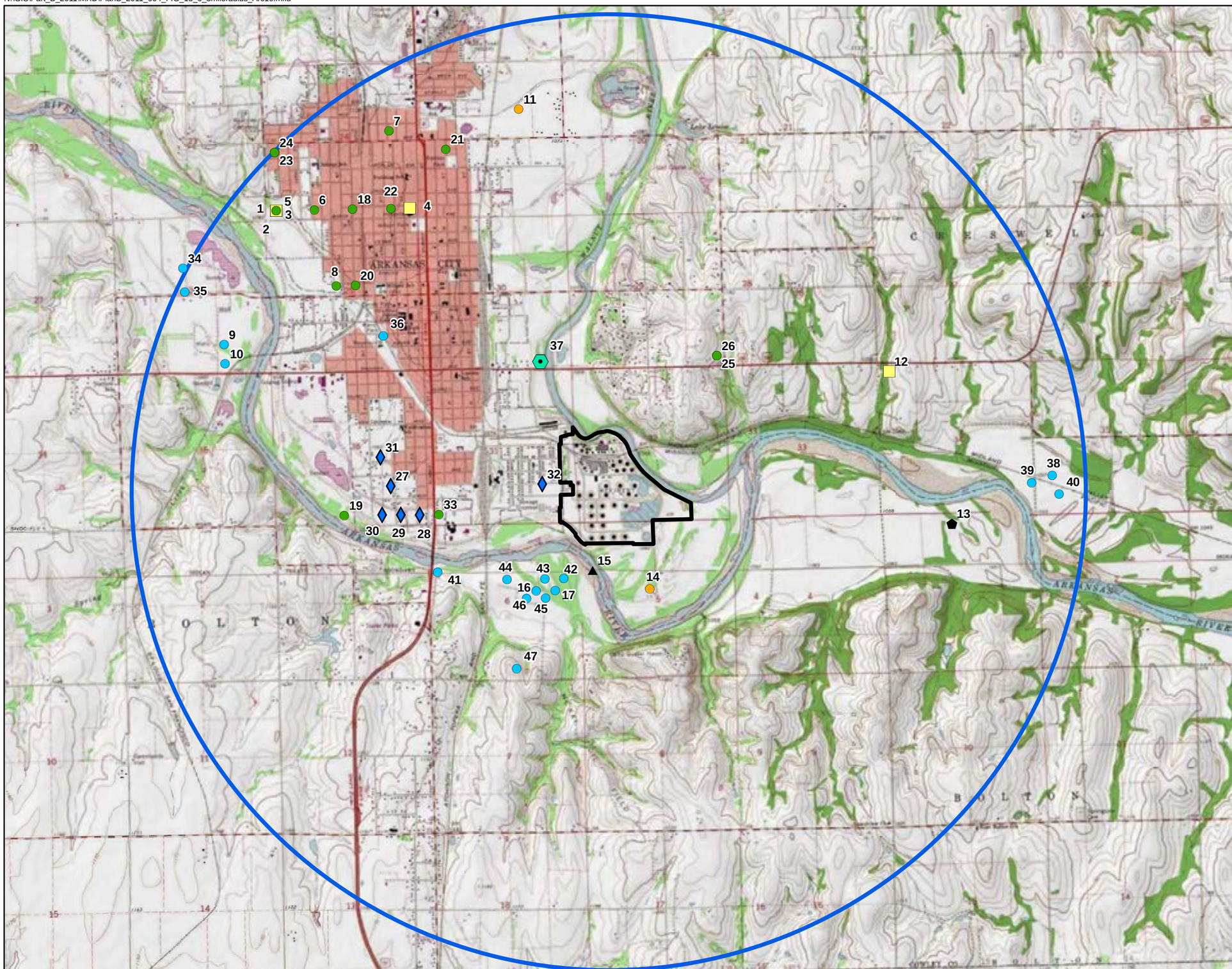
GROUNDWATER AVAILABILITY COWLEY COUNTY, KANSAS

PROJECT:
MPR PROPERTIES COMPANY, LLC ARKANSAS CITY, KANSAS

MWH

Figure No.: 15-5

N:\GIS\Part_B_2011\MXD\PlanB_2011_004_FIG_15_6_3mileradius_Arc10.mxd



EXPLANATION

SITE PROPERTY BOUNDARY

3 MILE RADIUS

WELL USE

- DEWATERING
- DOMESTIC
- INDUSTRIAL
- IRRIGATION
- LAWN/GARDEN- DOMESTIC
- OTHER
- PUBLIC WATER SUPPLY
- SURFACE WATER INTAKE
- 8 MAP NUMBER

SOURCE:
WELL USE DATA -
1) WATER WELL COMPLETION RECORDS (WWC5) DATABASE, KANSAS GEOLOGICAL SURVEY, MARCH 11, 2011

2) PUBLIC WATER SUPPLY SITES, KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT (KDHE)

TOPOGRAPHIC BACKGROUND- USGS 1997 CONTOUR INTERVAL 10 FEET

N
W E
S

Miles
0 1

DATE	DESIGN BY	DRAWN BY	REVIEWED BY
5/11/2011	GEE	GEE	JFM

TITLE:

WATER WELLS AND SURFACE WELLS USERS WITHIN A THREE MILE RADIUS

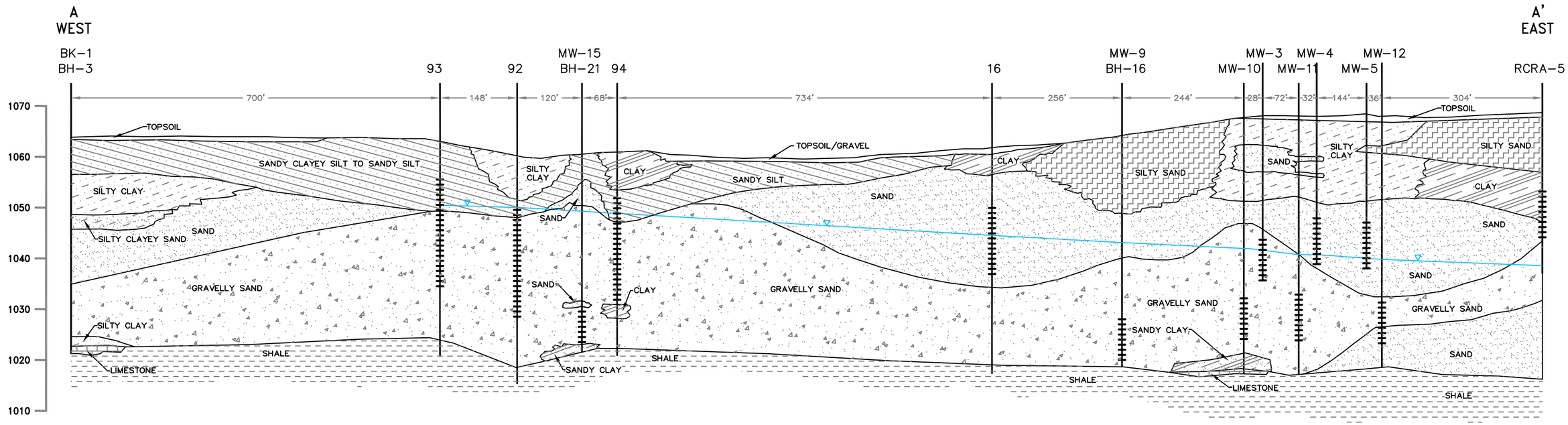
PROJECT:

MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:

15-6



EXPLANATION

MONITOR WELL
SCREENED INTERVAL

LITHOLOGY INTERPOLATED BETWEEN BORINGS

SCALE:
HORIZONTAL - 1"=200'
VERTICAL - 1"=20'

GROUNDWATER POTENTIOMETRIC
SURFACE JUNE 8-9, 1999

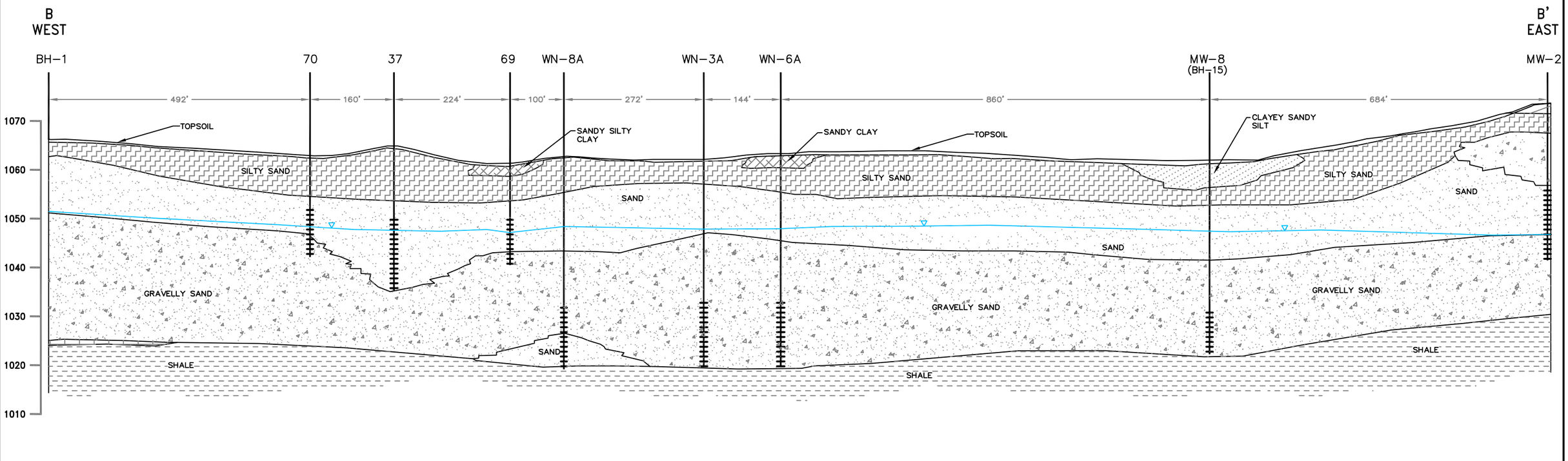
- TOPSOIL
- SILTY CLAY
- SILTY SANDY CLAY
- SANDY SILTY CLAY
- CLAY
- CLAYEY SANDY SILT
- SANDY SILT
- SILTY SAND
- GRAVELLY SAND
- SAND
- LIMESTONE
- SHALE

TITLE
GEOLOGICAL CROSS-SECTION A-A'

PROJECT
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

FIGURE
15-7



EXPLANATION

MONITOR WELL SCREENED INTERVAL

LITHOLOGY INTERPOLATED BETWEEN BORINGS

SCALE:
HORIZONTAL - 1"=200'
VERTICAL - 1"=20'

GROUNDWATER POTENTIOMETRIC SURFACE JUNE 8-9, 1999

- TOPSOIL
- SILTY CLAY
- SILTY SANDY CLAY
- SANDY SILTY CLAY
- CLAY
- CLAYEY SANDY SILT
- SANDY SILT
- SILTY SAND
- GRAVELLY SAND
- SAND
- LIMESTONE
- SHALE

TITLE

GEOLOGICAL CROSS-SECTION B-B'

PROJECT

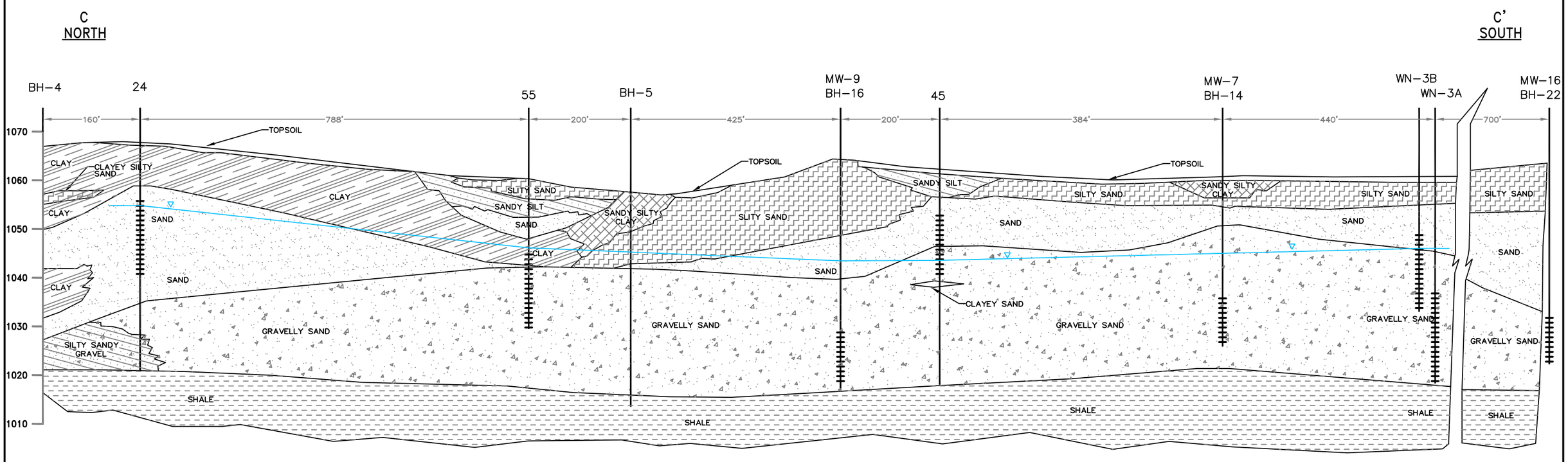
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

FIGURE

15-8

J:\Clients_2-2\TPI\Ark City\Technical\Article3\000\REGRAPHIC\PERMIT RENEWAL 2011\FIGURES & PLATES\Part B Figures_FINAL\Fig 15-8 X-Sect B-B 13880148.DWG May 25, 2011 - 8:20am



EXPLANATION

MONITOR WELL SCREENED INTERVAL

LITHOLOGY INTERPOLATED BETWEEN BORINGS

SCALE:
HORIZONTAL - 1"=200'
VERTICAL - 1"=20'

GROUNDWATER POTENTIOMETRIC SURFACE JUNE 8-9, 1999

- TOPSOIL
- SILTY CLAY
- SILTY SANDY CLAY
- SANDY SILTY CLAY
- CLAY
- CLAYEY SANDY SILT
- SANDY SILT
- SILTY SAND
- GRAVELLY SAND
- SAND
- LIMESTONE
- SHALE

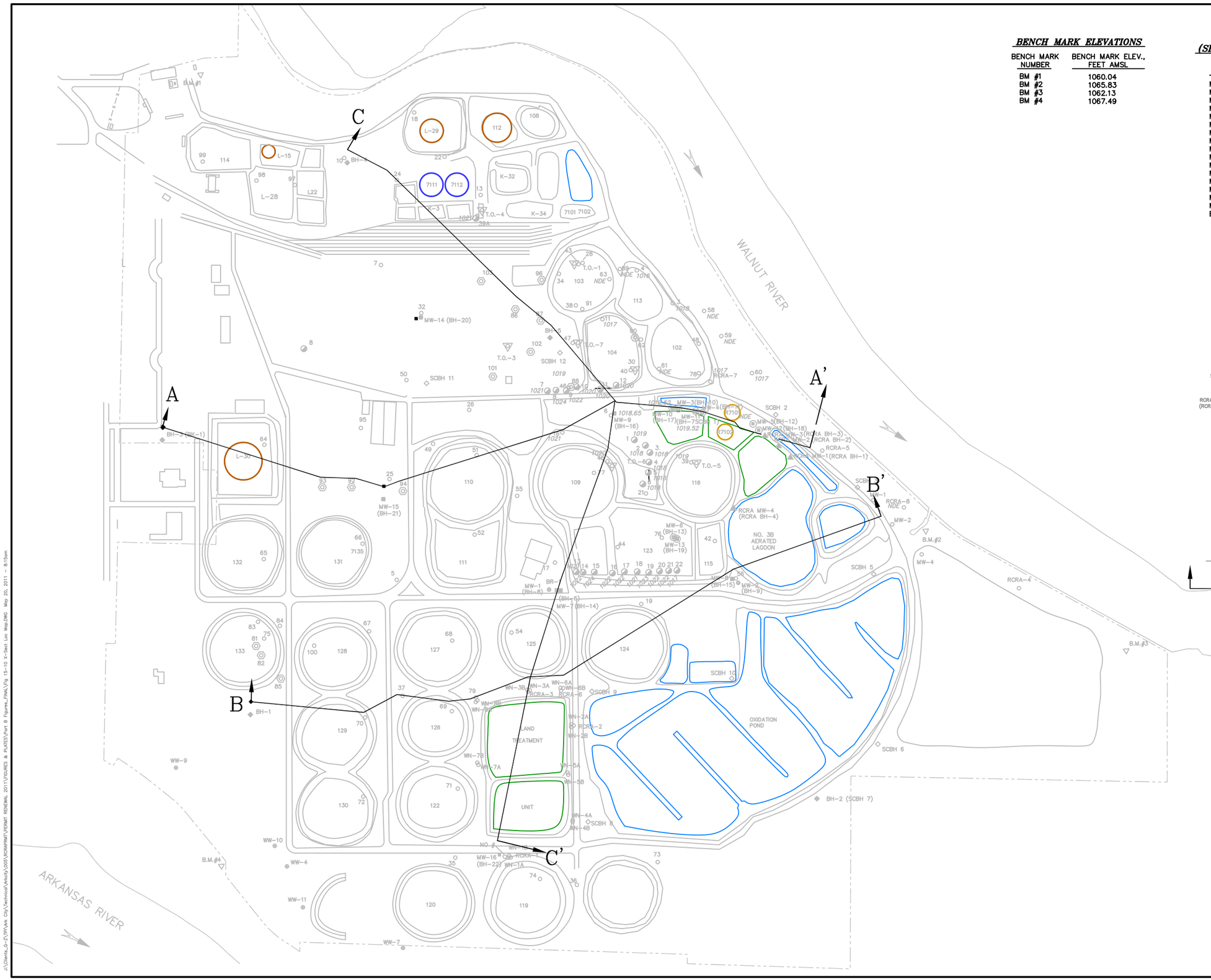
TITLE
GEOLOGICAL CROSS-SECTION C-C'

PROJECT
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

FIGURE
15-9

J:\Clients_G-Z\TP\Ark City\Technical\Activity\093\WORKPRNT\PERMIT RENEWAL 2011\FIGURES & PLATES\Part B Figures_FINAL\Fig 15-9 X-Sect C-C 13859140.DWG May 20, 2011 - 8:25am



BENCH MARK ELEVATIONS

BENCH MARK NUMBER	BENCH MARK ELEV., FEET AMSL
BM #1	1060.04
BM #2	1065.83
BM #3	1062.13
BM #4	1067.49

MONITOR WELL DATA (SHORT-TERM GROUNDWATER MONITORING INVESTIGATION)

WELL NUMBER	TOP CASING ELEV., FEET AMSL	GROUND ELEV., FEET AMSL
MW-1 (BH-8)	1064.58	1061.28
MW-2 (BH-9, SCBH-4)	1063.29	1060.03
MW-3 (BH-10)	1072.65	1068.47
MW-4 (BH-11)	1072.65	1068.64
MW-5 (BH-12)	1071.08	1067.40
MW-6 (BH-13)	1062.41	1060.34
MW-7 (BH-14)	1064.51	1061.41
MW-8 (BH-15)	1063.05	1060.16
MW-9 (BH-16)	1068.93	1065.15
MW-10 (BH-17)	1072.62	1068.82
MW-11 (BH-7, SCBH-1)	1071.93	1068.58
MW-12 (BH-18)	1070.83	1067.51
MW-13 (BH-19)	1063.02	1060.24
MW-14 (BH-20)	1064.35	1061.67
MW-15 (BH-21)	1063.38	1060.82
MW-16 (BH-22)	1068.10	1064.94
BR-1 (BH-6)	1064.76	1061.40

EXPLANATION

- MW-6 — STAINLESS STEEL RCRA SURFACE IMPOUNDMENT CLOSURE MONITORING WELL–SHALLOW ALLUVIAL AQUIFER
- MW-13 — STAINLESS STEEL RCRA SURFACE IMPOUNDMENT CLOSURE MONITORING WELL–DEEP ALLUVIAL AQUIFER
- MW-2 — PVC MONITORING WELL–SHALLOW ALLUVIAL AQUIFER
- MW-16 — PVC MONITORING WELL–DEEP ALLUVIAL AQUIFER
- BR-1 — PVC MONITORING WELL–BEDROCK
- BH-4 — SOIL BORING FOR LITHOLOGIC CHARACTERIZATION
- SCBH 6 — SOIL BORING DRILLED AS PART OF RFI SOIL CHARACTERIZATION
- 89 — EXISTING MONITORING WELL (INSTALLED BY OTHERS)
- RCRA MW-1 (RCRA BH-1) — NUMBER 3A AERATED LAGOON RCRA MONITORING WELL
- 85 — RECOVERY WELL (ONE PUMP)
- T.O.-3 — RECOVERY WELL (TWO PUMP)
- APPROXIMATE LOCATION OF ABANDONED BOREHOLE/WELL
- WW-11 — WATER SUPPLY WELL
- BM#4 — BENCH MARK SURVEYED AND REFERENCED TO AN OFF-SITE BENCH MARK
- 112 — ABOVE-GROUND PRODUCT STORAGE TANK
- 7710 — BIOREACTOR TANK – GROUNDWATER TREATMENT
- 7112 — WATER STORAGE TANK
- SITE PROPERTY BOUNDARY
- GEOLOGICAL CROSS-SECTION LINE

NOTE: THIS PLAN IS NOT A PLAT OF SURVEY.

NOTE: PREPARED BASED ON DATA FROM RSA, EEI, AND WOODWARD CLYDE INVESTIGATIONS.

SOURCE: ROBERTS/SCHORNICK & ASSOCIATES, INC. 1992

N W E S

SCALE IN FEET

0 400 800

TITLE

FACILITY LAYOUT AND GEOLOGIC CROSS-SECTION LINES

PROJECT

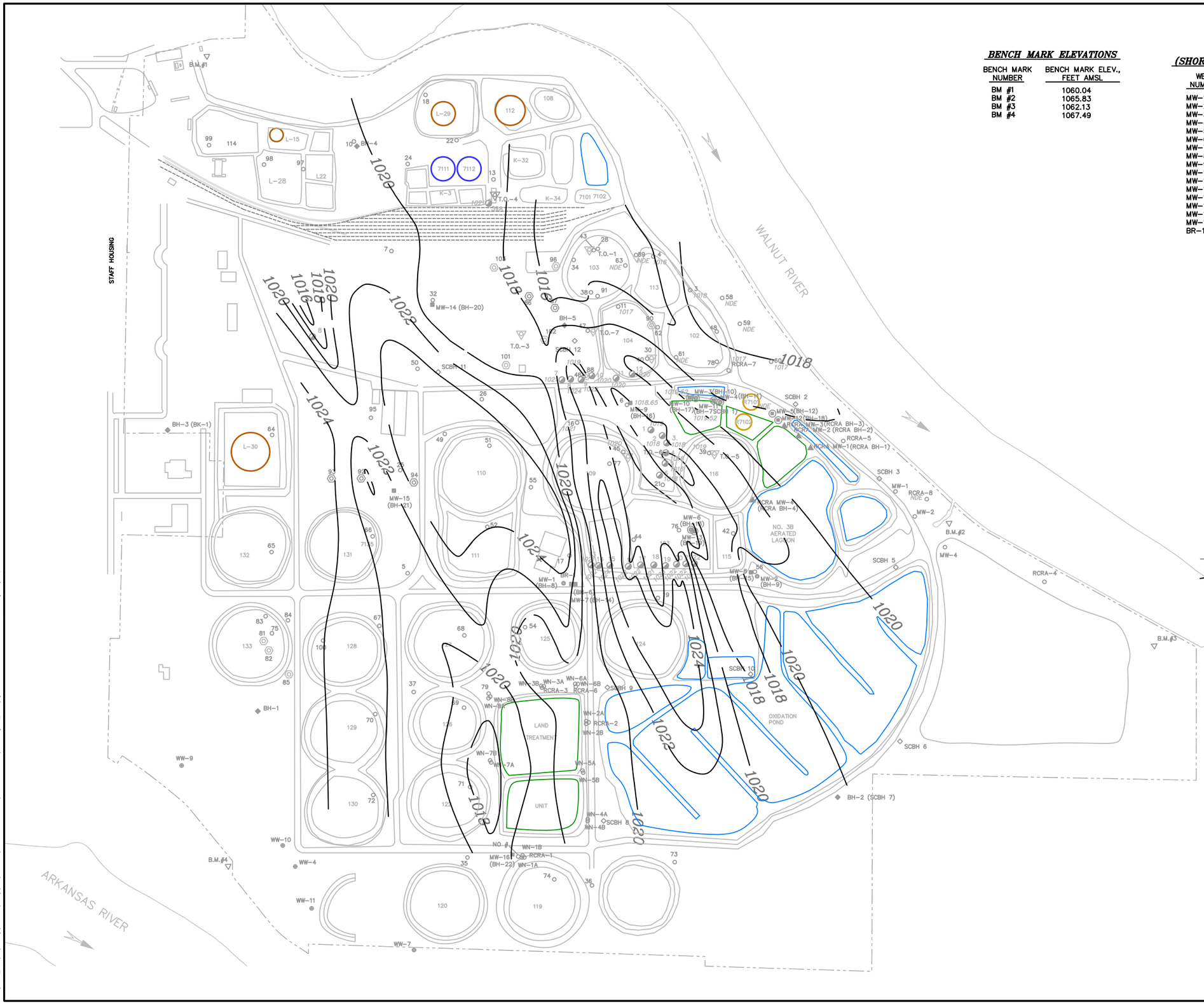
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

FIGURE

15-10

A:\Clients_G-Z\TPI\Ark City\Technical\Arkcity\005\RCRAPRMT\PERMIT RENEWAL 2011\FIGURES & PLATES\Part B Figures_FINAL\Fig 15-10 X-Sect Loc Map.DWG May 20, 2011 - 8:15am



BENCH MARK ELEVATIONS

BENCH MARK NUMBER	BENCH MARK ELEV., FEET AMSL
BM #1	1060.04
BM #2	1065.83
BM #3	1062.13
BM #4	1067.49

MONITOR WELL DATA (SHORT-TERM GROUNDWATER MONITORING INVESTIGATION)

WELL NUMBER	TOP CASING ELEV., FEET AMSL	GROUND ELEV., FEET AMSL
MW-1 (BH-8)	1064.58	1061.28
MW-2 (BH-9, SCBH-4)	1063.29	1060.03
MW-3 (BH-10)	1072.65	1068.47
MW-4 (BH-11)	1072.65	1068.64
MW-5 (BH-12)	1071.08	1067.40
MW-6 (BH-13)	1062.41	1060.34
MW-7 (BH-14)	1064.51	1061.41
MW-8 (BH-15)	1063.05	1060.16
MW-9 (BH-16)	1068.93	1065.15
MW-10 (BH-17)	1072.62	1068.82
MW-11 (BH-7, SCBH-1)	1071.93	1068.58
MW-12 (BH-18)	1070.83	1067.51
MW-13 (BH-19)	1063.02	1060.24
MW-14 (BH-20)	1064.35	1061.67
MW-15 (BH-21)	1063.38	1060.82
MW-16 (BH-22)	1068.10	1064.94
BR-1 (BH-6)	1064.76	1061.40

EXPLANATION

- MW-6 — STAINLESS STEEL RCRA SURFACE IMPOUNDMENT CLOSURE MONITORING WELL-SHALLOW ALLUVIAL AQUIFER
- MW-13 — STAINLESS STEEL RCRA SURFACE IMPOUNDMENT CLOSURE MONITORING WELL-DEEP ALLUVIAL AQUIFER
- MW-2 — PVC MONITORING WELL-SHALLOW ALLUVIAL AQUIFER
- MW-16 — PVC MONITORING WELL-DEEP ALLUVIAL AQUIFER
- BR-1 — PVC MONITORING WELL-BEDROCK
- BH-4 — SOIL BORING FOR LITHOLOGIC CHARACTERIZATION
- SCBH 6 — SOIL BORING DRILLED AS PART OF RFI SOIL CHARACTERIZATION
- 89 — EXISTING MONITORING WELL (INSTALLED BY OTHERS)
- RCRA MW-1 (RCRA BH-1) — NUMBER 3A AERATED LAGOON RCRA MONITORING WELL
- 85 — RECOVERY WELL (ONE PUMP)
- T.O.-2 — RECOVERY WELL (TWO PUMP)
- 2 — APPROXIMATE LOCATION OF ABANDONED BOREHOLE/WELL
- WW-11 — WATER SUPPLY WELL
- BM#4 — BENCH MARK SURVEYED AND REFERENCED TO AN OFF-SITE BENCH MARK
- 112 — ABOVE-GROUND PRODUCT STORAGE TANK
- 7101 — BIOREACTOR TANK – GROUNDWATER TREATMENT
- 7112 — WATER STORAGE TANK
- SITE PROPERTY BOUNDARY
- 1022 — STRUCTURE CONTOUR, BEDROCK SURFACE, FEET AMSL
- CONTOUR INTERVAL = 2 FEET
- 1022.40 — BEDROCK SURFACE ELEVATION, FEET AMSL
- NDE — NOT DEEP ENOUGH

NOTE: THIS PLAN IS NOT A PLAT OF SURVEY.

NOTE: PREPARED BASED ON DATA FROM RSA, EEI, AND WOODWARD CLYDE INVESTIGATIONS.

SOURCE: ROBERTS/SCHORNICK & ASSOCIATES, INC. 1992

N W E S

SCALE IN FEET

0 400 800

TITLE

STRUCTURE CONTOUR MAP OF BEDROCK SURFACE, FEET AMSL

PROJECT

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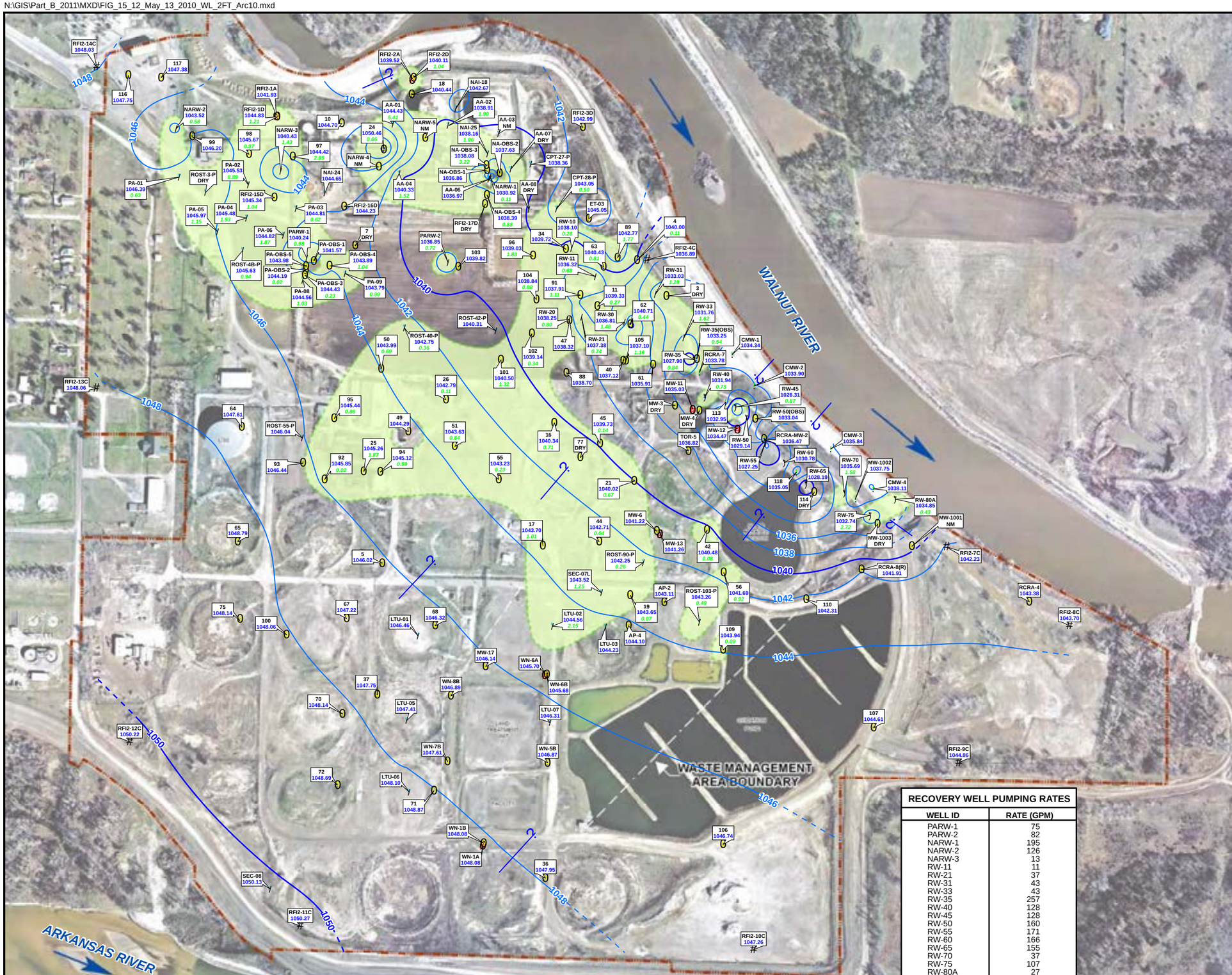
FIGURE

15-11

J:\Clients_Q-Z\TPI\Ark City\Technical\Arkcity\005\RCRAPRMT\PERMIT RENEWAL 2011\FIGURES & PLATES\Part B Figures_FINAL\Fig 15-11 BDRK Struct Contour 138c014x.dwg May 20, 2011 - 8:16am

N:\GIS\Part_B_2011\MXD\FIG_15_12_May_13_2010_WL_2FT_Arc10.mxd



RECOVERY WELL PUMPING RATES	
WELL ID	RATE (GPM)
PARW-1	75
PARW-2	82
NARW-1	195
NARW-2	126
NARW-3	13
RW-11	11
RW-21	37
RW-31	43
RW-33	43
RW-35	257
RW-40	128
RW-45	128
RW-50	160
RW-55	171
RW-60	166
RW-65	155
RW-70	37
RW-75	107
RW-80A	27

EXPLANATION

- CORRECTIVE ACTION GROUNDWATER RECOVERY WELL
- GROUNDWATER & LNAPL RECOVERY WELL
- SHALLOW ALLUVIAL MONITORING WELL
- DEEP ALLUVIAL MONITORING WELL
- # MONITORING WELL SCREENED BELOW THE WATER TABLE
- SHALLOW ALLUVIAL 1-INCH MONITORING WELL
- ! CAPTURE ZONE MONITORING WELL
- 1045.72 GROUNDWATER ELEVATION CORRECTED FOR PRODUCT THICKNESS. FEET ABOVE MEAN SEA LEVEL
- *1.82* PRODUCT THICKNESS (IN FEET - NO VALUE INDICATES PRODUCT WAS NOT DETECTED)
- *Tr* INDICATES TRACE OF PRODUCT
- NM NOT MEASURED
- DRY MONITORING WELL DRY
- DIRECTION OF SURFACE WATER FLOW
- 1042 CORRECTED WATER LEVEL ELEVATION CONTOUR DASHED WHERE INFERRED (FEET ABOVE MEAN SEA LEVEL, 2 FOOT CONTOUR INTERVAL)
- 1040 CORRECTED WATER LEVEL ELEVATION CONTOUR DASHED WHERE INFERRED (FEET ABOVE MEAN SEA LEVEL, 10 FOOT CONTOUR INTERVAL)
- DIRECTION OF GROUNDWATER FLOW
- FACILITY PROPERTY BOUNDARY
- LINE SURROUNDS ALL LOCATIONS WHERE MEASURABLE THICKNESS OF PHASE-SEPARATED HYDROCARBONS WAS OBSERVED - DASHED WHERE INFERRED

SCALE IN FEET

0 400 800

AERIAL PHOTO: MARCH 12, 2005

DATE	DESIGN BY	DRAWN BY	REVIEWED BY
6/6/2011	RPH	RPH	JFM

TITLE:

GROUNDWATER POTENTIOMETRIC SURFACE CONTOUR MAP AND EXTENT OF PHASE-SEPARATED HYDROCARBONS (MAY 13, 2010)

PROJECT:

MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:

15-12

N:\GIS\Part_B_2011\MXD\PartB_2011_FIG_15_13_Corrective_Action.mxd

EXPLANATION

WN-6B — SHALLOW ALLUVIAL MONITORING WELL

WN-6A — DEEP ALLUVIAL MONITORING WELL

CMW-3 — CAPTURE ZONE MONITORING WELL

DIRECTION OF SURFACE WATER FLOW

SITE PROPERTY BOUNDARY

LTU CORRECTIVE ACTION SOIL VAPOR EXTRACTION / GROUNDWATER AIR SPARGE SYSTEM

SCALE IN FEET

0 400 800

AERIAL PHOTO: MARCH 12, 2005

DATE	DESIGN BY	DRAWN BY	REVIEWED BY
6/6/2011	RPH	RPH	JFM

TITLE:

CORRECTIVE ACTION GROUNDWATER MONITORING PROGRAM

PROJECT:

MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:

15-13

N:\GIS\Part_B_2011\MXD\FIG_15_14_SiteMonitorWells.mxd Date: 5/19/2011

EXPLANATION

SITE PROPERTY BOUNDARY

MONITORING AND RECOVERY WELLS

- CORRECTIVE ACTION GROUNDWATER RECOVERY WELL
- GROUNDWATER & LNAPL RECOVERY WELL
- SHALLOW ALLUVIAL MONITORING WELL
- DEEP ALLUVIAL MONITORING WELL
- MONITORING WELL SCREENED BELOW THE WATER TABLE
- SHALLOW ALLUVIAL 1-INCH MONITORING WELL
- CAPTURE ZONE MONITORING WELL

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SCALE IN FEET

0 400 800

AERIAL PHOTO:
MARCH 12, 2005

REVISION	DATE	DESIGN BY	DRAWN BY	REVIEWED BY
Revision 1	5/19/2011	JFM	RPH	JFM

TITLE:

GROUNDWATER MONITORING AND RECOVERY WELL LOCATIONS

PROJECT:

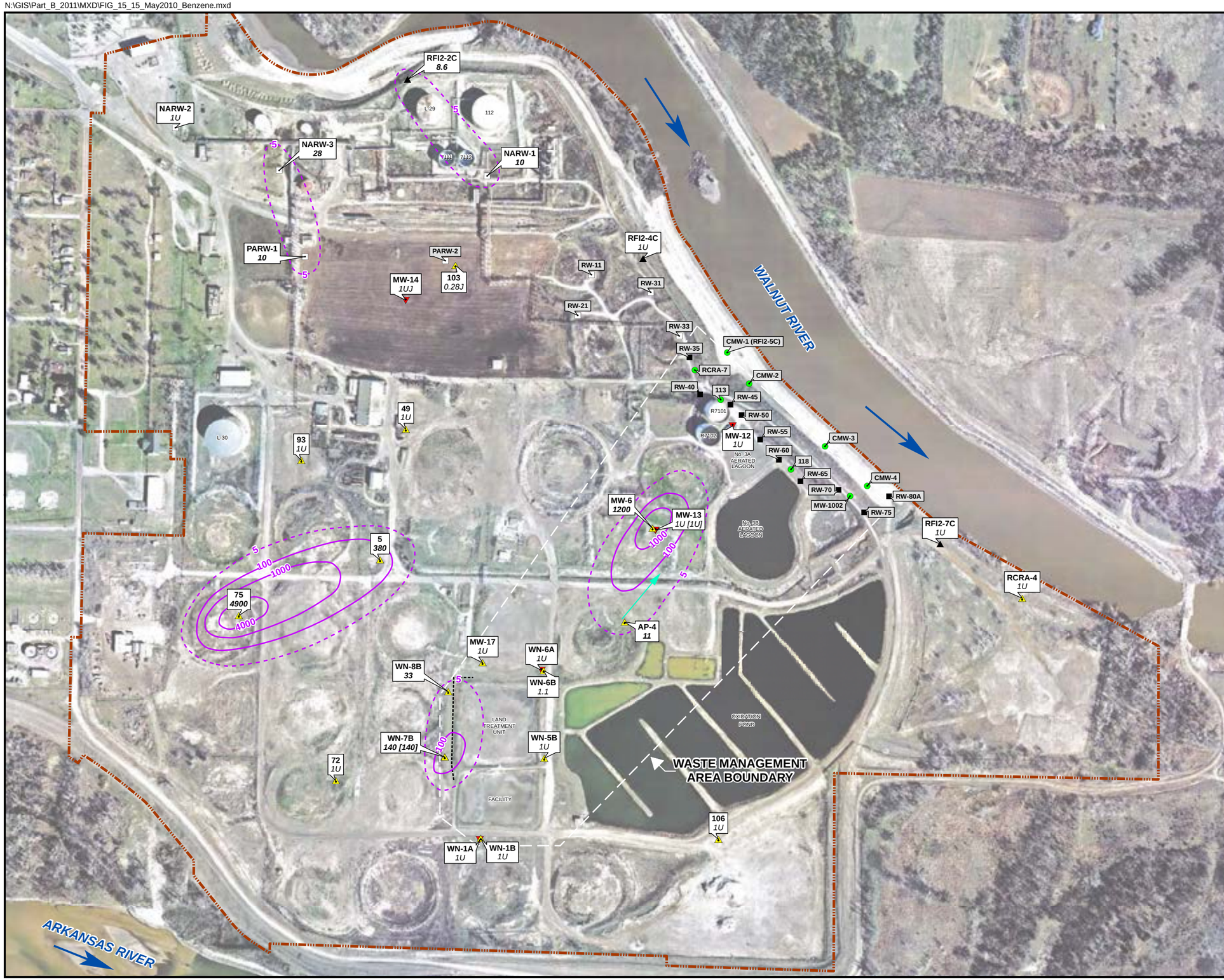
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:

15-14

N:\GIS\Part_B_2011\MXD\FIG_15_15_May2010_Benzene.mxd



EXPLANATION

- CORRECTIVE ACTION GROUNDWATER RECOVERY WELL
- GROUNDWATER & LNAPL RECOVERY WELL
- SHALLOW ALLUVIAL MONITORING WELL
- DEEP ALLUVIAL MONITORING WELL
- MONITORING WELL SCREENED BELOW THE WATER TABLE
- CAPTURE ZONE MONITORING WELL
- DIRECTION OF SURFACE WATER FLOW
- *5.0* BENZENE CONCENTRATION IN ug/L
- *J* INDICATES ESTIMATED CONCENTRATION
- *1U* INDICATES NOT DETECTED AT REPORTING LIMIT SHOWN
- 5 BENZENE ISOPLETH CONTOUR (DASHED WHERE INFERRED)
- DIRECTION OF GROUNDWATER FLOW
- SITE PROPERTY BOUNDARY

NOTE:
CONCENTRATION UNITS IN MICROGRAMS PER LITER (ug/L).

ONLY SHALLOW WELL GROUNDWATER CONCENTRATIONS CONTOURED.

DUPLICATE RESULTS ARE SHOWN IN BRACKETS [ ].

A RESULT IN **BOLDFACE** TYPE INDICATES AN EXCEEDANCE OF THE BENZENE NON-RESIDENTIAL GROUNDWATER STANDARD OF 5 ug/L.

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SCALE IN FEET
0 400 800

AERIAL PHOTO: MARCH 12, 2005

DATE	DESIGN BY	DRAWN BY	REVIEWED BY
5/19/2011	RPH	RPH	JFM

TITLE:

BENZENE CONCENTRATION MAP - UPPER ZONE OF ALLUVIAL AQUIFER MAY 17-24, 2010

PROJECT:
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:
15-15

N:\GIS\Part_B_2011\MXD\FIG_15_16_May2010_Toluene.mxd

EXPLANATION

- CORRECTIVE ACTION GROUNDWATER RECOVERY WELL
- GROUNDWATER & LNAPL RECOVERY WELL
- SHALLOW ALLUVIAL MONITORING WELL
- DEEP ALLUVIAL MONITORING WELL
- MONITORING WELL SCREENED BELOW THE WATER TABLE
- CAPTURE ZONE MONITORING WELL
- DIRECTION OF SURFACE WATER FLOW
- ***5.0*** TOLUENE CONCENTRATION IN ug/L
- ***J*** INDICATES ESTIMATED CONCENTRATION
- ***1U*** INDICATES NOT DETECTED AT REPORTING LIMIT SHOWN
- DIRECTION OF GROUNDWATER FLOW
- SITE PROPERTY BOUNDARY

NOTE:
CONCENTRATION UNITS IN MICROGRAMS PER LITER (ug/L).

DUPLICATE RESULTS ARE SHOWN IN BRACKETS [ ].

A RESULT IN **BOLDFACE** TYPE INDICATES AN EXCEEDANCE OF THE TOLUENE NON-RESIDENTIAL GROUNDWATER STANDARD OF 1,000 ug/L.

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SCALE IN FEET

0 400 800

AERIAL PHOTO: MARCH 12, 2005

DATE	DESIGN BY	DRAWN BY	REVIEWED BY
5/19/2011	RPH	RPH	JFM

TITLE:

TOLUENE CONCENTRATION MAP - UPPER ZONE OF ALLUVIAL AQUIFER MAY 17-24, 2010

PROJECT:

MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:

15-16

N:\GIS\Part_B_2011\MXD\FIG_15_17_May2010_Ethylbenzene.mxd

EXPLANATION

- CORRECTIVE ACTION GROUNDWATER RECOVERY WELL
- GROUNDWATER & LNAPL RECOVERY WELL
- SHALLOW ALLUVIAL MONITORING WELL
- DEEP ALLUVIAL MONITORING WELL
- MONITORING WELL SCREENED BELOW THE WATER TABLE
- CAPTURE ZONE MONITORING WELL
- DIRECTION OF SURFACE WATER FLOW
- ***5.0*** ETHYLBENZENE CONCENTRATION IN ug/L
- ***J*** INDICATES ESTIMATED CONCENTRATION
- ***1U*** INDICATES NOT DETECTED AT REPORTING LIMIT SHOWN
- DIRECTION OF GROUNDWATER FLOW
- SITE PROPERTY BOUNDARY

NOTE:
CONCENTRATION UNITS IN MICROGRAMS PER LITER (ug/L).

DUPLICATE RESULTS ARE SHOWN IN BRACKETS [ ].

A RESULT IN **BOLDFACE** TYPE INDICATES AN EXCEEDANCE OF THE ETHYLBENZENE NON-RESIDENTIAL GROUNDWATER STANDARD OF 700 ug/L.

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SCALE IN FEET

0 400 800

AERIAL PHOTO: MARCH 12, 2005

DATE	DESIGN BY	DRAWN BY	REVIEWED BY
5/19/2011	RPH	RPH	JFM

TITLE:

ETHYLBENZENE CONCENTRATION MAP - UPPER ZONE OF ALLUVIAL AQUIFER MAY 17-24, 2010

PROJECT:

MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:

15-17

N:\GIS\Part_B_2011\MXD\FIG_15_18_May2010_Xylene.mxd

EXPLANATION

- CORRECTIVE ACTION GROUNDWATER RECOVERY WELL
- GROUNDWATER & LNAPL RECOVERY WELL
- SHALLOW ALLUVIAL MONITORING WELL
- DEEP ALLUVIAL MONITORING WELL
- MONITORING WELL SCREENED BELOW THE WATER TABLE
- CAPTURE ZONE MONITORING WELL
- DIRECTION OF SURFACE WATER FLOW
- ***5.0*** TOTAL XYLENES CONCENTRATION IN ug/L
- ***J*** INDICATES ESTIMATED CONCENTRATION
- ***1U*** INDICATES NOT DETECTED AT REPORTING LIMIT SHOWN
- DIRECTION OF GROUNDWATER FLOW
- SITE PROPERTY BOUNDARY

NOTE:
CONCENTRATION UNITS IN MICROGRAMS PER LITER (ug/L).

DUPLICATE RESULTS ARE SHOWN IN BRACKETS [ ].

A RESULT IN **BOLDFACE** TYPE INDICATES AN EXCEEDANCE OF THE TOTAL XYLENES NON-RESIDENTIAL GROUNDWATER STANDARD OF 10,000 ug/L.

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SCALE IN FEET

0 400 800

AERIAL PHOTO: MARCH 12, 2005

DATE	DESIGN BY	DRAWN BY	REVIEWED BY
5/19/2011	RPH	RPH	JFM

TITLE:

TOTAL XYLENES CONCENTRATION MAP - UPPER ZONE OF ALLUVIAL AQUIFER MAY 17-24, 2010

PROJECT:

MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:

15-18

N:\GIS\Part_B_2011\MXD\FIG_15_19_May2010_GRO.mxd

EXPLANATION

- CORRECTIVE ACTION GROUNDWATER RECOVERY WELL
- GROUNDWATER & LNAPL RECOVERY WELL
- SHALLOW ALLUVIAL MONITORING WELL
- DEEP ALLUVIAL MONITORING WELL
- MONITORING WELL SCREENED BELOW THE WATER TABLE
- CAPTURE ZONE MONITORING WELL
- DIRECTION OF SURFACE WATER FLOW
- *5.0* TPH-GRO CONCENTRATION IN ug/L
- *J* INDICATES ESTIMATED CONCENTRATION
- *1U* INDICATES NOT DETECTED AT REPORTING LIMIT SHOWN
- 5 TPH-GRO ISOPLETH CONTOUR (DASHED WHERE INFERRED)
- DIRECTION OF GROUNDWATER FLOW
- SITE PROPERTY BOUNDARY

NOTE:
CONCENTRATION UNITS IN MICROGRAMS PER LITER (ug/L).

ONLY SHALLOW WELL GROUNDWATER CONCENTRATIONS CONTOURED.

DUPLICATE RESULTS ARE SHOWN IN BRACKETS [ ].

A RESULT IN **BOLDFACE** TYPE INDICATES AN EXCEEDANCE OF THE TPH-GRO NON-RESIDENTIAL GROUNDWATER STANDARD OF 500 ug/L.

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SCALE IN FEET

0 400 800

AERIAL PHOTO: MARCH 12, 2005

DATE	DESIGN BY	DRAWN BY	REVIEWED BY
5/19/2011	RPH	RPH	JFM

TITLE:

TPH-GRO CONCENTRATION MAP - UPPER ZONE OF ALLUVIAL AQUIFER MAY 17-24, 2010

PROJECT:

MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:

15-19

N:\GIS\Part_B_2011\MXD\FIG_15_20_May2010_DRO.mxd

EXPLANATION

- CORRECTIVE ACTION GROUNDWATER RECOVERY WELL
- GROUNDWATER & LNAPL RECOVERY WELL
- SHALLOW ALLUVIAL MONITORING WELL
- DEEP ALLUVIAL MONITORING WELL
- MONITORING WELL SCREENED BELOW THE WATER TABLE
- CAPTURE ZONE MONITORING WELL
- DIRECTION OF SURFACE WATER FLOW
- ***5.0*** TPH-DRO CONCENTRATION IN ug/L
- ***J*** INDICATES ESTIMATED CONCENTRATION
- ***1U*** INDICATES NOT DETECTED AT REPORTING LIMIT SHOWN
- 5 TPH-DRO ISOPLETH CONTOUR (DASHED WHERE INFERRED)
- DIRECTION OF GROUNDWATER FLOW
- SITE PROPERTY BOUNDARY

NOTE:
CONCENTRATION UNITS IN MICROGRAMS PER LITER (ug/L).

ONLY SHALLOW WELL GROUNDWATER CONCENTRATIONS CONTOURED.

DUPLICATE RESULTS ARE SHOWN IN BRACKETS [ ].

A RESULT IN **BOLDFACE** TYPE INDICATES AN EXCEEDANCE OF THE TPH-DRO NON-RESIDENTIAL GROUNDWATER STANDARD OF 720 ug/L.

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SCALE IN FEET

0 400 800

AERIAL PHOTO: MARCH 12, 2005

DATE	DESIGN BY	DRAWN BY	REVIEWED BY
5/19/2011	RPH	RPH	JFM

TITLE:

TPH-DRO CONCENTRATION MAP - UPPER ZONE OF ALLUVIAL AQUIFER MAY 17-24, 2010

PROJECT:

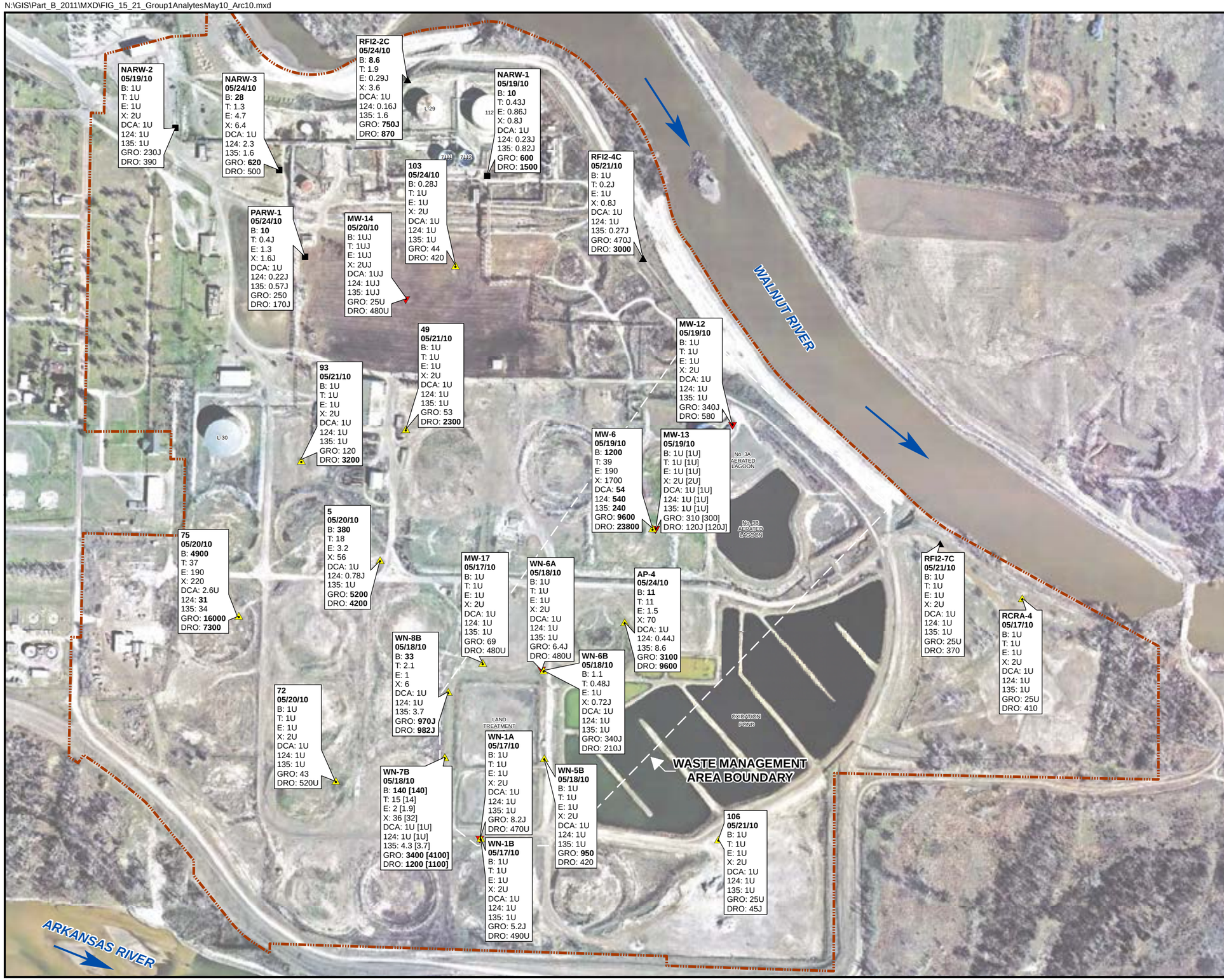
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:

15-20

N:\GIS\Part_B_2011\MXD\FIG_15_21_Group1AnalytesMay10_Arc10.mxd



EXPLANATION

- RECOVERY WELL
- SHALLOW ALLUVIAL MONITORING WELL
- DEEP ALLUVIAL MONITORING WELL
- MONITORING WELL SCREENED BELOW THE WATER TABLE
- DIRECTION OF SURFACE WATER FLOW
- SITE PROPERTY BOUNDARY

GROUNDWATER SAMPLING RESULTS:
LABORATORY RESULTS ARE SHOWN FOR THE FOLLOWING ANALYTES.

MAP CODE	ANALYTE	KANSAS TIER 2 RISK-BASED STANDARDS FOR GROUNDWATER (OCTOBER, 2010) NON-RES	UNITS
B	Benzene	5	µg/L
T	Toluene	1,000	µg/L
E	Ethylbenzene	700	µg/L
X	Xylenes (total)	10,000	µg/L
DCA	1,2-Dichloroethane	5	µg/L
124	1,2,4-Trimethylbenzene	17.4	µg/L
135	1,3,5-Trimethylbenzene	88.4	µg/L
GRO	TPH-GRO	500	µg/L
DRO	TPH-DRO (C10-C36)	720	µg/L

NOTES:
DUPLICATE RESULTS ARE SHOWN IN BRACKETS [ ] FOR APPLICABLE SAMPLE(S) AND ANALYTE(S).
A RESULT IN **BOLDFACE** TYPE INDICATES AN EXCEEDANCE OF THE RESPECTIVE ANALYTE'S NON-RESIDENTIAL GROUNDWATER STANDARD.
SEE REPORT DATA TABLES FOR DETAILED ANALYTICAL RESULTS AND COMPARISON TO THE APPLICABLE RISK-BASED STANDARDS.

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SCALE IN FEET
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AERIAL PHOTO: MARCH 12, 2005

DATE	DESIGN BY	DRAWN BY	REVIEWED BY
5/19/2011	RPH	RPH	JFM

TITLE:

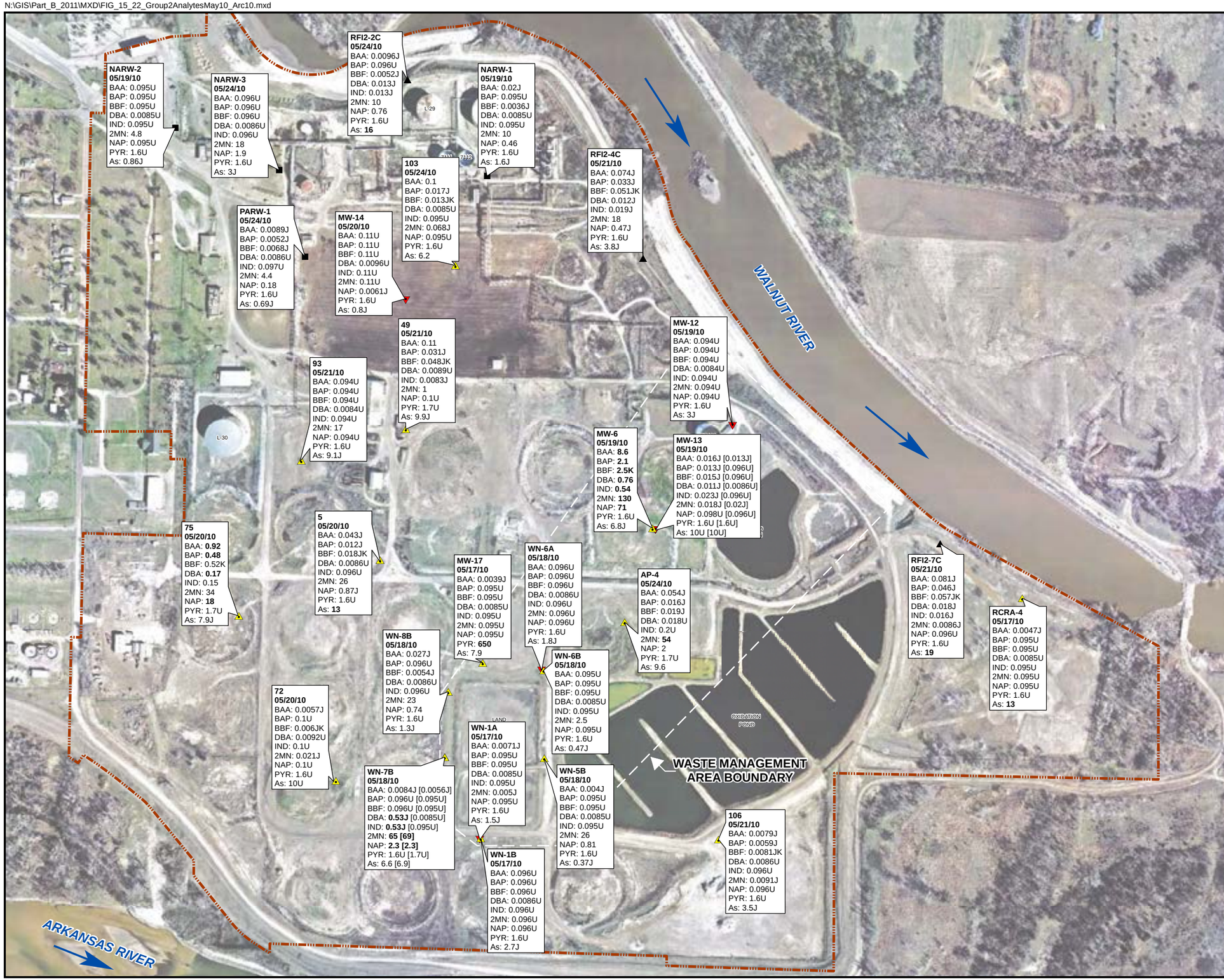
GROUNDWATER RESULTS GROUP 1 ANALYTES (MAY 17-24, 2010)

PROJECT:
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:
15-21

N:\GIS\Part_B_2011\MXD\FIG_15_22_Group2AnalytesMay10_Arc10.mxd



EXPLANATION

- RECOVERY WELL
- SHALLOW ALLUVIAL MONITORING WELL
- DEEP ALLUVIAL MONITORING WELL
- MONITORING WELL SCREENED BELOW THE WATER TABLE
- DIRECTION OF SURFACE WATER FLOW
- SITE PROPERTY BOUNDARY

GROUNDWATER SAMPLING RESULTS:
LABORATORY RESULTS ARE SHOWN FOR THE FOLLOWING ANALYTES.

MAP CODE	ANALYTE	KANSAS TIER 2 RISK-BASED STANDARDS FOR GROUNDWATER (OCTOBER, 2010) NON-RES	UNITS
BAA	Benzo(a)anthracene	0.75	µg/L
BAP	Benzo(a)pyrene	0.2	µg/L
BBF	Benzo(b)fluoranthene	0.537	µg/L
DBA	Dibenz(a,h)anthracene	0.027	µg/L
IND	Indeno(1,2,3-cd)pyrene	0.392	µg/L
2MN	2-Methylnaphthalene	34.6	µg/L
NAP	Naphthalene	2.11	µg/L
PYR	Pyridine	9.28	µg/L
As	Arsenic	10	µg/L

NOTES:
DUPLICATE RESULTS ARE SHOWN IN BRACKETS [ ] FOR APPLICABLE SAMPLE(S) AND ANALYTE(S).
A RESULT IN **BOLDFACE** TYPE INDICATES AN EXCEEDANCE OF THE RESPECTIVE ANALYTE'S NON-RESIDENTIAL GROUNDWATER STANDARD.
SEE REPORT DATA TABLES FOR DETAILED ANALYTICAL RESULTS AND COMPARISON TO THE APPLICABLE RISK-BASED STANDARDS.

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SCALE IN FEET
0 400 800

AERIAL PHOTO: MARCH 12, 2005

DATE	DESIGN BY	DRAWN BY	REVIEWED BY
5/19/2011	RPH	RPH	JFM

TITLE:

GROUNDWATER RESULTS GROUP 2 ANALYTES (MAY 17-24, 2010)

PROJECT:
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

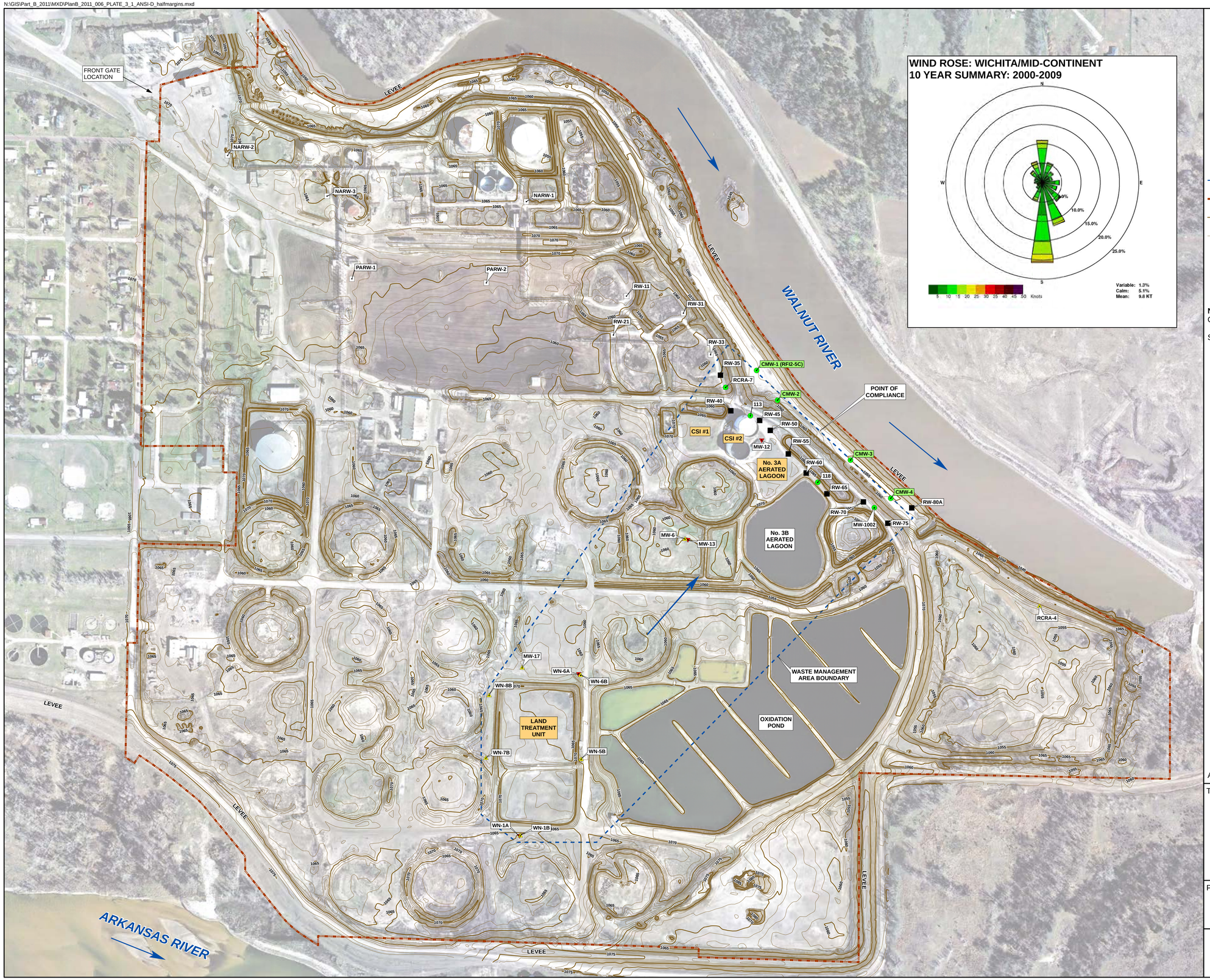
MWH

Figure No.:
15-22

REPORT

Plates

N:\GIS\Part_B_2011\MXD\PlanB_2011_006_PLATE_3_1_ANSI-D_halfmargins.mxd



EXPLANATION

- 113 — CAPTURE ZONE MONITORING WELL
- RW-11 — GROUNDWATER & LNAPL RECOVERY WELL
- WN-6A — DEEP ALLUVIAL MONITORING WELL
- RW-40 — CORRECTIVE ACTION GROUNDWATER RECOVERY WELL
- WN-6B — SHALLOW ALLUVIAL MONITORING WELL
- DIRECTION OF SURFACE WATER FLOW
- SITE PROPERTY BOUNDARY
- MAJOR CONTOURS- FIVE FT INTERVALS
- MINOR CONTOURS- ONE FT INTERVALS
- CSI #1 — HAZARD WASTE MANAGMENT UNIT
- CMW-3 — GROUNDWATER POINT-OF-COMPLIANCE MONITORING WELL

NOTES:
CSI = CLOSED SURFACE IMPOUNDMENT

SOURCE OF CONTOURS- INTERSEARCH, MARCH 2005

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SCALE IN FEET
0 200 400 600 800

AERIAL PHOTO: MARCH 12, 2005

DATE	DESIGN BY	DRAWN BY	REVIEWED BY
5/19/2011	RPH	GEE	JFM

TITLE:

TOPOGRAPHIC MAP (SCALE 1" = 200 FT)

PROJECT:
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

PLATE No.: **3-1**

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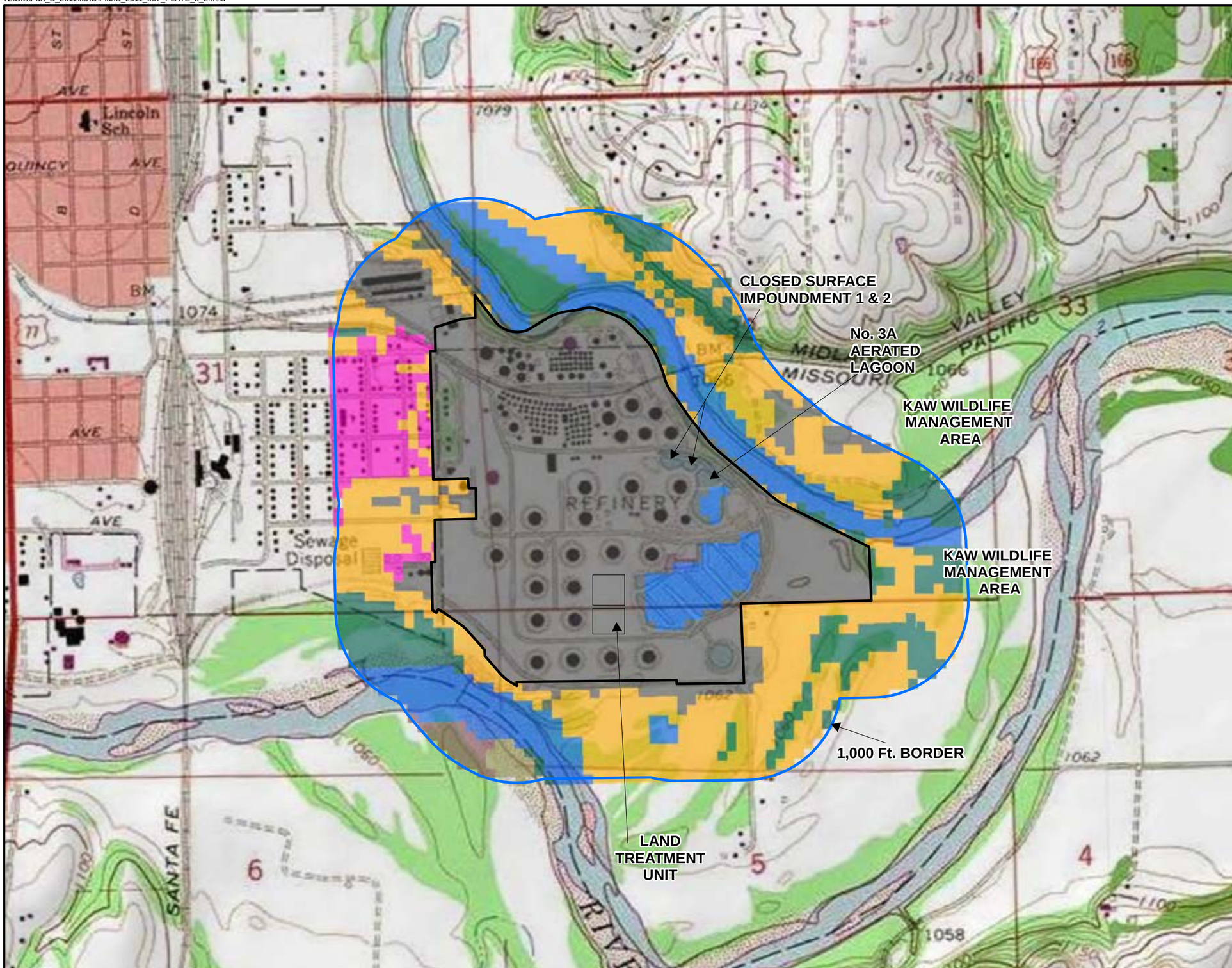

EXPLANATION

- SITE PROPERTY BOUNDARY
- 1,000 ft. BORDER

LEVEL IV LAND USE

- URBAN COMMERCIAL/INDUSTRIAL
- URBAN OPENLAND
- URBAN RESIDENTIAL
- URBAN URBAN WOODLAND
- URBAN WATER
- WATER
- WOODLAND
- OTHER

SOURCE:
TOPOGRAPHIC BACKGROUND- USGS 1997 CONTOUR INTERVAL 10 FEET

LEVEL IV LAND USE- 2005 KANSAS LAND COVER PATTERNS, LEVEL IV, STATE OF KANSAS, KANSAS APPLIED REMOTE SENSING (KARS) PROGRAM, 2009

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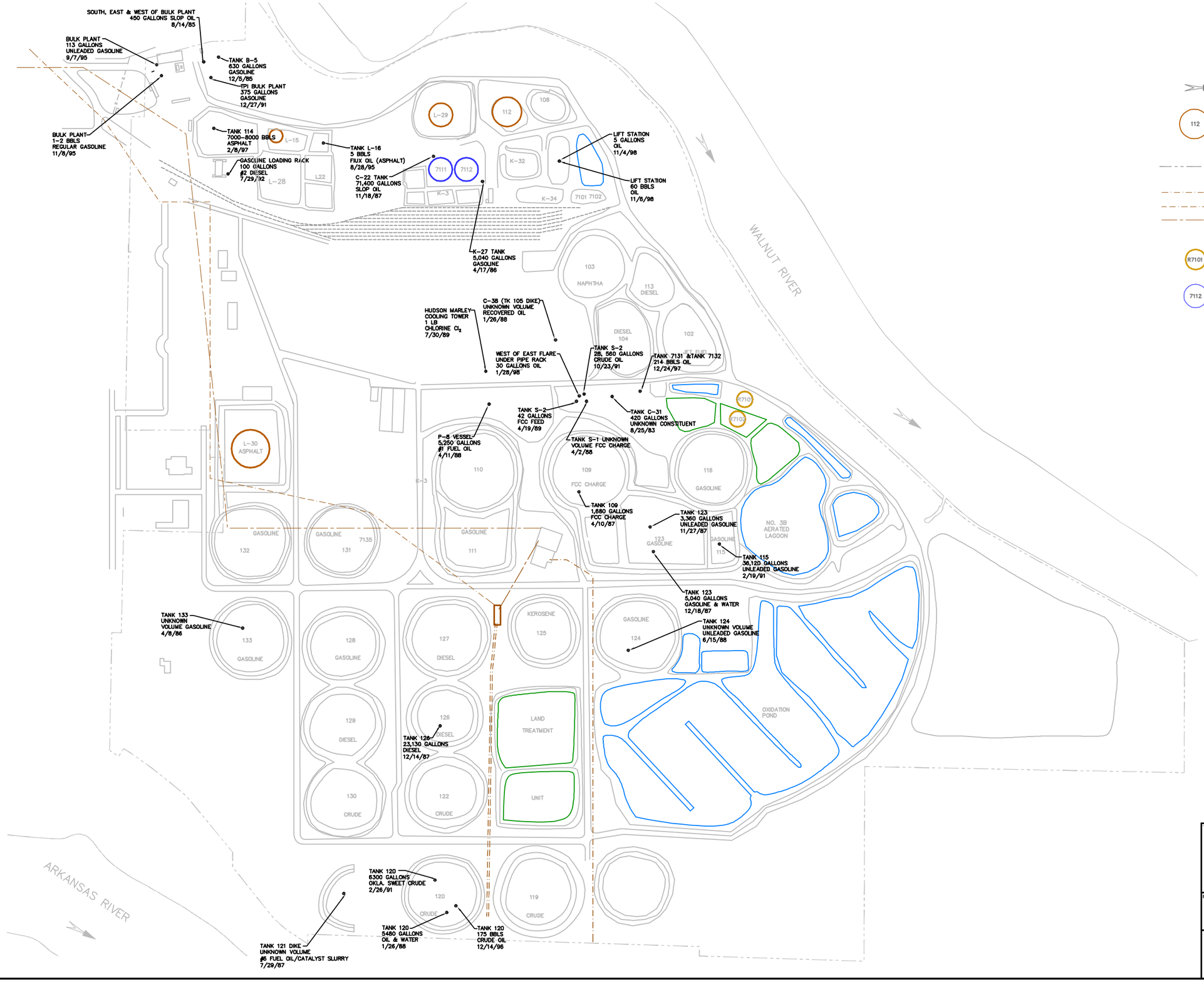
DATE	DESIGN BY	DRAWN BY	REVIEWED BY
7/16/2012	GEE	GEE	JFM

TITLE:
SURROUNDING TOPOGRAPHY AND LAND USE MAP (SCALE 1" = 1,000 FT) (40 CFR 270.14 (19) (iv))

PROJECT:
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

PLATE No.:
3-2



EXPLANATION

DIRECTION OF SURFACE WATER FLOW

112 — ABOVE GROUND PRODUCT STORAGE TANK

SITE PROPERTY BOUNDARY

Magellan (NOT IN SERVICE) 8" PIPELINE
ConocoPhillips 10" PIPELINE
NuStar 8" PIPELINE

R7101 — BIOREACTOR TANK - GROUNDWATER TREATMENT

7112 — WATER STORAGE TANK

NOTE:

PREPARED BASED ON DATA FROM RFI REPORT (RSA, 1992) AND REFINERY SPILL REPORTS.

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SCALE IN FEET

0 400 800

TITLE

HISTORIC RELEASES (1983 to 1998) AND PIPELINE LOCATIONS

PROJECT

MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

PLATE

15-1

U:\Francisco Andrade\Plate 15-1 Spill Location Map SJJSAGE.dwg Jun 06, 2011 - 3:14pm

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EXPLANATION

- SWMU-52 LOCATIONS
- SWMU LOCATIONS
- SITE PROPERTY BOUNDARY
- MAJOR CONTOURS- FIVE FT INTERVALS
- MINOR CONTOURS- ONE FT INTERVALS

NOTES:
SOURCE OF CONTOURS- INTERSEARCH, MARCH 2005

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SCALE IN FEET
0 200 400 600 800

AERIAL PHOTO: MARCH 12, 2005

DATE	DESIGN BY	DRAWN BY	REVIEWED BY
6/9/2011	RPH	GEE	JFM

TITLE:

SWMU LOCATION MAP
(SCALE 1" = 200 FT)

PROJECT:
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

PLATE No:
16-1

REPORT

Appendices

APPENDIX A

Notice to Close LTU, SI #1, #2, #3A; Certification KDHE Approval Letter

APPENDIX A

Notice of Intent to Close LTU
KDHE Approval of #1 and #2 Surface Impoundment Closure Plan
Certification of Closure for Surface Impoundments#1 & #2
Certification of Closure for #3 Aerated Lagoon
KDHE Closure Approval Letter and Deed Recordation for #3A Aerated Lagoon

FILE 47800

ULTRAMAR DIAMOND SHAMROCK
CORPORATION

Brenda B. Manterola
Senior Environmental Coordinator
Technical Services

November 6, 1997

CERTIFIED MAIL

Ms. Andrea L. Austin, MS
Environmental Scientist
Permits Section, Bureau of Waste Management
Kansas Department of Health and Environment
Forbes Field, Building 740
Topeka, Kansas 66620-0001

Re: **Notification of Intent to Close Land Treatment Unit**
Part B Permit Renewal Submittal: Extension Request
Total Petroleum Inc. - Arkansas City Refinery
EPA ID No.: KSD 087418695

Dear Ms. Austin,

Thank you for discussing our permit renewal process on the phone. The purpose of this letter is (1) to formally notify the Kansas Department of Health and Environment (KDHE) of Ultramar Diamond Shamrock's (UDS) intent to close the land treatment unit (LTU) at the refinery located in Arkansas City and (2) to request an extension for the response to KDHE comments on the Part B permit renewal application.

Ultramar Diamond Shamrock intends to close the LTU on July 31, 1998. As we discussed on the phone, the facility is no longer actively generating the non-hazardous wastes which were being placed in the LTU. It is anticipated that some additional non-hazardous wastes will be generated during the decommissioning of the facility and UDS plans to place appropriate wastes into the LTU in the spring and early summer. Since the LTU can only accept wastes from April to October, this process cannot start until next spring. No wastes will be accepted after July 31, 1998. We recognize that the closure plan needs to be updated for the LTU. UDS will submit a revised closure plan with the revised Part B permit renewal application for a post-closure permit.

Ultramar Diamond Shamrock is also requesting an extension to the submittal for the revised Part B permit renewal application. There are two components to the permit, a HSWA component for corrective action which is administered by U.S. EPA and a component for the active waste treatment, storage, and disposal units at the site which is administered by KDHE. This extension will allow UDS to coordinate review issues on the groundwater monitoring programs between the U.S. EPA and KDHE. In addition, this extension will allow UDS to receive additional comments on the current submittal from Ms. Andrea Austin, KDHE. This extension will allow a

P. O. Box 696000, San Antonio, Texas 78269-6000 (210) 592-4619, Fax: (210) 592-2304
6000 North Loop 1604 West, San Antonio, Texas 78249-1112

more complete submittal and expedite final approval of the permit. As we discussed on the phone, we are requesting an extension for 60 days beyond the date when we are able to coordinate a meeting between representatives from UDS, Earth Tech, KDHE, and U.S. EPA. We are committed to moving this project to completion and we will work with KDHE to schedule this meeting at your convenience during December, 1997.

To assure that UDS will be able to meet this deadline, UDS will initiate revision of the permit after receipt of your comments on the permit. I also understand that you will supply a recommended outline for a post-closure permit for the facility. Upon review of your comments and outline, UDS will formalize our outline for the permit renewal application for a post-closure permit and submit this outline to you for discussion. It is our understanding that the upcoming submittal will be a post-closure permit which includes the closure plan for the LTU, a contingent post-closure plan for the LTU, and a post-closure plan for the impoundments.

Thank you for your assistance. I look forward to working closely with you to assure that this project moves forward. If you have any questions, please call me at (210) 592-4619 or Jim Tolbert, Earth Tech, at (616) 940-4231.

Sincerely,

Brenda B. Manterola

cc: Mr. Mostafa Kamal, P.E., KDHE
Mr. James Tolbert, Earth Tech
Mr. Jay Mednick, EnecoTech

blue

State of Kansas . . . John Carlin, Governor

DEPARTMENT OF HEALTH AND ENVIRONMENT

Barbara J. Sabol, Secretary

Forbes Field
Topeka, Kansas 66620
913-862-9360

February 20, 1986

Mr. J.M. Hazen
Refinery Manager
Total Petroleum, Inc.
P.O. Box 857
Arkansas City, Kansas 67005

Dear Mr. Hazen:

Please be advised that the public comment period for the hazardous waste surface impoundment closure plan ended on February 19, 1986. Since no public comments were received approval is granted for you to proceed with implementation.

Please be advised that the schedule required in the plan must be followed. If any reason prevents implementation of the plan we are to be contacted immediately.

We would also request that before you begin to collect samples of the sediment sludge in the ponds that we be advised so that our representative may be present at the time of sampling.

Sincerely,

John Paul Goetz

John Paul Goetz, P.E., Chief
Hazardous Waste Section
Bureau of Waste Management

dl/B6
C Dale Stuckey
Karen Flournoy

TOTAL
Total Petroleum, Inc.

1400 SOUTH M STREET
ARKANSAS CITY, KANSAS 67005

TELEPHONE 316 442-5100

TWX 910 740-1641

MAILING ADDRESS:
P. O. BOX 957
ARKANSAS CITY, KANSAS 67005

July 25, 1988

RECEIVED
BUREAU OF
JUL 28 1988
WASTE
MANAGEMENT

Mr. J. P. Goetz
Kansas Department of Health & Environment
Bureau of Waste Management
Hazardous Waste Section
Forbes Field
Topeka, KS 66620

Dear Mr. Goetz,

The closure of the Hazardous Waste Surface Impoundments in accordance with the approved closure plan was completed on June 6, 1988. The #1 Hazardous Waste Surface Impoundment was closed as per the Contingency Closure Plan. The #2 Hazardous Waste Surface Impoundment was closed as per the Closure Plan. All soil analysis data, laboratory data and other specifications are kept on file at the Arkansas City Refinery.

Enclosed is a certification of closure from Total Petroleum, Inc. and also a certification from Mr. James Spicer of Wilson & Company, Salina, KS (independent registered professional engineer).

Enclosed also is a notice to the local zoning commission (Cowley County Commission) containing a survey plat and the type and amount of hazardous waste remaining in the #1 Surface Impoundment.

If you have any quest[illegible] do not hesitate to call.

Thank you.

Certification of Closure SE 172

Sincerely,

AL PETROLEUM, INC.

P. A. Morgan

P. A. Morgan

Environmental Specialist

cc: JMH-PAL-JWH

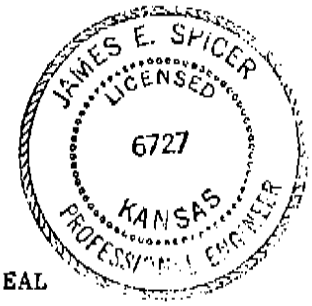
CLOSURE CERTIFICATION

1. TOTAL PETROLEUM, INC.
2. WILSON & COMPANY

CLOSURE CERTIFICATION

I certify, under penalty of law, that I have personally examined and am familiar with the engineering information presented in the Closure Plan, and that, based on the inquiry of those individuals immediately responsible for obtaining the information, I believe the engineering information to be true, accurate and complete to the best of my knowledge. Furthermore, I am satisfied, by personal inspection, that the closure of the Hazardous Waste Surface Impoundments at Total Petroleum, Inc., Arkansas City, Kansas, has been performed in accordance with the approved Plan.

In addition, it must be noted that the smaller, eastern surface impoundment was closed per Section 265.228(a) and (b), while the larger, western surface impoundment was closed per Section 265.228(c) in accordance with the Contingent Closure Plan.



SEAL

WILSON & COMPANY

James E. Spicer

James E. Spicer, P.E.
Chemical Engineer

Date: 6-28-88

WASTE DESCRIPTION
40 CFR, PART 264, SUBPART G, 264.117
HAZARDOUS WASTE REGULATIONS
ENVIRONMENTAL PROTECTION AGENCY

The undersigned, Total Petroleum, Inc., as owner and operator of its Arkansas City Refinery, does hereby notify all persons who may hereafter be concerned with the title to the lands described by the "Notice," "Survey Plat," and "Description" that the area thus described contains 18,000 cubic feet of listed Hazardous Waste defined by 40 CFR 261.32 as K051 - API Separator Sludge from the Petroleum Refining Industry and K049 - Slop Oil Emulsions Solids from the Petroleum Refining Industry. The waste was stabilized in place before backfilling and capping.

See attached "Notice by Total Petroleum, Inc.," attached "Plat of Survey," and attached "Description."

DATED the 22 day of July, 1988

TOTAL PETROLEUM, INC.

By: J M Magaw

Title: Refinery Manager

JOE B. AVERY
State of Kansas
My Appt. Exp. 4-27-92

NOTICE BY TOTAL PETROLEUM, INC.
40 CFR, PART 264, SUBPART G, § 264.117
HAZARDOUS WASTE REGULATIONS
ENVIRONMENTAL PROTECTION AGENCY

The Undersigned, Total Petroleum, Inc., as owner and operator of its Arkansas City Refinery, does hereby notify all persons who may hereafter be concerned with the title to the lands hereafter described, on which its said facility is located, that (1) the land (as herein described) has been used to manage hazardous wastes, (2) its use is restricted under 40 CFR Subpart G, and, (3) the survey plat and record of the type, location, and quantity of the hazardous wastes disposed of within each cell or other hazardous waste disposal unit of the facility required by §§ 264.116 and 264.119 (a) have been filed with the local zoning authority or the authority with jurisdiction over local land use and with the Kansas Department of Health and Environment.

Said land is situated in Cowley County, Kansas and is described as follows:

See attached "Plat of Survey" and attached Description.

DATED the 22 day of July, 1988.

TOTAL PETROLEUM, INC.

By: J. M. Byrne

Title: Refinery Manager

JOE B. AVERY
State of Kansas
My Appt. Exp. 4-27-92

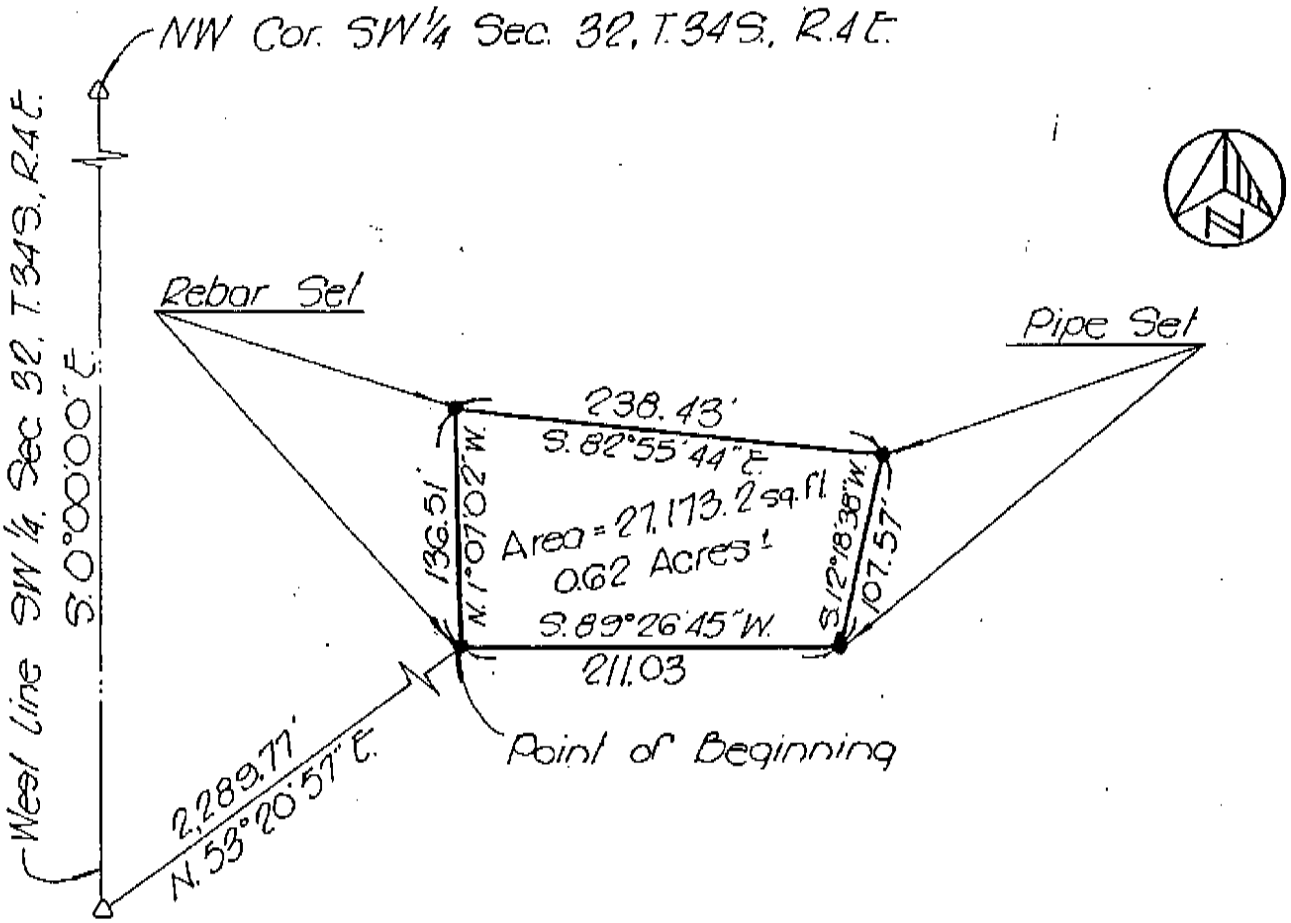
GARRY E. SMITH
CONSULTING ENGINEERS
107 N. SUMMIT – P.O. BOX 696 – ARKANSAS CITY, KS 67005

PLAT OF SURVEY

CLIENT: Total Petroleum ADDRESS: 1400 S. M St. Arkansas City, KS 67005

TYPE OF SURVEY: Boundary

DESCRIPTION: (See Attached)



I hereby certify that the above is an accurate Plat of the Survey completed by me on the 6th day of July, 19 88.

REGISTERED LS-953 Kansas LAND SURVEYOR

Ko - 953

Project No: 4005-075

GARRY E. SMITH

CONSULTING ENGINEERS

316-442-4756
P.O. Box 696
Arkansas City, Kansas 67005

July 7, 1988

DESCRIPTION

A tract of land situated in the Southwest Quarter of Section 32, Township 34 South, Range 4 East of the 6th Principal Meridian, Cowley County, Kansas, being more particularly described as follows:

Commencing at the Southwest corner of Section 32, Township 34 South, Range 4 East of the 6th Principal Meridian, Cowley County, Kansas (with the West Line of said Southwest Quarter on an assumed bearing of South 0 degrees, 00 minutes, 00 seconds East); thence North 53 degrees, 20 minutes, 57 seconds East, a distance of 2,289.77 feet to the Point of Beginning of the herein described tract of land; thence North 1 degree, 7 minutes, 2 seconds West, a distance of 136.51 feet to a point; thence South 82 degrees, 55 minutes, 44 seconds East, a distance of 238.43 feet to a point; thence South 12 degrees, 18 minutes, 38 seconds West, a distance of 107.57 feet to a point; thence South 89 degrees, 26 minutes, 45 seconds West, a distance of 211.03 feet to the Point of Beginning, containing 27,173.18 sq. ft. or 0.62 acre, more or less.

VIII. NOTICE IN DEED TO PROPERTY (265.120)

The following notice was filed and recorded along with the Plat of Survey in the appropriate registered book of plats with the local land authority (Registrar of Deeds). This notice should satisfy the requirements of 40 CFR 265.120. PLEASE NOTE: Only Exhibits C and D referred to in the NOTICE are enclosed since they apply to the Surface Impoundments. Exhibits A and B are not enclosed because they apply to other facilities not covered by this plan.

NOTICE BY TOTAL PETROLEUM, INC.
40 CFR, PART 264, SUBPART G, §264.120
HAZARDOUS WASTE REGULATIONS
ENVIRONMENTAL PROTECTION AGENCY
F.R., May 19, 1980, page 33243

The undersigned, Total Petroleum, Inc., as owner and operator of its Arkansas City Refinery, does hereby notify all persons who may hereafter be concerned with the title to the lands hereafter described, on which its said facility is located, that (1) said land has been used to manage hazardous waste, and (2) its use thereof is restricted under §265.117(c) and (3) upon closure, a survey plat and record of the type, location, and quantity of hazardous waste disposed of within said facility will be filed with the local zoning authority and the Secretary of the Kansas Department of Health and Environment in accordance with §264.119.

Said land is situated in Cowley County, Kansas, and is described as follows:

See exhibits A, B, C, D, [redacted], [redacted], [redacted] and [redacted] attached hereto and by this reference incorporated herein.

DATED the 23 day of MAY, 1985.

TOTAL PETROLEUM, INC.

By: J M Hazen

Title: REFINERY MANAGER.

STATE OF KANSAS }
COUNTY OF COWLEY } ss:

NOTARY PUBLIC STATEMENT

The foregoing acknowledged this 23rd day of May, 1985 before me, a Notary Public within and for said county and state, by J. M. Hazen, Refinery Manager for Total Petroleum, Inc.

JOE B. AVERY
State of Kansas
My Appt. Exp. 4-27-88

Joe B. Avery, Notary Public

STATE OF KANSAS }
COWLEY COUNTY } SS. 2358
Filed for record on May 24, 1985
at 8:38 o'clock A M., recorded in
Book 103 of Deed Page 461
Eldena Glasgow
Reg. of Deeds
By Kristin Moore
Deputy

GARRY E. SMITH
CONSULTING ENGINEER
316-442-1756
P. O. Box 148
Arkansas City, Kansas 67005

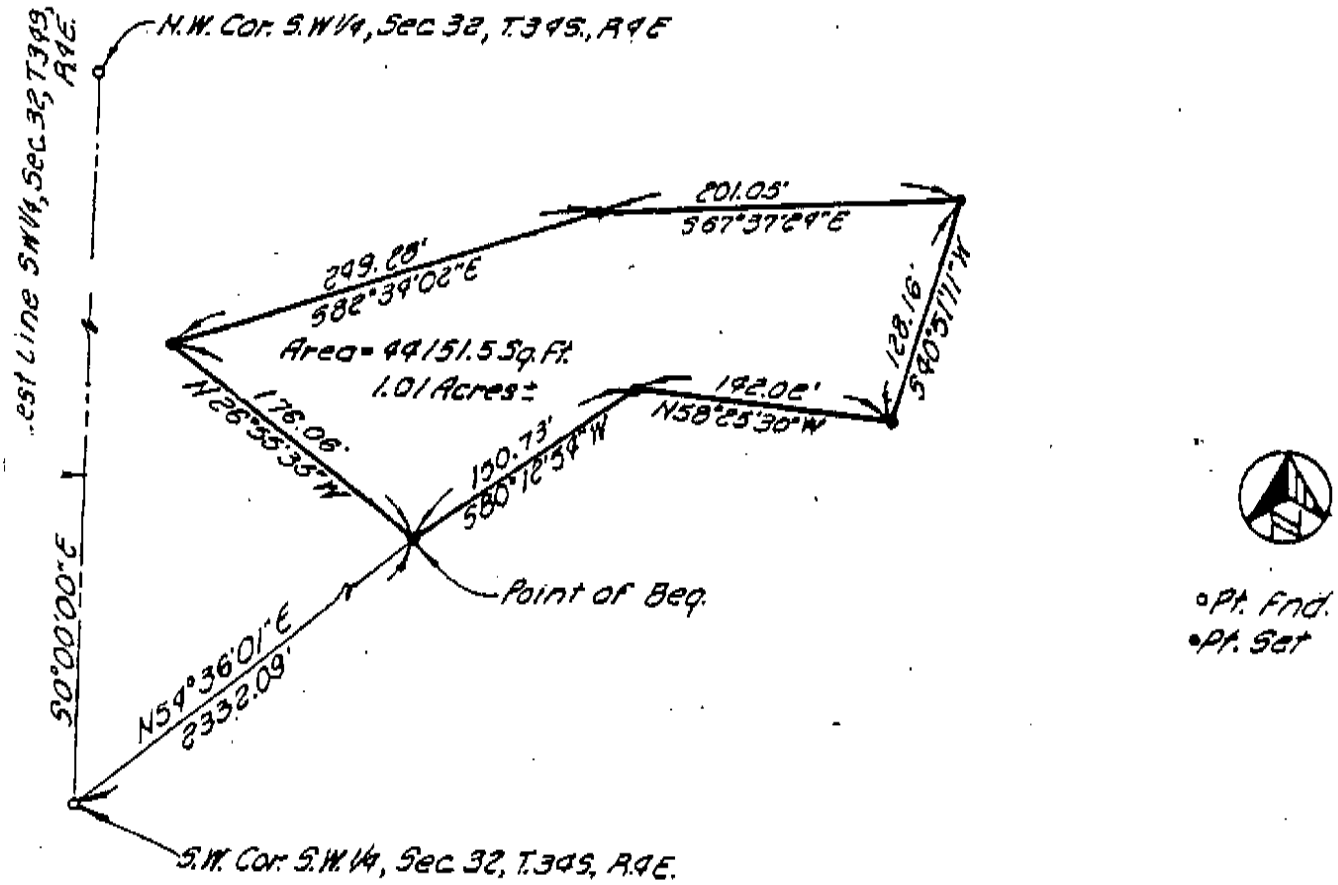
Exhibit C

PLAT OF SURVEY

SW1/4 SECTION 32 TOWNSHIP 34S RANGE 4E COUNTY Cowley STATE Kansas

CLIENT: Total Petroleum ADDRESS: South M Street Arkansas City, Ks. 67005

TYPE OF SURVEY: Boundary (See Attached Description)



I HEREBY CERTIFY THAT THE ABOVE IS A TRUE AND ACCURATE PLAT OF THE SURVEY COMPLETED BY ME ON THE 17th DAY OF ..., 19 85.

GARRY E. SMITH REGISTERED LS-637 KANSAS LAND SURVEYOR

Garry Smith

Kansas Reg. no. LS-637

Exhibit D

May 17, 1985

DESCRIPTION

Commencing at the Southwest corner of the Southwest Quarter of Section 32, Township 34 South, Range 4 East of the 6th Principal Meridian, Cowley County, Kansas (with the West Line of said Southwest Quarter Section on an assumed bearing of South 0 degrees, 00 minutes, 00 seconds East); thence North 54 degrees, 36 minutes, 01 seconds East, a distance of 2332.09 feet to the Point of Beginning of the herein described tract; thence North 26 degrees, 55 minutes, 35 seconds West, a distance of 176.06 feet to a point; thence South 82 degrees, 34 minutes, 02 seconds East, a distance of 249.28 feet to a point; thence South 67 degrees, 37 minutes, 24 seconds East, a distance of 201.05 feet to point; thence South 40 degrees, 51 minutes, 11 seconds West, a distance of 128.16 feet to a point; thence North 58 degrees, 25 minutes, 30 seconds West, a distance of 142.02 feet to a point; thence South 80 degrees, 12 minutes, 54 seconds West, a distance of 150.73 feet to the Point of Beginning.

The above described tract contains 44151.5 sq. ft., or 1.01 acres, more or less.

State of Kansas

Bill Graves Governor

Department of Health and Environment

Gary R. Mitchell, Secretary Designee

May 2, 1997

Mr. Jim Charles
Environmental Manager
Total Petroleum, Inc.
1400 South M Street
Arkansas City, KS 67005

CERTIFIED MAIL: P 419 226 926

Re: Total Petroleum, Inc. - Arkansas City Refinery
#3A Aerated Lagoon, RCRA Interim Status Closure Plan
Arkansas City, KS
EPA ID No. KSD087418695

Dear Mr. Charles:

The Public Comment period concerning the closure plan for the interim status hazardous waste treatment operation in the #3A Aerated Lagoon at your facility ended on January 17, 1997. No adverse comments were received. Further review of the closure plan by KDHE indicated a few additional discrepancies which were pointed out in comments to Total via a letter dated February 11, 1997. The comments in the KDHE letter have been sufficiently addressed by Total with final revisions to the above referenced closure plan. The final revised closure plan dated April 28, 1997 is therefore approved as submitted.

In accordance with 40 Code of Federal Regulation (CFR) § 265.115, you should submit certification both by the facility owner or operator and by an independent registered professional engineer that the treatment operation in the #3A Aerated Lagoon has been closed in accordance with 40 CFR Part 265 standards and the approved closure plan. The closure activities for the #3A Aerated Lagoon must be completed on or before October 29, 1997. The certification of closure with supporting documentation must be received by KDHE within 60 days of completion of closure.

If you have any questions regarding this letter, please call me at (913) 296-6562.

Sincerely,

Andrea L. Austin

Andrea L. Austin, M.S.
Environmental Scientist
Hazardous Waste Facilities Unit
Permits Section

ALA

C: Wes Bartley - EPA Region VII/ RCRA Permitting and Compliance Branch
Mark Bradbury - DEA/SCDO/Waste Programs
Joseph Mednick - Eneco Tech, Inc.

Division of Environment, Bureau of Waste Management, Forbes Field Building 740, Topeka, Kansas 66620-0001

Telephone: (913) 296-6562
Fax Number: (913) 296-1592

Printed on Recycled Paper

4.0 CLOSURE CERTIFICATION

40 CFR Section 265.115 Certification of Closure for the Aeration Lagoon

We hereby certify that we have reviewed the steps taken during closure of the No. 3A Aerated Lagoon and questioned those individuals who supervised those steps and found that the No. 3A Aerated Lagoon was closed in accordance with the closure plan approved for that unit by the Kansas Department of Health and Environment.

OWNER/OPERATOR CERTIFICATION

2-5-98

Brenda B Manterola — Date

Ultramar Diamond Shamrock Corporation

PROJECT MANAGER CERTIFICATION

2-5-98

Joseph F. Mednick — Date

EnecoTech Inc.

Recycled Paper

EnecoTech
ENVIRONMENTAL CONSULTANTS

EnecoTech Inc.
1580 Lincoln Street • Suite 1000
Denver, Colorado 80203
(303) 861-2200 • Fax (303) 861-2201

EnecoTech®

FILE COPY

Certified Mail Returu Receipt Requested #Z416 951 568

March 26, 1998

01-0138R-010

Ms. Nancy C. Horst
Registrar of Deeds
Cowley County, Kansas
P.O. Box 714
Winfield, Kansas 67156

Re: Deed Recordation Requirement
Hazardous Waste Management Unit Closure
Total Petroleum, Inc. - Arkansas City Refinery

Dear Ms. Horst:

Attached please find the plat describing the location and dimensions of a closed hazardous waste management unit that is subject to the deed recordation requirements stated in 40 CFR §265 Subpart G. This unit is located at the Total Petroleum, Inc. (Total) - Arkansas City Refinery. The physical address is 1400 South M Street, Arkansas City, Kansas 67005. The plat was prepared and certified by a professional land surveyor and contains the statement that the owner, Total, will restrict disturbances of the closed unit in accordance with applicable 40 CFR §265, Subpart G regulations.

Also please find a check in the amount of $6.00 to pay for the deed recordation processing fee. The original plat can be returned to me at EnecoTech Inc., 1580 Lincoln Street, Suite 1000, Denver, Colorado 80203. Please call me at (303) 861-2200 if you have any questions or comments regarding this issue.

Sincerely:
ENECOTECH

Jay F. Mednick
Principal

JFM/dh

cc: A. Austin, Kansas Department of Health and Environment
B. Manterola, Ultramar Diamond Shamrock Corporation
J. Mednick, EnecoTech

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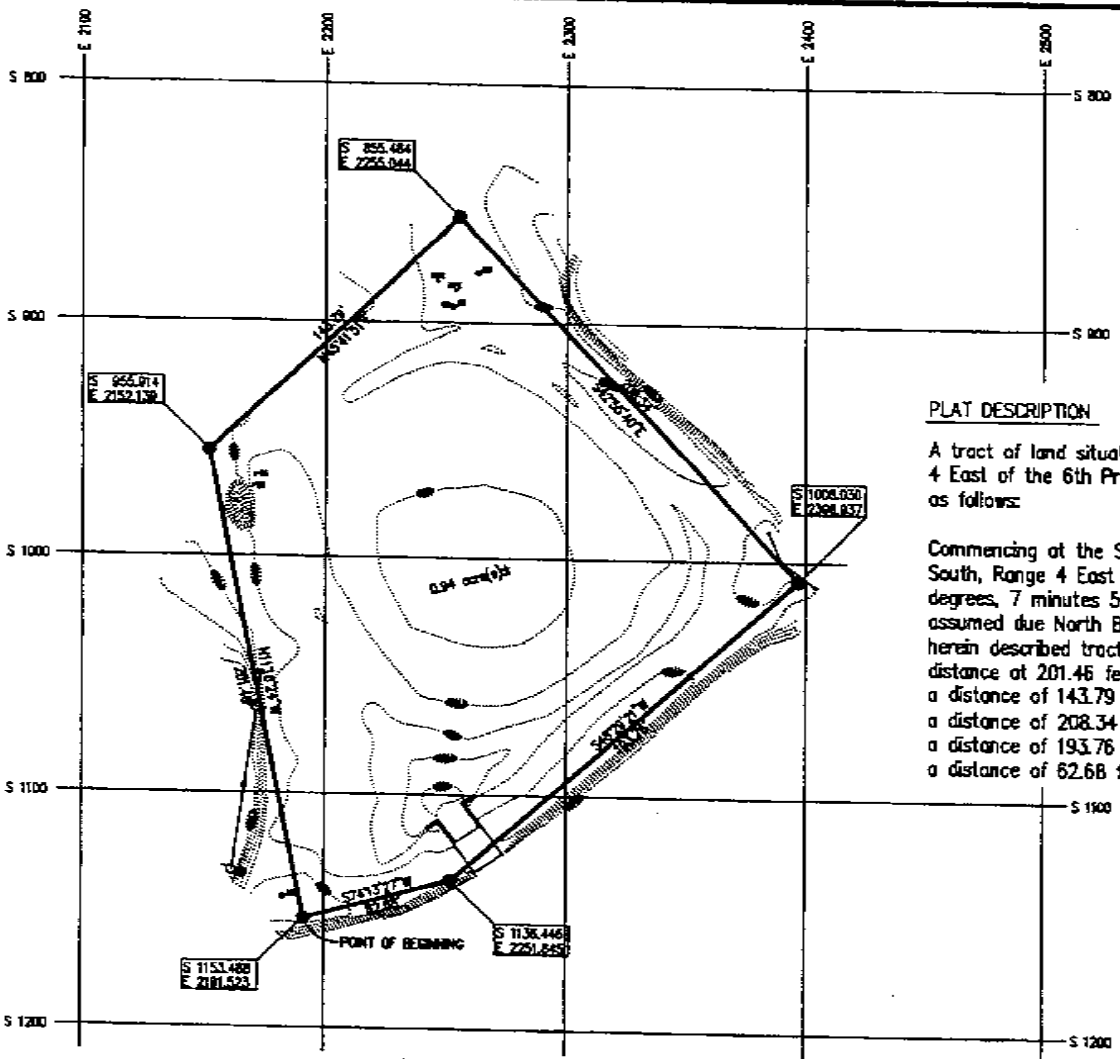
Recycled Paper

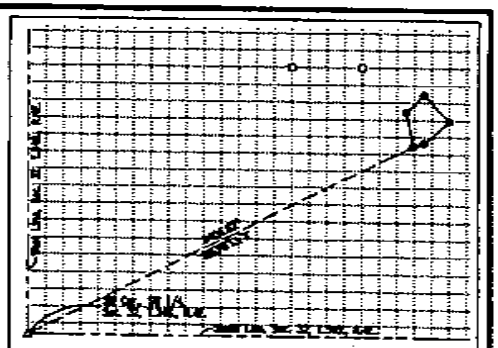


△ SEC. COR.
● POINT SET (#4 rebar)
○ BRASS CAP

BRASS CAP(S) (TOTAL PETROLEUM GRID SYSTEM)
S 700.00
E 1500.00
ELEV. 1067.52

SW Cor., SW 1/4, Sec. 32-34S-4E
S 2283.53
E 0000.00

S 700.00
E 1900.00
ELEV. 1068.43



LOCATION MAP

PLAT DESCRIPTION

A tract of land situated in the Southwest Quarter of Section 32, Township 34 South, Range 4 East of the 6th Principal Meridian, Cowley County, Kansas being more particularly described as follows:

Commencing at the Southwest Corner of the Southwest Quarter of Section 32, Township 34 South, Range 4 East of the 6th Principal Meridian, Cowley County, Kansas; thence North 63 degrees, 7 minutes 56 seconds, East (with the West Line of said Southwest Quarter on an assumed due North Bearing), a distance of 2456.62 feet to the Point of Beginning of the herein described tract of land; thence North 11 degrees, 16 minutes, 24 seconds West, a distance at 201.46 feet to a point; thence North 45 degrees, 41 minutes, 51 seconds East, a distance of 143.79 feet to a point; thence South 42 degrees, 55 minutes, 40 seconds East, a distance of 208.34 feet to a point; thence South 48 degrees, 29 minutes, 21 seconds West, a distance of 193.76 feet to a point, thence South 74 degrees, 13 minutes, 27 seconds West, a distance of 62.68 feet to Point of Beginning, containing 0.94 acre(s) more or less.

The closed hazardous waste unit (No. 3A Aerated Lagoon) described by this plat was formerly utilized to manage waste exhibiting the benzene toxicity characteristic. Total Petroleum Inc., as owner and operator of the unit will restrict disturbance of the unit in accordance with the applicable 40 CFR Part 265, Subpart G regulations.

CERTIFICATION: The undersigned hereby certifies that the survey information as shown hereon was obtained by field methods and investigations under his direction and supervision and that all information as shown hereon is correct to the best of his knowledge and belief.

A. J. OAKES REGISTERED 4-93 LAND SURVEYOR

A.J. OAKES, KANSAS L.S. 1953

AS-BUILT DRAWING #3a AERATED LAGOON
ARKANSAS CITY REFINERY – TOTAL PETROLEUM INC.
ARKANSAS CITY, KANSAS

EnecoTech
ENVIRONMENTAL CONSULTANTS

Project: TOTAL PETROLEUM, INC.

ARKANSAS CITY REFINERY
ARKANSAS CITY, KANSAS

AS-BUILT DRAWING/FINAL PROTECTIVE COVERING & PLAT DESCRIPTION
No.3A AERATED LAGOON CLOSURE

File No.: 0138R-014	ACAD No.: 14SURVY2	Drawn: LKB	Designed: AJO	Checked:	Approved:	Date: 1/28/98	Rev.: 3/17/98	Figure No.: 3

KANSAS
DEPARTMENT OF HEALTH & ENVIRONMENT
BILL GRAVES, GOVERNOR
[redacted] Clyde D. Graeber, Acting Secretary

RECEIVED
MAR 15 1999
ENVIRONMENTAL SERVICES

March 10, 1999

Certified Mail: P 419 226 937
Return Receipt Requested

Ms. Brenda Manterola
Senior Environmental Coordinator
Ultramar Diamond Shamrock Corporation
P.O. Box 696000
San Antonio, Texas 78269-6000

Dear Ms. Manterola:

Re: TPI Petroleum, Inc. (formerly Total Petroleum, Inc.)
No. 3A Lagoon Closure Report and Closure Certification
RCRA ID No.: KSD087418695

The Kansas Department of Health and Environment (KDHE) received the above referenced report and closure certification on February 9, 1998. KDHE has reviewed the description of the closure activities, soil analytical results, other documentation and the closure certification. We find the documentation report and certification to be complete. KDHE accepts the closure report and certification as well as the deed recordation/survey plat documentation received on April 1, 1998 for the No. 3A Lagoon. KDHE releases UDS from financial assurance for closure. However, UDS must continue to provide financial assurance for post-closure care of the No. 3A lagoon, groundwater monitoring, and corrective action.

Although no residual individual metals and organic constituents were detected in the unsaturated bottom soil of the lagoon, elevated concentrations of TPH for diesel range organics were detected. At some sampling locations, the soil was oily and dark grey to black from the surface of the bottom of the lagoon to the saturated capillary zone at a depth of five feet below the surface. Since the groundwater remains contaminated at closure, the No. 3A lagoon is subject to post-closure care and groundwater monitoring.

KDHE did not conduct a final closure inspection of the No. 3A lagoon. The final closure inspection was not necessary since a representative from KDHE was present during closure sampling activities and KDHE was kept well informed of the closure progress. Also, during the flood of November 1998, KDHE visited the facility on November 9, 1999 to inspect the damage caused by the flooding of Walnut River. The No. 3A lagoon was found not to be impacted by the flood. The.

backfilled area and vegetative cover at the closed No. 3A lagoon were found to be intact.

KDHE appreciates your efforts and cooperation in resolving the environmental concerns at your facility. If you have further questions, please feel free to call me at 785-296-6562.

With sincerest regards,

Andrea L. Austin, M.S.
Environmental Officer
RCRA Permits Section

ALA:aa

cc: Wes Bartley - USEPA Region VII, ARTD/RPCB
Mark Bradbury - DEA/SCDO/Waste Programs
Steve Travis - BWM

APPENDIX B

Closure/Post-Closure Plans #1, #2, and #3A

RESOURCE CONSERVATION AND RECOVERY ACT
CLOSURE AND POST-CLOSURE PLAN FOR THE
HAZARDOUS WASTE SURFACE INSOUNEMENT FACILITY

TOTAL PETROLEUM, INC.
1400 SOUTH M STREET
P.O. BOX 857
ARKANSAS CITY, KANSAS 67005
(316) 442-5100

Respectfully Submitted

by

Engineering Enterprises, Inc.

Revised September, 1985

Closure/Post-Closure Contact

Mr. Jack Hazen, Refinery Manager
Total Petroleum, Inc.
1400 E. M Street
P.O. Box 857
Arkansas City, Kansas 67005
(316) 442-5100

EPA Region VII Regional Administrator

Morris Kay
U.S. Environmental Protection Agency
726 Minnesota Avenue
Kansas City, Kansas 66101
(913) 236-2800

Secretary, Kansas Department of Health & Environment

Barbara Sabol
Kansas Department of Health & Environment
Forbes Field
Topeka, Kansas 66620
(913) 862-9360

Local Land Authority

Registrar of Deeds
Eldine Glasgow
311 E. 9th
Winfield, Kansas 67156
(316) 442-6480

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A. INVENTORY OF WASTES IN STORAGE OR IN TREATMENT..

B. CORRESPONDENCE.....

FIGURES

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2. DRAWING OF SOIL SAMPLE COLLECTION LOCATIONS..... III - 9

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I. INTRODUCTION

This closure and post-closure plan has been prepared for Total Petroleum, Inc.'s Arkansas City Refinery to meet the requirements of Chapter 1, Title 40, "Protection of Environment" contained in the Code of Federal Regulations (CFR) as administered by the Kansas Department of Health and Environment (KDHE). Specifically addressed by this report is Part 265, "Interim Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities". The regulations addressed in this report are those promulgated January 12, 1981, July 26, 1982, and April 1, 1983.

The applicable rules are subpart G "Closure and Post-Closure of Hazardous Waste Facilities", Sections 265.111 - 265.120; subpart H "Financial Requirements", Sections 265.142 - 265.146; and subpart K "Surface Impoundments", Section 265.228.

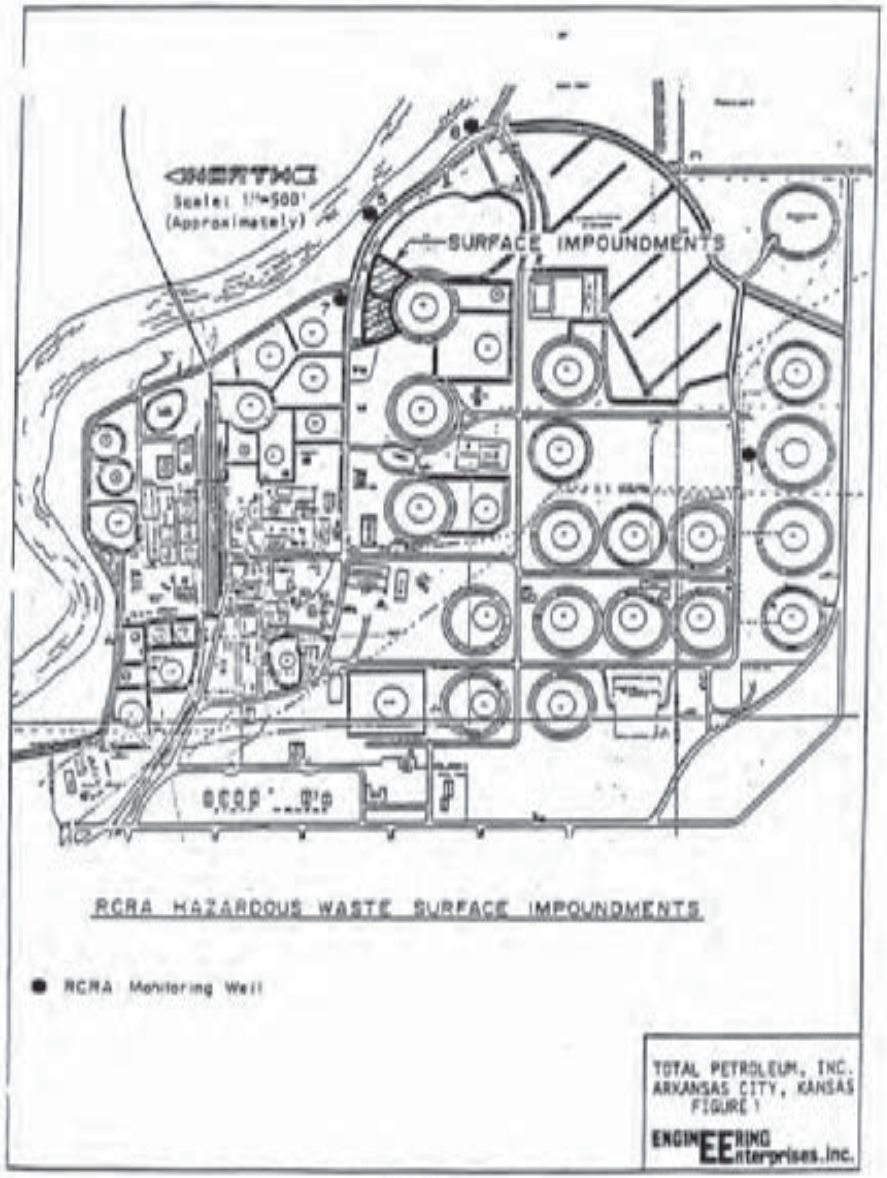
Each section heading includes the corresponding Code of Federal Regulations section(s), for example, II. CLOSURE PERFORMANCE STANDARD (§ 265.111).

This written closure and post-closure plan will be kept on file at the Arkansas City Refinery. The plan will be updated and amended as may be required and submitted to the Secretary of the KDHE for subsequent approval.

General Site Description

Arkansas City's Total Petroleum Inc. Refinery is located near the southeast corner of Arkansas City in the southwest 1/4 of Section 32, Township 34 South, Range 4 East and the NW 1/4 of Section 5, Township 35 South, Range 4 East in southwestern Cowley County, Kansas. The hazardous waste storage facility is located in the east central portion of the refinery property. The storage facility consists of a 1,152,000 and a 761,250 gallon (approximate-based on maintained 3 foot freeboard) surface impoundments known as the oil skimming ponds. The location of the storage facility in the refinery is shown in Figure 1.

The refinery is located at the confluence of the Arkansas and Walnut Rivers. It consists of flat lying alluvium soils and sediments. Most of the land around the refinery is cultivated for growing wheat and grain sorghum. Several oil wells are also active in the immediate vicinity.



II. CLOSURE PERFORMANCE STANDARD (§ 265.111)

Total Petroleum, Inc. will close the hazardous waste facility in a manner that will (a) minimize the need for further maintenance, and (b) control, minimize, or eliminate the post-closure escape of hazardous waste constituents to the ground water, surface water, or the atmosphere.

Surface Impoundment Facility

Removal of all liquid, sludges, and contaminated soil from the surface impoundments, and disposal according to applicable regulations, (265.228(a) and (b) will be done to eliminate both the possibility of escape of any hazardous waste constituents and the need for further post closure maintenance.

If all contaminated soil cannot be removed, the surface impoundments will be closed according to the contingent closure plan in accordance with 265.228(c). In this case, the proper installation and grading of a clay cap of very low permeability will effectively prevent the migration of liquids through the closed impoundments, and accommodate settling and subsidence. A layer of topsoil and native vegetative cover over the cap will prevent erosion of the cover and function with minimum maintenance. Proper slope design of the final cover will promote drainage. Post closure care will then be performed in accordance with Subpart G Section 265.310.

III. CLOSURE PLAN FOR THE SURFACE IMPOUNDMENTS (§§ 265.112, 265.228)

Total Petroleum, Inc. will keep this written closure plan on file at the Arkansas City Refinery. This plan outlines the steps necessary to completely close the surface impoundments.

Theoretically the surface impoundments have an indefinite life. However, they will be replaced by a new API separator system in 1987 and will be closed by November 8, 1988. The anticipated closure dates and activity schedule is presented in Tables III-1 and III-2 respectively. Partial closure is not anticipated nor planned during the remaining life of the facility and therefore is not addressed by this closure plan. If for some unanticipated reason partial closure may become necessary, a partial closure plan will be developed and the closure plan revised accordingly. The revised or amended closure plan will be submitted to the Kansas Department of Health and Environment for approval and public notice.

An estimate of the maximum inventory of wastes in storage is presented in Appendix A. The estimate is based on past operating accumulation prior to the cleaning of the ponds in 1976 and recent soundings extrapolated to closing.

Closure of the surface impoundments will be accomplished as follows:

1. Any free-floating oil and emulsions will be skimmed and processed through the slop oil recovery system.

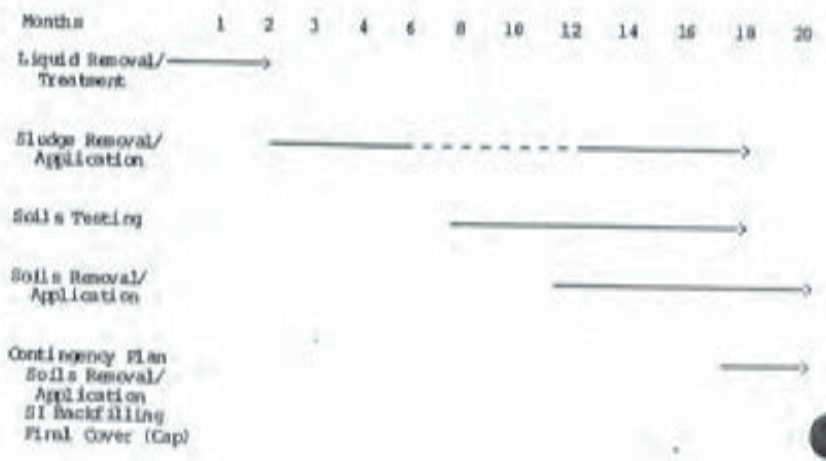
TABLE III - 1

CLOSURE-RELATED DATES

1.	Engineering Design for API Separator System (Phase I)	12-31-85
2.	Construction of API Separator System	10-31-86
3.	Commission API Separator System	12-31-86
4.	Engineering for API Separator water treatment System (Phase II)	9-30-86
5.	Construction of API Separator water treatment system (Phase II)	6-30-87
6.	Commissioning of API Separator water treatment system (Phase II)	8-31-87
7.	Initiate Closure of surface impoundments	3-01-87
8.	Complete Closure of surface impoundments	11-8-88

TABLE III - 2

CLOSURE ACTIVITIES SCHEDULE



2. Free water will be pumped from the two impoundment ponds at a controlled rate of 80 gpm and processed through the new API separator and waste oil recovery system. It will take approximately eighteen days pumping continually and fifty-two days pumping eight hours a day. A conservative estimate of sixty days is used to allow plenty of time should problems arise. The API system can more than adequately handle the discharge.

3. The light or slightly suspended sludges present in the ponds may be treated by a liquid reduction process if necessitated because of time constraints or weather conditions. If so, the free liquids will be discharged to the API Separator and the residual sludges applied to the LTF.

4. The oil skimming pond sludges will be, at a minimum, air dried in-place and treated at the existing hazardous waste land treatment facility. Free liquids will be discharged into the new API Separator System for treatment. Using current estimates (see Appendix A) of 70,000 cubic feet of sludge at 53 percent air-dried solids (1984 composite analysis) there will be approximately 2,000 tons of dried sludge for disposal at the LTF.

(70,000 ft^3 x .53 = 37,100 ft^3 x 105 lbs/ft^3 ÷ 2,000 lbs/ton

= 1947.75 ≈ 2,000 tons)

(37,100 ft^3 x 7.48 gal/ft^3 = 277,508 gal x 14.0 lbs/gal

= 3,885,112 lbs ÷ 2,000 = 1942.56 ≈ 2,000 tons)

The LTF can handle this additional amount of sludge without any problems and only a reduction in site life of 1.1 years (see site life and capacity calculations below).

The water content will not be a factor. The oil content, as with other sludges, is the limiting factor that sets the application rate at the LTF. The LTF has an established oil application rate of 120 barrels/acre/month which equals a total of 462 bbls (120 x 3.85a) per month or 3234 bbls/year (based on 7 month application season). An oil application rate limit of 3300 bbls/yr or 462 bbls/month will be used. The oil content of the oil skimming sludges average 5 percent (1984 and other composite analysis). A total oil content of 623 bbls is estimated by conservatively using the wet sludge volume of 70,000 ft^3 and 5 percent oil content (70,000 ft^3 x 7.48 gal/ft^3 ÷ 42 gal/bbl = 12,467 bbls x .05 = 623 bbls of oil). This is a conservative estimate since no allowances are made for the oil that would be removed with the water. This leaves a balance of 2677 bbls for routine application during the normal application year. The average annual

waste generation and application rate is typically 1300 - 1400 tons (4000 - 4800 bbls) of sludge at 5-14 percent oil which produces 220 - 670 bbls of oil for disposal. This still leaves a balance of 2,000 bbls (2677-670) that could be applied at the LTF. It is apparent from these calculations that the oil skimming pond sludges can be safely applied along with the typical sludges at the LTF.

Following are capacity limit-site life calculations based on analyses of composite samples of oil skimming pond sludges taken in 1984. More recent composite samples have been taken, (September, 1985) so these calculations will be revised if higher metals concentrations are indicated.

OIL SKIMMING POND SLUDGE
COMPOSITE SAMPLE ANALYSES (1984)

Parameter		
Air-Dried Solids (%)		53
Hexane Extractables (%)		5.0
Total Non-Extractable Organic Carbon(%)		8.5
Total Metals (mg/kg-dry wt.)		**meq/kg**
Antimony	7.2	.1774
Arsenic	6.8	.2723
Barium	220	3.2037
Beryllium	ND	-----
Cadmium	1.1	.0196
Chromium - Total	680	39.2338
Chromium - Hex	ND	-----
Cobalt	4.5	.1527
Lead	67	.6467
Mercury	1.2	.0120
Nickel	25	.8516
Selenium	ND	-----
Silver	ND	-----
Vanadium	21	2.0612
	TOTAL	46.631

(meq = mg/kg ÷ mol. wt. x valence)

$$46.631 \frac{meq}{kg} \times \frac{907.18\ kg}{ton} \times 2000\ tons = 84.605.421 = 8.46 \times 10^7\ meq$$

Current Life of Facility = 13.82 years at 7.61×10^7 meq/year

$8.46 \times 10^7 \div 7.61 \times 10^7 = 1.1$ years

Thus, the addition of the Oil Skimming Pond Sludges will reduce the site life by 1.1 years and result in a 12.72 year life

5. Contaminated soils will be removed for treatment at the LTF. Soil samples will be collected by coring on a grid system using a 30 foot spacing - see Drawing (Figure III-1) and composited by depth to provide a vertical profile of each pond. Soil core samples will be taken at the approximate locations shown on Figure III-1. The soils from each six (6) inches in depth in each hole will be collected separately for composite analyses, i.e. individual samples will be collected from 0-6", 6"-12", 12"-18", etc. from each hole for compositing with samples from equivalent depths in other holes. Each individual sample will be placed in plastic ziploc bags, labeled for proper identification and shipped to the lab for compositing. Samples will be taken and analyzed that represent each 6" vertical profile. Samples will be composited horizonatally and not vertically, e.g. samples collected from the 0-6" vertical depth at several soil core locations (no more than 6) will be composited for a single analysis. Table III-3 indicates those locations (areas) that will be composited into one representative sample. Three locations have been selected for background soil core samples and are shown on Drawing (Figure III-1). These will be composited within each vertical profile just as other core samples. The soil samples will be analyzed for total metals concentrations and those concentrations projected by depth.

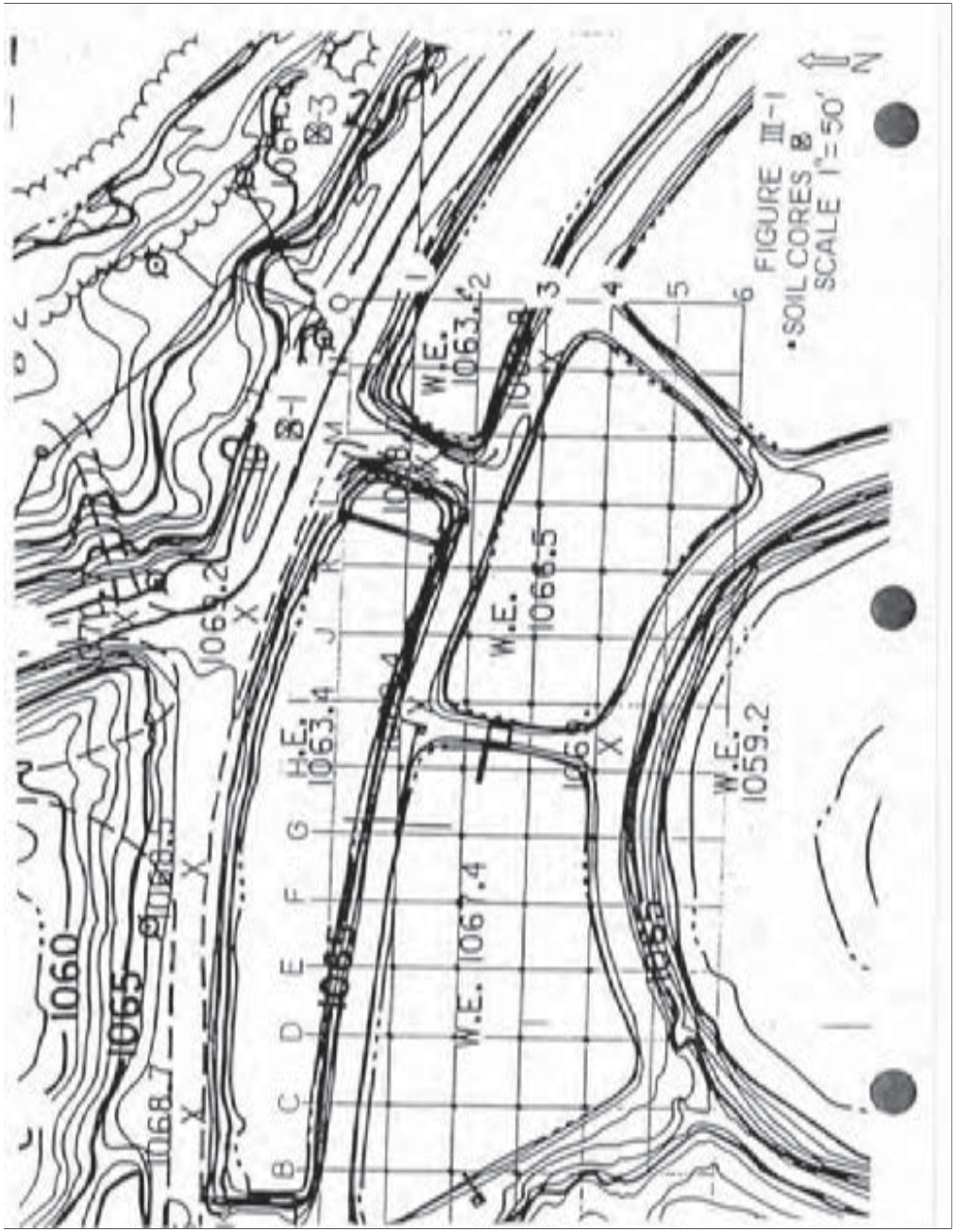


TABLE III-3

COMPOSITE SAMPLE GROUPS

The following groups of soil core locations represent composite sample groups. The individual samples within those groups will be composited by depth into one sample:

1)	A-1, B-1, C-1 B-2, C-2	2)	D-1, E-1, F-1 D-2, E-2, F-2	3)	G-1, H-1 G-2, H-2
4)	B-3, C-3, D-3 C-4, D-4	5)	E-3, F-3 E-4, F-4	6)	G-3, H-3 G-4, H-4
7)	I-2, J-2, K-2 I-3, J-3, K-3	8)	L-3, M-3, N-3 L-4, M-4, N-4		
9)	I-4, J-4, K-4 K-5	10)	L-5, M-5 L-6, M-6	B)	B-1, B-2, B-3 (Background)

Tests will be performed by methods specified in EPA Manual SW846 "Test Methods for Evaluating Solid Waste". The soil samples obtained from the grid locations will be visually inspected for oil contamination in addition to the metal analysis. All areas exhibiting visible oil contamination will be excavated. Soil sampling will be conducted to the depth of highest seasonal groundwater table elevation (1048' msl) which is from three to ten feet below the bottom of the ponds. Water table elevations have been obtained from hydrographs of monitoring wells in the vicinity of the impoundments. All soils that exceed background values for total lead and chromium concentrations will be excavated and applied to the Land Treatment Facility. The application and loading rates will be established once analyses are completed, before removal is started. No problems are anticipated since the metals content should be the only limiting factor which would only result in a slight reduction in site life (capacity). It is anticipated that the water and oil content will be minimal or neglible.

6. Provided that all contaminated soil has been removed, based on the results of the soil analysis, closure of the surface impoundments will be complete at this point according to Section 265.228(b), and backfilling and grading will begin. The excavations will be backfilled and capped with native soil from off-site and graded to

properly drain and blend in with surrounding terrain. Then at the beginning of the first growing season after the final cap is placed, the site will be lightly disked and seeded with proper vegetation (a local perennial grass) to stabilize and prevent erosion. Groundwater monitoring will be conducted according to the facility's groundwater sampling and analysis plan without interruption during the closure period. However, if all contaminated soil cannot be removed, closure will continue as described below in the contingent closure plan required by Section 265.228(c).

Contingent Closure Plan

This Contingent Closure Plan will be followed if soil sample analysis or conditions indicate that not all contaminated soil can be removed from the surface impoundment facility.

1. All free liquids, sludges, solids and most of the underlying soil will be removed according to the methods contained in the closure plan outlined above.

2. The remaining soils will be stabilized to a bearing capacity sufficient to support the final cover, as directed by a qualified engineer.

3. A final cover will be designed by a qualified engineer, and constructed to:

   (a) provide long term minimization of the migration of liquids through the closed impoundment.

(b) function with minimum maintenance,

(c) promote drainage and minimize erosion or abrasion of the final cover,

(d) accommodate potential settling and subsidence so that the cover's integrity is maintained, and

(e) have a permeability one order of magnitude less than or equal to the permeability of any subsoils present.

4. This final cover will most likely consist of the following:

(a) Compacted fill to provide proper drainage design and support for the cap. Slopes on the top of the cap might be on the order of 4% and slopes on the sides will not be greater than 25%.

(b) The cap will consist of not less than two feet of compacted clay to provide a low permeability barrier to liquid. Only soils exhibiting recompacted permeabilities no greater than 1×10^{-5} cm/sec should be used.

(c) A minimum of 6" with an optimum of 12 inches of topsoil suitable to promote vegetative growth will then be placed on top of the clay.

(d) The topsoil will be seeded and watered until sufficient growth of native grasses has been established to minimize erosion.

This plan will be amended by Total Petroleum, Inc. at any time that changes in the operating plans or facility design affect the closure plan, and a request to the Secretary of the KDHE for modification of the closure plan will be submitted within 60 days after the change.

Total Petroleum, Inc. will serve as the closure contact and can be reached by written letter or telephone contact as listed on pg. (i).

IV. TIME ALLOWED FOR CLOSURE (§ 265.113)

Surface Impoundments

Within 90 days after receiving the final (discharge) volume of wastes into the Oil Skimming Ponds, Total Petroleum, Inc. will start treatment, removal, and disposal of all wastes in storage or in treatment in the ponds. However, a period longer than 90 days will be required to remove and treat the wastes. It is anticipated that the closure activities will take over one and one-half years to complete (see closure activity schedule, Table III-2).

Total Petroleum, Inc. will strive to complete the closure activities in accordance with the closure plan within twenty (20) months after receiving the final volume of wastes. It is anticipated that this time period is necessary due to weather dependent conditions and activities. This extended closure time may be necessary to allow the complete drying and land treatment of the wastes and carry-out all closure related activities that are weather dependent. This extended closure period is subject to the approval of the Kansas Department of Health and Environment.

V. DECONTAMINATION OF EQUIPMENT (§ 265.114)

When closure is complete at the facility, Total Petroleum, Inc. will steam clean all facility equipment prior to alternate usage.

During the closure operations decontamination areas will be established in the Oil Skimming Ponds and the Land Treatment facility. Sludge and soils handling, removal, collection and sampling equipment will be steam cleaned in these areas before and after their use. The minimal amount of water and residues from the steam cleaning operations will therefore be contained in the ponds and land farm. Both facilities will have sumps for removal of any run-off water for discharge to the wastewater treatment system which will be the API Separator during closure. All solid residues will be removed from the decontamination areas and applied to the LTF.

Following is a listing of equipment and structures that may require decontamination. The list will be updated and/or amended as changes deem this necessary.

List of Equipment and Structures
That May Require Decontamination

Tractor-Towed Tiller
or Disk

Tractor

Vacuum Truck

Dump Truck

Back Hoe

Front-End Loader

Scraper

Dozer

Hand Shovels and Rakes

Misc. Tools and Equipment

Inflow and Outflow Piping

Pumps

Oil Skimming Equipment

Hand Auger

Hand Shovel

Mixing Bowl

X. CONTINGENT CLOSURE COST ESTIMATE FOR THE SURFACE IMPOUNDMENTS (§ 265.142)

Total Petroleum, Inc. will keep this written estimate of closure cost and any subsequent revised or adjusted estimates on file at the Arkansas City Refinery. This closure cost is for complete closure of the surface impoundments under the contingent closure plan. This cost estimate was selected since it represents the most expensive manner of closure, as required by 265.142(a).

Total Petroleum, Inc. will revise the estimate of closure cost whenever a change in the closure plan affects the cost of closure. The revised estimate will be adjusted for inflation.

Total Petroleum, Inc. will also re-evaluate and adjust or revise the costs projected for closure each year within 30 days after each anniversay of the date on which the first estimate was prepared (5-1-85). Included in the re-evaluations will be the yearly inflation factor adjustment of the closure cost estimate. The inflation factor adjustment is achieved by:

1. dividing the latest published annual Deflator[1] by the Deflator for the previous year. The result of this division will be used as the inflation factor.
2. multiplying the latest closure cost estimate by the inflation factor. The result will be the adjusted closure cost estimate.

[1] Implicit Price Deflator for Gross National Product as published by the U.S. Department of Commerce in its Survey of Current Business.

Estimated closure costs for the Arkansas City Refinery surface impoundments in 1985 dollars are as follows:

1.	Remove liquid and sludges	$ 5,300
	Sludge Dewatering @ $1.00/yd^3	$ 2,500
	Sludge Land Application @ $2.25/yd^{3}x1500	$ 3,300
2.	Scrape bottom and sides, and apply to land treatment facility 5500 yd. @ $4/yd.	22,000
3.	Groundwater sample and analysis	2,800
4.	Sample soil and analyze	16,000
5.	Fill, grade, and compact fill 22,200 yd. @ $2.50/yd.	55,500
6.	Install 2 ft. clay cap 3,800 yd. @ $3.50/yd.	13,300
7.	Install 1 ft. topsoil 2,000 yd. @ $4.10/yd.	8,200
8.	Fertilize and seed cover	1,500
9.	Decontaminate equipment	300
10.	Design and certify by engineer	2,000
	Closure Cost	$ 132,700
	Contingency	15,500
	Total Closure Cost	$ 148,200

The adjusted closure costs are as follows:

A	B	C	D*	E	F**
Year	Previous Year Deflator	Current Year Deflator	Inflation Factor	Previous Adjusted Closure Cost Estimate	Current Adjusted Closure Cost Estimate
1985					$148,200
1986					
1987					
1988					
1989					

* Column D = Column C/Column B
** Column F = Column E x Column D

XI. CONTINGENT POST-CLOSURE COST ESTIMATE FOR THE SURFACE IMPOUNDMENTS (§ 265.144)

Total Petroleum, Inc. will keep this written annual cost estimate of post-closure monitoring and maintenance of the surface impoundment and any subsequent adjusted or revised estimates on file at the Arkansas City Refinery.

Total Petroleum, Inc. will revise the estimate of annual post-closure cost whenever a change in the post-closure plan affects the cost of post closure care.

Total Petroleum, Inc. will also re-evaluate and adjust or revise the costs projected for post-closure care each year within 30 days after each anniversary of the date (5-1-85) on which the first estimate was prepared. Included in the re-evaluations will be the yearly inflation factor adjustment of the post-closure cost estimate (refer to Section X of this report, Paragraph 3 on page X-1, for explanation of inflation factor adjustment).

Estimated contingent post-closure costs for the Arkansas City Refinery surface impoundments in 1985 dollars are as follows:

1.	Plant labor to sample wells 16 hrs/yr x $20/hr	$ 320/year
2.	Sample shipment	25/year
3.	Groundwater analysis 4 wells x 2 times/yr @ $350/sample	2,800/year
4.	Maintenance cost	500/year
Contingent annual post-closure cost		$ 3,645/year
Contingency		555/year

Total contingent annual post-closure cost	$ 4,200/year
	x 30 years
30 year total contingent post-closure cost	$ 126,000

The adjusted post-closure costs are as follows:

A	B	C	D*	E	F**
Year	Previous Year Deflator	Current Year Deflator	Inflation Factor	Previous 30 yr. Adjusted Post-Closure Cost Estimate	30 yr. Adjusted Post Closure Cost Estimate
1985					$126,000
1986					
1987					
1988					
1989					

* Column D = Column C/ Column B
** Column F = Column E X Column D

APPENDIX A

INVENTORY OF WASTES IN STORAGE OR IN TREATMENT

APPENDIX A

Inventory of Wastes in Storage or in Treatment

The projected inventory of wastes in storage at the time of closure (1987) presented herein was obtained from information obtained prior to the cleaning of the ponds in 1976. Immediately prior to the cleaning of the ponds in 1976, they were sounded utilizing a weighted device to measure the volume of wastes accumulated since their construction in 1956. Therefore, the data used represents the accumulation of wastes over twenty years of operation and should therefore provide a good basis for estimating the volume of wastes expected to have accumulated up to 1987, some 11 years after their cleaning. From the soundings in 1976 conducted on a grid spacing of 20' x 25' a total volume of 100,000 ft^3 of sludges had accumulated over the twenty years of operation. Dividing the 100,000 ft^3 of sludges by 20 years yields a rate of accumulation of 5,000 ft^3/year.

The projected volume in storage at closure in 1987 can be obtained by taking the projected years of accumulation between 1976 and 1987 (12) and multiplying by the rate of accumulation (5,000 ft^3/year) which yields a projected volume of 60,000 ft^3 of waste sludges in storage at closure.

Recent soundings (week of 9-16-85) indicate an approximate volume of sludge equal to 67,000 cubic feet. It is impossible to take soundings and make volume calculations with any great degree of accuracy since the sludge is distributed unevenly, averages and estimates must be made and accepted. To compensate for

accuracy of previous and recent measurements, and generation of sludge between now and 1987, an arbitrary estimate of 70,000 cubic feet will be used. This is not critical since all calculations have been conservatively made and there is still a large margin for adjustment without creating any problems. An additional 10 percent of sludge could be handled without any problem.

EXHIBIT 9-2

KDHE APPROVAL LETTER FOR CLOSURE

AND POST-CLOSURE PLAN

CC: JMH
FAL
Letters only

State of Kansas . . . John Carlin, Governor

DEPARTMENT OF HEALTH AND ENVIRONMENT

Barbara J. Sabol, Secretary

Forbes Field
Topeka, Kansas 66620
913-862-9360

January 9, 1986

P.A. Morgan
Environmental Specialist
Total Petroleum, Inc.
P.O. Box 857
Arkansas City, Kansas 67005

Re: Total Petroleum, Inc. Surface Impoundment Closure Plan
EPA I.D. Number KS0087418695

Dear Ms. Morgan:

The Kansas Department of Health and Environment (KDHE) has reviewed the closure plan for the interim status hazardous waste surface impoundments at your facility. The closure plan was found to meet the requirements of Title 40 Code of Federal Regulations Part 265, Subpart G and has been placed on public notice prior to final approval by KDHE.

A copy of the public notice and of the closure plan is enclosed. You may submit written comments and/or a request for a public hearing during the public comment period.

If you have any questions regarding this letter, please contact me. Your continued cooperation with the hazardous waste management program is appreciated.

Sincerely,

Marla A. Noak

Marla A. Noak
Hazardous Waste Section
Bureau of Waste Management

dl/A7
Enclosures
C Dale Stuckey
Karen Flournoy

HAZARDOUS WASTE MANAGEMENT FACILITY CLOSURE PLAN
Public Notice

The Kansas Department of Health and Environment (KDHE) has received and reviewed a hazardous waste management facility closure plan from Total Petroleum, Inc. in Arkansas City, Kansas. Total Petroleum, Inc. will terminate operation of two surface impoundments used to store hazardous waste. The closure plan associated with these interim status activities is being made available for public review and comment prior to final approval by KDHE.

Total Petroleum, Inc., located at 1400 South M Street in Arkansas City, Kansas, is currently an interim status hazardous waste management facility. Hazardous waste management units at the facility consist of the two surface impoundments having storage capacities of 1,150,000 and 760,000 gallons which will be closed and a 3.8 acre land treatment area. Total Petroleum, Inc. has submitted a hazardous waste permit application for the land treatment area. The closure plan for the surface impoundments has been found to meet the requirements of Title 40 Code of Federal Regulations (40 CFR) Part 265, Subpart G.

The closure plan is available for public review from January 20, 1986 to February 19, 1986 during normal business hours, 8:00 a.m. to 4:30 p.m., Monday through Friday at the KDHE Central Office, Building 321, Forbes Field, Topeka, Kansas; the KDHE District Office, 3244 East Douglas, Wichita, Kansas; the EPA Region VII Office, 726 Minnesota Avenue, Kansas City, Kansas; and the Arkansas City Public Library, 120 East 5th, Arkansas City, Kansas.

Comments or requests for additional information should be directed in writing to Mr. Dennis Murphey, Bureau of Waste Management at the KDHE Central Office or by telephone at (913) 862-9360. Comments must be submitted by February 19, 1986.

If comments or requests are received which indicate public interest in the closure proceedings, a public hearing will be scheduled. Such requests must be made by February 19, 1986. The public notice and public hearing procedures may be found in 40 CFR 265.112.

dl/A14

XC: MATTI M.
PAT LINCOL

John Carlin, Governor

Barbara J. Sabol, Secretary

Forbes Field
Topeka, Kansas 66620
913-862-9360

February 20, 1986

Mr. J.M. Hazen
Refinery Manager
Total Petroleum, Inc.
P.O. Box 857
Arkansas City, Kansas 67005

Dear Mr. Hazen:

Please be advised that the public comment period for the hazardous waste surface impoundment closure plan ended on February 19, 1986. Since no public comments were received approval is granted for you to proceed with implementation.

Please be advised that the schedule required in the plan must be followed. If any reason prevents implementation of the plan we are to be contacted immediately.

We would also request that before you begin to collect samples of the sediment sludge in the ponds that we be advised so that our representative may be present at the time of sampling.

Sincerely,

John Paul Goetz, P.E., Chief
Hazardous Waste Section
Bureau of Waste Management

dl/86
C Dale Stuckey
Karen Flournoy

11.0 POST-CLOSURE COST ESTIMATE AND FINANCIAL ASSURANCE MECHANISM

11.1 Post-Closure Cost Estimate

The approved Closure and Post-Closure Plan for the #1 and #2 Surface Impoundments, presented in Section 9 as Exhibit 9-1, includes the approved post-closure cost estimate developed in 1985 to comply with 40 CFR 265.144(b). When the approved post-closure cost estimate was updated through the second quarter of 1989 by the method described in 40 CFR 265.144(b) and in the approved post-closure plan, then the current estimate on a 30-year basis is $143,053. However, closure was completed in 1988. On the basis of only 29 remaining years in 1989 in the post-closure period established in the approved post-closure plan, the current 1989 post-closure estimate would be $138,285.

The approved post-closure cost estimate discussed above now requires modification under 40 CFR 265.144(c) due to pending requirements by the KDHE to develop additional groundwater monitoring capabilities for the closed #1 and #2 Surface Impoundments. Information on groundwater monitoring is discussed in Section 14.0. For the purposes of revising the post-closure cost-estimate to maintain compliance with 40 CFR 265.144 and to project an estimate for post-closure permitting purposes under 40 CFR 264.144, a one time expenditure of $137,380 is added to the post-closure cost estimate for the year 1990. This amount will cover costs of

installation, development, and initial sampling and analysis for as many as eight additional groundwater monitoring wells at the #1 and #2 Surface Impoundments.

Table 11-1 presents a revised post-closure cost estimate which is submitted as the actual current post-closure cost estimate for post-closure permitting purposes. The cost estimate in Table 11-1 includes the one-time, 1990, groundwater monitoring system cost and also includes revisions to other projected annual costs from those established in the previously approved post-closure plan. The total post-closure cost estimate is $2,266,500 for the year 1990. The annual cost estimate on which to base remaining future post-closure cost estimates is $76,040.

During the remainder of the post-closure period established under the existing approved post-closure plan or under a future post-closure permit, Total will again revise the estimate of annual post closure cost whenever a change in the post-closure plan or permit affects the cost of post-closure care, in accordance with 40 CFR 264.144(c)

Table 11-2 provides a work sheet which will be used to update and/or revise the post-closure cost estimate. It should be noted that the specific requirement of 40 CFR 264.144(b) to update the post-closure cost estimate is applicable only

during the active life of the facility. During the post-closure period, 40 CFR 265.145 and 40 CFR 264.145 allow reductions in covered post-closure costs based on remaining costs during the post-closure period. In Table 11-3, Total is proposing to annually update its post-closure cost estimate based on remaining post-closure costs after adjustment for inflation. The annual cost estimate of Table 11-1 will be the annual cost estimate on which to base future post-closure cost estimate updates.

Total will reevaluate or adjust its post-closure care estimate each year within time frames dependent on the nature of future financial mechanisms used to comply with 40 CFR 264.145. When a corporate financial test is used, Total will adjust the post-closure estimate within 30 days after the close of Total's fiscal year and before any updated information is submitted under 40 CFR 264.145(f)(5). When another financial instrument may become required to be used to comply with 40 CFR 264.145, then Total will adjust the post-closure estimate within 60 days of the anniversary date of the establishment of the financial instrument(s).

Total will maintain a copy of the current annual post-closure cost estimate and latest adjusted remaining post-closure cost estimate at the facility offices at the refinery during the

post-closure period, similar to the requirement in 40 CFR 264.144(d).

11.2 Post-Closure Financial Assurance Mechanism (40 CFR 264.145)

Exhibit 12-1 is a copy of Total's current financial test and corporate guarantee for post-closure care under 40 CFR 264.145(f). Also included is correspondence from the KDHE accepting the financial assurance mechanism.

EXHIBIT 11-1

POST-CLOSURE COST ESTIMATES FOR
#1 AND #2 SURFACE IMPOUNDMENTS

Cost A: 1998 Upgrade of #1 and #2 Groundwater Monitoring System (Assume Based on 8 wells)

Item	Costs	Amount
Installation Management, Testing, Reporting	8 wells x $16,000/well	$128,000
First Round Sampling	8 wells x 4 man hr/well/event x $40/hr x 1 event	$1,280
First Round Analyses	8 wells x $1000/sample x 1 sample/well	$8,000
Sample Shipment	$100/event x 1 event	$100
	Total Cost A	$137,380

Cost B: Annual Groundwater Monitoring After Upgrade (Assume Based on 8 wells)

Item	Costs	Amount
Sampling	8 wells x 4 man hr/well/sampling x 4 samplings/event x 2 event/year x $40/hr	$10,240
Analysis	8 wells x 4 samples/well/event x $1000/sample x 2 event/year	$64,000
Sample Shipment	$100/sampling x 4 sampling/event x 2 event/year	$800
	Total Cost B	$75,040

Cost C: Annual Maintenance Cost for Closed #1 and #2 Surface Impoundments

Item	Cost	Amount
Estimated Average Lump Sum	$1000/year	$1000
	Total Cost C	$1000

Annual Post-Closure Cost Estimate (Excluding One-time Costs):

Cost B + Cost C = $76,040/year during post-closure period

TABLE 11-2

POST-CLOSURE COST ESTIMATE
ADJUSTMENT WORK SHEET

	A CURRENT ANNUAL COST ESTIMATE	B NO. OF REMAINING YEARS IN POST-CLOSURE	C CURRENT BASE YEAR DEFLATOR	D CURRENT YEAR DEFLATOR	E INFLATION FACTOR	F ADJUSTED POST-CLOSURE COST ESTIMATE	G KNOWN ONE TIME COST REQUIREMENT	H TOTAL ADJUSTED POST-CLOSURE COST ESTIMATE
1984								
1985	75,000	20	N/A	N/A	N/A	2,101,125	127,380	92,206,505
1986								
1987								
1988								
1989								
1990								
1991								
1992								
1993								
1994								
1995								
1996								
1997								
1998								
1999								
2000								

NOTES:

A: The annual cost estimate is taken from Table 11-1 (last revised November, 1989) and will be revised in the future based on any change in post-closure plans or post-closure permit requirements.

B: The number of remaining years decreases yearly beginning with 20 remaining years in 1988 according to the approved post-closure plan. The number of remaining years is also subject to other decrease or increase according to 40 CFR 264.117(a)(2).

C: The current base year is the most recent year in which the annual cost estimate in Column A was revised (see Table 11-1). The current base year deflator then is the deflator obtained as in Note D for the base year. Until revised, 1989 is the current base year.

D: The current year deflators are the most recent yearly Implicit Price Deflators for Gross National Product as are published by the U.S. Department of Commerce in its Survey of Current Business. Contact the U.S. department of Commerce, Bureau of Economic Analysis at 202-523-0777.

E: Column E = Column D/Column C

F: Column F = Column A x Column B x Column E

G: Column G should include any foreseen required one time expenditures for the coming year.

H: Column H = Column F + Column G. Column H is the Post-Closure Cost Estimate amount for which the current financial mechanism under 40 CFR 264.142 must provide coverage.

EXHIBIT 11-1

POST-CLOSURE FINANCIAL ASSURANCE MECHANISM

State of Kansas
Mike Hayden, Governor

Department of Health and Environment
Division of Environment

Joey C. Grant, Ph.D., Secretary

Forbes Field, Bldg. 740, Topeka, KS 66620-0001

(913) 296-1535
FAX (913) 296-6247

August 28, 1989

Ms. Patti Morgan
Total Petroleum, Inc.
1400 South "M" Street
Arkansas City, Kansas 67005

Re: RCRA Closure and Post-Closure Financial Assurance
EPA I.D. Number KSD087418695

Dear Ms. Morgan:

The revised letter from the chief financial officer submitted by Total Petroleum on August 18, 1989 has been reviewed. This letter was submitted to complete Total's financial test demonstration for closure and post-closure cost assurance.

All revisions requested in our letter of August 8, 1989 were adequately addressed. KDHE thus considers the Arkansas City facility to be in compliance with the closure and post-closure cost assurance requirements of 40 CFR 264 Subpart H. Since Total is using the financial test for closure and post-closure assurance, KDHE is releasing Letter of Credit No. 120697 and the Standby Trust Agreement established on July 22, 1986. These instruments are no longer needed to demonstrate compliance with RCRA regulations in Kansas; they are being returned to you with this letter for further handling.

If you have any questions concerning this letter please call me at (913) 296-1612.

Sincerely,

Brenda Clark

Brenda Clark
Environmental Engineer
Hazardous Waste Section
Bureau of Air and Waste Management

df/tpc&plass.bc
Enclosures
C Dale Stuckey
Rita Huff

Charles Konigsberg, Jr., M.D., M.P.H.
Director of Health
(913) 296-1343

James Power, P.E.,
Director of Environment
(913) 296-1535

Lance Phillips, Ph.D.,
Director of Information Systems
(913) 296-1415

Roger Carlson, Ph.D.,
Director of the Kansas Health and Environmental Laboratory
(913) 296-1619

TOTAL
Total Petroleum, Inc.

ONE DENVER PLACE - SUITE [illegible]
999 18TH STREET
DENVER, COLORADO 80202

TELEPHONE 303 [illegible]

MAILING ADDRESS
P. O. BOX [illegible]
DENVER, COLORADO 80201-[illegible]

ROBERT C. SMITH
TREASURY MANAGER

August 18, 1989

Kansas Department of Health and Environment
Forbes Field
6700 SW Topeka Boulevard, Building 740
Topeka, KS 66620-0001

Attention: Ms. Brenda Clark
Hazardous Waste Section
Bureau of Waste Management

Gentlemen:

Enclosed is the revised CFO letter for use in showing compliance with the financial assurance regulations pertaining to the hazardous waste facilities located at our Arkansas, KS refinery. This letter includes those changes highlighted in your letter of August 8, and which you and I discussed on August 15. I hope this will bring us into compliance with the relevant requirements under State environmental laws.

It is our intent to use the financial test demonstrations wherever the financial results for Total Petroleum Inc. for a particular fiscal year pass the requirements of Part 264.143(f). Thus, for 1989 we would rely on the financial test and request that you release Total Petroleum Inc. from the letter of credit and Standby Trust Fund we put in place in 1986. To cancel the letter of credit, please return the original document to Mr. Mike Morris at the Bank of America, along with a letter indicating that the letter of credit is no longer needed and may be canceled by the Bank. Mike's address is:

Bank of America NT & SA
International Corporate
DFI Group 5117
355 Madison Avenue
New York, NY 10017

Thanks again for your help in answering my questions on the CFO's letter. If you have any questions, please call me at 303/291-2088.

Regards,

Robert C. Smith
SMB

Robert C. Smith
Treasury Manager

RCS/mcd
Enclosure

OTAL
Total Petroleum, Inc.
DENVER PLACE NORTH TOWER
999 18TH STREET, SUITE 2201
DENVER, COLORADO 80202-2499
TELEPHONE 303 291-2000
MAILING ADDRESS
P.O. BOX 999
DENVER, COLORADO 80201-0999

August 18, 1989

Secretary of the Kansas Department of Health
and Environment
State of Kansas
Forbes Field
Topeka, KS 66620-0001

Attention: Ms. Brenda Clark
Hazardous Waste Section
Bureau of Waste Management

Dear Ms. Clark:

I am the chief financial officer of Total Petroleum, Inc., One Denver Place, Suite 2201, 999-18th Street, Denver, Colorado 80202. This letter is in support of this firm's use of the financial test to demonstrate financial assurance, as specified in Subpart H of 40CFR Parts 264 and 265.

This firm is the owner or operator of the following facilities for which financial assurance for closure or post-closure care is demonstrated through the financial test specified in Subpart H of 40CFR Parts 264 and 265. The current closure and/or post-closure cost estimates covered by the test are shown for each facility:

SEE SCHEDULE ATTACHED

This firm guarantees, through the corporate guarantee specified in Subpart H of 40CFR Parts 264 and 265, the closure or post-closure care of the following facilities owned or operated by subsidiaries of this firm. The current cost estimates for the closure or post-closure care so guaranteed are shown for each facility:

NONE

In states were EPA is not administering the financial requirements of Subpart H of 40CFR Parts 264 and 265, this firm, as owner or operator or guarantor, is demonstrating the financial assurance for the closure or post-closure care of the following facilities through the use of a test equivalent or substantially equivalent to the financial test specified in Subpart H of 40CFR Parts 264 and 265. The current closure and/or post-closure cost estimates covered by such a test are shown for each facility.

Arkansas City Refinery
1400 S. M Street
Arkansas City, KS
EPA ID No. KSD007418695

Facility	Closure Cost Estimate	Post Closure Cost Estimate	Total
Drainage Ditch	$ 61,400	$ 20,970	$ 82,370
Land Treatment Unit	$ 28,021	$201,755	229,776
Surface Impoundment	$ 0	$141,228	141,228
			$453,374

This firm is the owner or operator of the following hazardous waste management facilities for which financial assurance for closure or, if a disposal facility, post-closure care, is not demonstrated either to EPA or a State through the financial test or any other financial assurance mechanism specified in Subpart H of 40CFR Parts 264 and 265 or equivalent or substantially equivalent State mechanisms. The current closure and/or post-closure cost estimates not covered by such financial assurance are shown for each facility:

NONE

This firm is the owner or operator of the following UIC facilities for which financial assurance for plugging and abandonment is required under Part 144. The current closure cost estimates as required by 40 CFR 144.62 are shown for each facility:

	Closure Cost Estimate
Waste Disposal Well #2 Alma, NI	$41,800

This firm is not required to file a form 10K with the Securities and Exchange Commission (SEC) for the latest fiscal year.

The fiscal year of this firm ends on December 31. The figures for the following items marked with an asterisk (*) are derived from the firm's independently audited year-end finascial statements for the latest completed fiscal year ended December 31, 1988.

Alternative I

1. Sum of current closure and post-closure cost estimates..... $ 3,377,934

* 2. Total Liabilities..... 482,169,000

*	3. Tangible Net Worth.....	324,507,000
*	4. Net Worth.....	324,507,000
*	5. Current Assets.....	323,885,000
*	6. Current Liabilities.....	267,479,000
*	7. Net Working Capital.....	56,406,000
*	8. The sum of net income plus depreciation, depletion, and amortization.....	137,051,000
*	9. Total Assets in U.S.....	806,676,000
	10. Is line 3 at least $10 million?.....	YES
	11. Is line 3 at least 6 times line 1?.....	YES
	12. Is line 7 at least 6 times line 1?.....	YES
*	13. Are at least 90% of firm's assets located in the U.S.? If not, complete line 14.....	YES
	14. Is line 9 at least 6 times line 1?.....	YES
	15. Is line 2 divided by line 4 less than 2.0?.....	YES
	16. Is line 8 divided by line 2 greater than 0.1?.....	YES
	17. Is line 5 divided by line 6 greater than 1.5?.....	NO

I hereby certify that the wording of this letter is identical to the wording specified in 40CFR 264.151(f) as such regulations were constituted on the date shown immediately below.

Richard E. Dana
Vice President Finance, Treasurer
and Controller

August 18, 1989
Date

*

SCHEDULE OF HAZARDOUS WASTE FACILITIES

		Costs $
1.	ALMA REFINERY WASTE WATER PONDS E. Superior Street Alma, MI	
*	EPA ID No. MID005358130 Closure Cost Estimate: Post-Closure Cost Estimate:	 $305,400 9,100
2.	ALMA REFINERY LAND TREATMENT FACILITY Alma, MI	
	EPA ID No. MID005358130 Closure Cost Estimate: Post-Closure Cost Estimate:	 $ 850,000 1,076,500
3.	CRYSTAL STATION Alma, MI	
	EPA ID No. MID000780486 Closure Cost Estimate:	 $11,900
4.	WOW #2 WELL Alma, MI	
	EPA ID No. TBA Closure Cost Estimate:	 $41,800
5.	ARKANSAS CITY REFINERY 1400 S.M. Street Arkansas City, KS	
	EPA ID No. KSD007418695 Closure Cost Estimate: Post-Closure Cost Estimate:	 $ 89,471 363,953
6.	OKLAHOMA LAND TREATMENT FACILITY P. O. Box 188 Ardmore, OK	
	EPA ID No.OKD057705972 Closure Cost Estimate: Post-Closure Cost Estimate:	 $ 72,701 556,359
		$3,377,934

*

* We believe this facility carries same number as the Refinery Land Treatment Facility.

State of Kansas

Bill Graves — Governor

Department of Health and Environment

Gary R. Mitchell, Secretary Designee

May 2, 1997

Mr. Jim Charles
Environmental Manager
Total Petroleum, Inc.
1400 South M Street
Arkansas City, KS 67005

CERTIFIED MAIL: P 419 226 926

Re: **Total Petroleum, Inc. - Arkansas City Refinery**
#3A Aerated Lagoon, RCRA Interim Status Closure Plan
Arkansas City, KS
EPA ID No. KSD087418695

Dear Mr. Charles:

The Public Comment period concerning the closure plan for the interim status hazardous waste treatment operation in the #3A Aerated Lagoon at your facility ended on January 17, 1997. No adverse comments were received. Further review of the closure plan by KDHE indicated a few additional discrepancies which were pointed out in comments to Total via a letter dated February 11, 1997. The comments in the KDHE letter have been sufficiently addressed by Total with final revisions to the above referenced closure plan. The final revised closure plan dated April 28, 1997 is therefore approved as submitted.

In accordance with 40 Code of Federal Regulation (CFR) § 265.115, you should submit certification both by the facility owner or operator and by an independent registered professional engineer that the treatment operation in the #3A Aerated Lagoon has been closed in accordance with 40 CFR Part 265 standards and the approved closure plan. The closure activities for the #3A Aerated Lagoon must be completed on or before October 28, 1997. The certification of closure with supporting documentation must be received by KDHE within 60 days of completion of closure.

If you have any questions regarding this letter, please call me at (913) 296-6562.

Sincerely,

Andrea L. Austin, M.S.
Environmental Scientist
Hazardous Waste Facilities Unit
Permits Section

ALA

C: Wes Bartley - EPA Region VII/ RCRA Permitting and Compliance Branch
Mark Bradbury - DEA/SCDO/Waste Programs
Joseph Mednick - Eneco Tech, Inc.

Division of Environment, Bureau of Waste Management, Forbes Field Building 748, Topeka, Kansas 66620-0001
Telephone: (913) 296-6562
Fax Number: (913) 296-1599

Printed on Recycled Paper

RCRA Interim Status Closure Plan
#3A Aerated Lagoon
Total Petroleum, Inc.
Arkansas City, Kansas

Prepared for:

Total Petroleum, Inc.
1400 South M Street
Arkansas City, Kansas 67005

Prepared by:

EnecoTech Inc.
1580 Lincoln Street, Suite 1000
Denver, Colorado 80203

April 30, 1997

Project Number : 01-0138R-010

EnecoTech

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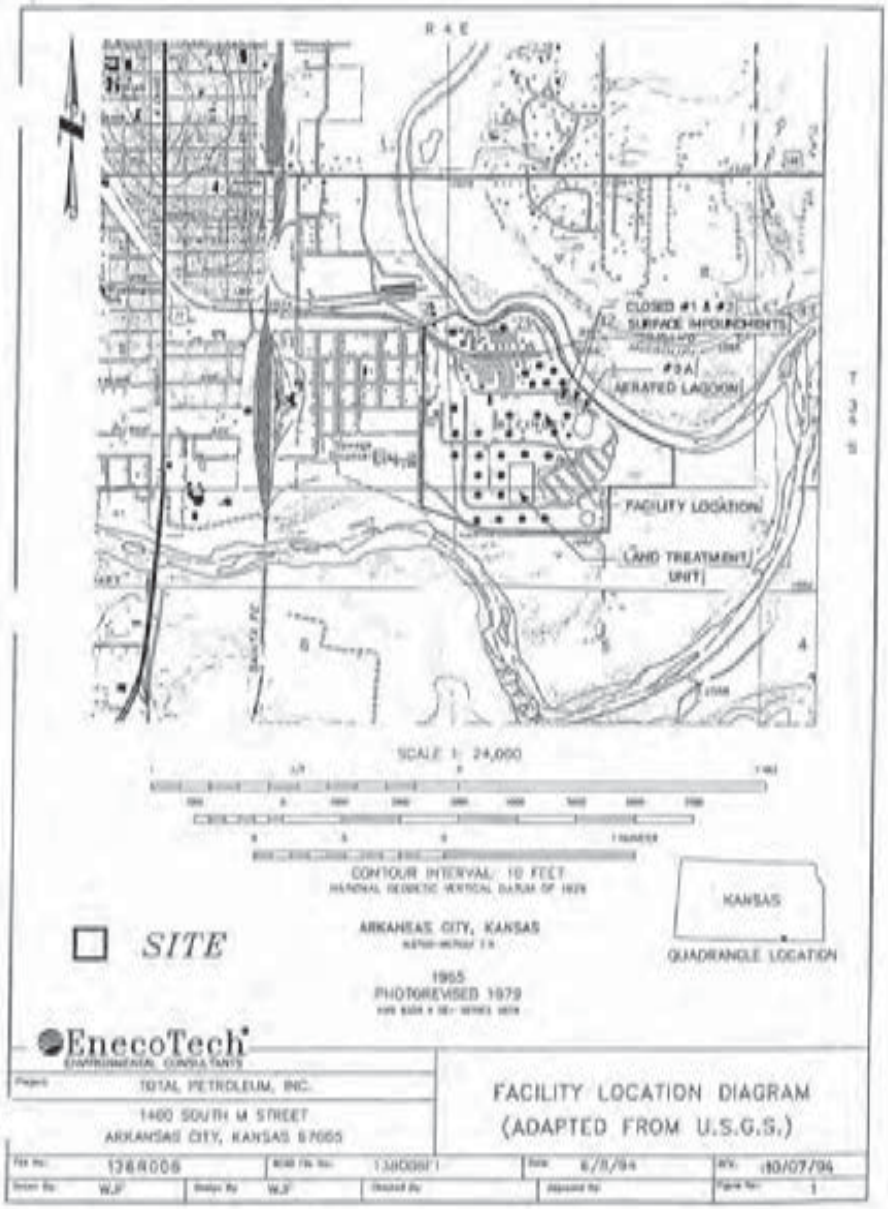
1.0 Introduction

This document presents the revised Closure Plan for the #3A Aerated Lagoon, which is located at the Total Petroleum, Inc. (Total) Refinery in Arkansas City, Kansas (Refinery). This revised closure plan incorporates comments from the Kansas Department of Health and Environment (KDHE) comments dated May 30, 1996. The statutory language of RCRA and applicable regulations require that the #3A Aerated Lagoon be retrofitted to meet minimum technology requirements (MTR). The regulations require compliance with MTR by September 25, 1994, which is 48 months after the effective date of the MTR regulations. Total modified their wastewater treatment system by installing a new tank system (bio-reactors) to replace the #3A Aerated Lagoon between September 1993 and September 20, 1994. Total then discontinued treatment of potentially hazardous wastewater in the impoundment on September 21, 1994, and plans to commence implementation of closure within thirty (30) days after this closure plan is approved. Accordingly, the Closure Plan for the #3A Aerated Lagoon is resubmitted herein for approval, so that closure can be implemented.

The closure plan provided herein is designed to meet the closure requirements of 40 CFR Part 265 Subpart G and the specific requirements for surface impoundments (40 CFR § 265.228). This plan specifically addresses closure of the #3A Aerated Lagoon. Total is committed to efficiently addressing corrective measures at the Facility to protect human health and the environment, therefore, Total will perform closure of the #3A Aerated Lagoon in a manner that minimizes both the need for maintenance and the potential for release of hazardous constituents from the unit after closure as required by the closure performance standard of 40 CFR § 265.111. This closure plan may be amended if, upon implementation of this plan, any unexpected condition occurs as provided by 40 CFR § 265.112(c). The approved closure plan, and any future revisions, will be maintained on file at the Refinery until certification of final closure has been submitted and accepted by KDHE, to fulfill the requirements of § 265.112(a).



2.0 Facility Description

2.1 Facility Location

Total is the current owner and operator of the Total Petroleum Refinery located southeast of the incorporated limits of Arkansas City in southwestern Cowley County, Kansas. The Refinery was initially constructed in the 1920's and has had several different owners prior to purchase by Total Petroleum, Inc., in April, 1978. The Total Petroleum Refinery complex occupies approximately 300 acres and is located near the confluence for the Walnut River and the Arkansas River. A site location map is presented as Figure 1.

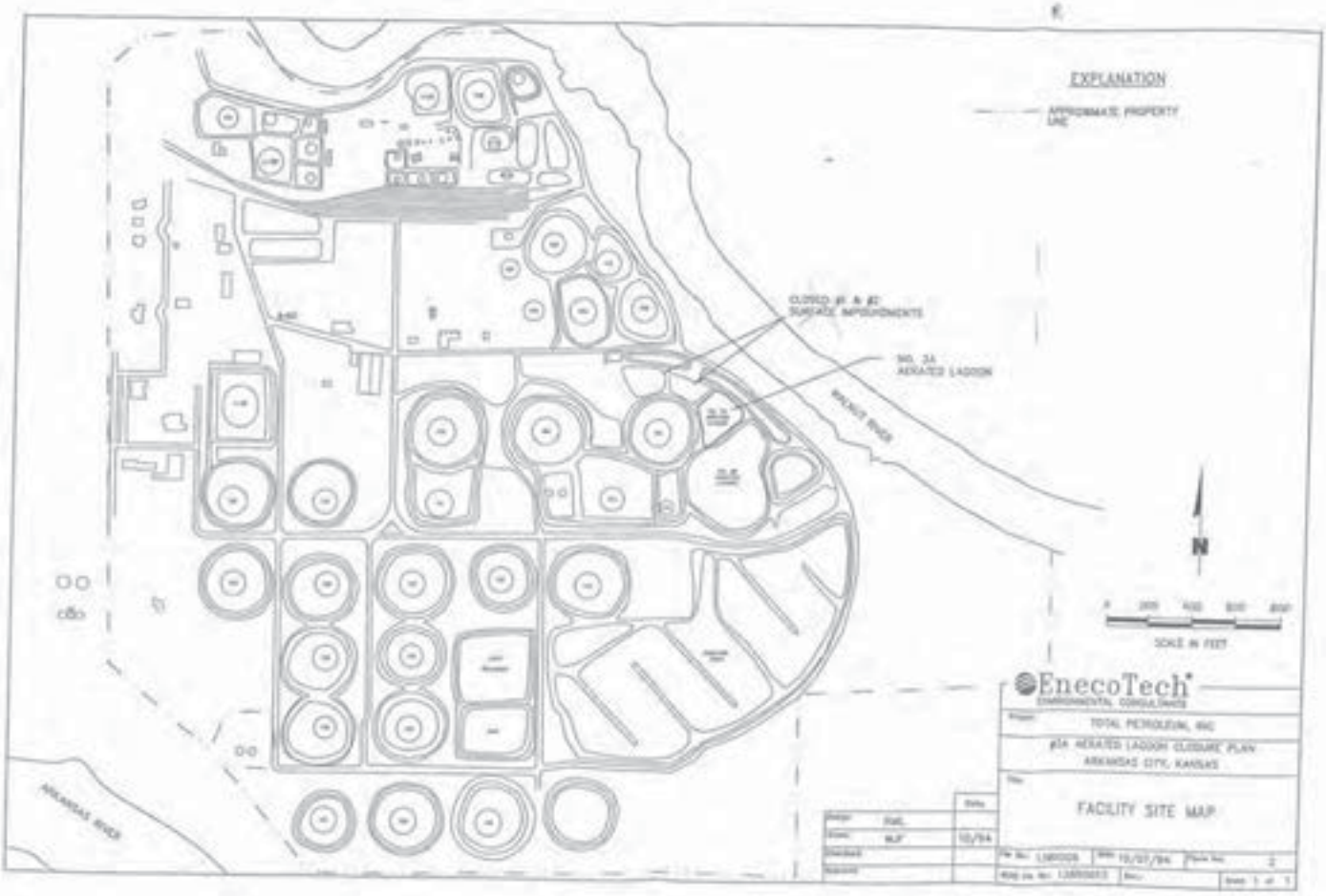
The Facility is located within parts of Section 31 and 32 of Township 34 South and Range 4 East; and Section 5 of Township 35 South and Range 4 East, in Cowley County, Kansas. The #3A Aerated Lagoon is located at the east central boundary of the Refinery, adjacent to the Walnut River. The #3A Aerated Lagoon was utilized as part of the Refinery Wastewater Treatment System until September 21, 1994, at which time it was replaced by the Refinery's new tank system. The location of the #3A Aerated Lagoon is presented in Figure 2.

2.2 Facility Products and Operating Capacity

The Refinery currently has a nominal operating capacity of 60,000 barrels per stream day. Products produced at the Refinery include unleaded gasoline, liquefied petroleum gas (LPG), propylene, fuel oils, jet fuels, and asphalt. The Refinery receives approximately 90% of its crude oil supply by pipeline and transports approximately 90% of its refined products by pipeline. The remaining product is transported by truck.

2.3 Facility Security

The #3A Aerated Lagoon is located within the interior of the Refinery. Total operates and maintains an established security system for the entire Refinery which is designed to prevent unknowing entry and to minimize the possibility for the unauthorized entry of persons or livestock into the Refinery, including the areas of permitted hazardous waste management units.


EXPLANATION
APPROXIMATE PROPERTY LINE
CLOSED #1 & #2 SURFACE IMPOUNDMENTS
NO. 3A AERATED LAGOON
WALNUT RIVER
ARKANSAS RIVER
N
SCALE IN FEET
EnecoTech
ENVIRONMENTAL CONSULTANTS
TOTAL PETROLEUM, INC
#3A AERATED LAGOON CLOSURE PLAN
ARKANSAS CITY, KANSAS
FACILITY SITE MAP
10/94

The Refinery is fenced on three sides in accordance with 40 CFR § 264.14(b)(2). The northeast side of the Refinery is not fenced but is bounded by the Walnut River. The size of the Walnut River and the steep bank between the river and the active area of the Refinery form an effective natural barrier against unknowing or unauthorized entry on the northeast side of the Refinery. Upon Total's request, KDHE reviewed this natural barrier and concluded that the natural barrier created by Walnut River satisfies the requirements of § 264.14(b)(2) for issuance of Total's existing hazardous waste permit number KSD087418095. These security provisions are currently employed under the existing RCRA permit.

Entrance gates at the Refinery are either locked or guarded at all times. Total maintains a security guard force who identify all employees and visitors before allowing entry to the Facility. The security guards are present 24 hours per day. The Operations Department provides surveillance inside the Refinery.

There are four warning signs posted at #3A Aerated Lagoon. The signs bear the legend, "Danger-Keep Out-Authorized Personnel Only". The signs are legible from a distance of 25 feet. A sign is posted at each of the four corners of the #3A Aerated Lagoon.

3.0 Description of the #3A Aerated Lagoon

3.1 #3A Aerated Lagoon Description and Design Capability

The #3A Aerated Lagoon, an aggressive biological treatment unit, was a component of the Refinery's wastewater treatment system until September 21, 1994. The #3A Aerated Lagoon is an irregularly shaped surface impoundment that is approximately 200 feet by 200 feet and covers approximately 35,700 square feet. The lagoon has sloping walls which vary between a 2:1 and 4:1 ratio of horizontal to vertical, that contain dikes and had a freeboard of 2.42 feet. The #3A Aerated Lagoon has a compacted soil liner, the thickness will be investigated during the closure sampling.

The design capability of the #3A Aerated Lagoon at its maximum operating capacity was 252,634 cubic feet or 1,889,702 gallons. The lagoon had an influent rate of up to 900 gallons per minute, and an hydraulic retention time of approximately 1.5 days. The lagoon was equipped with three 10-horsepower (hp) aerators mounted on floating tri-pontoon assemblies. To satisfy the definition of aggressive biological treatment by high rate aeration, a minimum of 6 hp per million gallons of treatment volume is required per 40 CFR §261.31 (b)(2). The #3A Aerated Lagoon had 30 hp of aeration which exceeds the calculated minimum requirement of 11.4 hp for the #3A Aerated Lagoon. The #3A Aerated Lagoon met the definition of an aggressive biological treatment unit.

3.2 Construction History of the #3A Aerated Lagoon

The #3A Aerated Lagoon was created in 1990 as a subunit of the former existing #3 Aerated Lagoon. Total reconstructed the former #3 Aerated Lagoon by subdividing it and constructing the #3A Aerated Lagoon and the #3B Aerated Lagoon, as shown in Figure 2. This reconstruction was completed before the effective date of the RCRA toxicity characteristic (TC) regulations of September 25, 1990 (Section 2.5 of Total's *Part B Permit Renewal Application* (RSA, November 1992)). During reconstruction, the #3 Aerated Lagoon was drained, sludges removed, construction of the dike that now separates the #3A Aerated Lagoon and the #3B Aerated Lagoon was completed, bottom soils were compacted, and construction of new appurtenant features and equipment was completed on or before September 24, 1990. The #3A Aerated Lagoon was an operating component

of the Refinery's wastewater system from September 25, 1990 until September 21, 1994. The #3A Aerated Lagoon was replaced by the Refinery's new tank-based biological-reactor system in September 1994.

3.3 #3A Aerated Lagoon Ground Water Monitoring

Total installed RCRA ground water monitor wells upgradient and downgradient of the #3A Aerated Lagoon in 1993. As shown in Figure 3, monitoring well RCRA-MW-4 is upgradient of the lagoon, and wells RCRA-MW-1, -2, and -3 are downgradient of the lagoon. The ground water flow direction is from the southwest toward the northeast. The ground water table elevation ranges from 1046.51 feet above mean sea level (AMSL) at upgradient ground water monitoring well RCRA-MW4 to approximately 1046.02 feet AMSL at downgradient monitoring well RCRA-MW2 (measured in October, 1995). The change in the ground water hydraulic head between the upgradient and downgradient monitoring wells is approximately 0.5 feet. The depth to ground water is approximately 23 feet below the measuring point elevation at the #3A Aerated Lagoon ground water monitoring wells. Total commenced collection and analysis (BPI ground water parameters) of ground water samples from these four lagoon monitoring wells on a quarterly basis after their installation in 1993.

4.0 #3A Aerated Lagoon Closure

4.1 Background

The wastewater that entered the #3A Aerated Lagoon exhibited the benzene TC (hazardous waste code D018) during the operational life of the unit. Based on historical testing, neither the wastewater inventory nor the sludge inventory have exhibited the benzene TC or any other hazardous waste characteristic (Appendix A). Waste characterization of the liquid wastewater and sludge were conducted in September and October 1994. Due to aggressive aeration of the unit (Section 3.1), the wastewater managed in the #3A Aerated Lagoon is not a listed F037 waste.

4.2 #3A Aerated Lagoon Closure Constituents

The soil closure constituents are presented in Table 1. These soil closure constituents will be addressed during closure.

4.3 Closure Performance Standard (40 CFR § 265.111)

This closure plan has been designed to satisfy the performance standard in accordance with the requirements of 40 CFR § 265.111. The closure performance standard states that the Facility must be closed in a manner that:

- Minimizes the need for further maintenance;
- Controls, minimizes or eliminates, to the extent necessary to protect public health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere; and
- Complies with the closure and post closure care requirements of Subparts G and K (§ 265.228(a)(1)).

The specific criteria to demonstrate the clean soil closure performance standard is described in Section 4.5. These criteria meet the specific standards outlined above.

Table 1
List of #3A Aerated Lagoon Closure Analytes

	Cleanup Goals[1,2] (mg/kg)		Target PQL (mg/kg)
	Non-Residential	Residential	
METALS			
Antimony	135	9	3
Arsenic	100	7	5
Barium	24000	1600	2.5
Cadmium	170	12	2.5
Chromium	1700	120	2.5
Cobalt	8kg	8kg	2.5
Lead	1000	400	2.5
Mercury	20	2	0.01
Nickel	6800	470	2
Selenium	1700	120	5
Vanadium	2400	160	2.5
VOLATILE ORGANIC COMPOUNDS			
Acetone	1975	1300	0.01
Benzene	2	1	0.01
Carbon Disulfide	10	7	0.01
Carbon Tetrachloride	0.7	0.4	0.01
Chlorobenzene	99	55	0.01
Chloroform	0.6	0.3	0.01
1,2-Dichloroethane	0.6	0.035	0.01
1,1-Dichloroethene	0.035	0.02	0.01
1,4-Dioxane	30	16	0.01
Ethylbenzene	1980	1980	0.01
Ethylene Dibromide[3]	0.03	0.007	0.01
Methyl Ethyl Ketone	7600	9000	0.01
Styrene	1385	1385	0.01
Toluene	1500	980	0.01
Trichloroethylene	11	6	0.01
Xylene	630	630	0.01

TABLE 1
LIST OF #3A AERATED LAGOON CLOSURE ANALYTES (CONTINUED)

	Cleanup Goals[1,2] (mg/kg)		Target PQL (mg/kg)
	Non-Residential	Residential	
SEMIVOLATILE COMPOUNDS			
ACID COMPOUNDS			
Cresols[4]	16871	1102	0.35
2,4-Dimethylphenol	6750	465	0.35
2,4-Dinitrophenol	675	45	0.35
4-Nitrophenol	Bkg	Bkg	0.35
Phenol	200000	14000	0.35
BASE/NEUTRAL COMPOUNDS			
Anthracene	80	80	0.35
Benzo(a)anthracene	4	0.85	0.35
Benzo(b)fluoranthene	4	0.85	0.35
Benzo(k)fluoranthene	4	0.85	0.35
Benzo(a)pyrene	0.4	0.1	0.35
Bis(2-ethylhexyl) phthalate	200	45	0.35
Butylbenzylphthalate	67500	4650	0.35
Chrysene	390	85	0.35
Dibenzo(a,h)anthracene	0.4	0.1	0.35
1,2-Dichlorobenzene	1400	1400	0.35
1,4-Dichlorobenzene	16	9	0.35
Diethylphthalate	270000	18600	0.35
7,12-Dimethylbenz(a)anthracene	Bkg	Bkg	0.35
Dimethylphthalate	Bkg	Bkg	0.35
Di(n)butylphthalate	Bkg	Bkg	0.35
Di(n)octylphthalate	6750	465	0.35
Fluoranthene	13600	940	0.35
Indene	Bkg	Bkg	0.35
1-Methylnaphthalene	Bkg	Bkg	0.35
Naphthalene	500	500	0.35
Phenanthrene	Bkg	Bkg	0.35
Pyrene	10000	700	0.35
Pyridine	340	93	0.35
Quinoline	Bkg	Bkg	0.35

TABLE 1
LIST OF #3A AERATED LAGOON CLOSURE ANALYTES (CONTINUED)

	Cleanup Goals[1,2] (mg/kg)		Target PQL (mg/kg)
	Non-Residential	Residential	
BASE/NEUTRAL COMPOUNDS (continued)			
2-Methyl Naphthalene	Bkg	Bkg	0.35
Acenaphthylene	Bkg	Bkg	0.35
Dibenzofuran	Bkg	Bkg	0.35
Fluorene	300 (sat)	300 (sat)	0.35

Notes:

1) Kansas Department of Health and Environment, Interim Remedial Guidelines for Contaminated Soils. 6 pg. plus References, Appendix, and Table August 1995.

2) See Section 4.5 for discussion on the development of risk-based cleanup goals for compounds where the goal is listed as background.

Bkg Indicates background.

3) Cleanup goals for Ethylene Dibromide developed using the following equations for residential and non-residential scenarios. Slope factors are from IRIS (IRIS, April 1997).

Residential Carcinogenic Ingestion Risk

$$CGI = \frac{CDI(mg/kg/day)\times 10^{-6}\times(\text{risk/carcinogenic})}{15\,kg \times 25{,}550\,days} + \frac{CDI(mg/kg/day)\times 10^{-6}\times(\text{risk/carcinogenic})}{70\,kg \times 25{,}550\,days}$$

OR: $CDI = CS \times (1.15^{-6} + 4.70^{-6})$

OR: $CDI = CS \times 1.47E^{-5}$

Slope Factor for Ethylene Dibromide = 0.50 x 1 (mg/kg/day)

And: $Risk = CDI \times SF_c$

OR: $10^{-6} = CS \times 1.47E^{-5} \times SF_c$

OR: $CS\,(PQL) = \frac{0.68}{SF_c}$

Non-Residential Carcinogenic Ingestion Risk

$$CDI = \frac{CS \times 100\,mg/day \times 10^{-6} \times 1{,}095\,days/yr \times 25\,years}{70\,kg \times 25{,}550\,days}$$

OR: $CDI = CS \times 4.46^{-6}$

And: $Risk = CDI \times SF_c$

OR: $10^{-6} = CS \times 4.46^{-6} \times SF_c$

OR: $CS\,(PQL) = \frac{0.67}{SF_c}$

4) Cleanup goals for Cresol developed using the following equations for residential and non-residential scenarios. Reference dose is from IRIS (IRIS, April 1997).

Residential Non-Carcinogenic Ingestion Risk

$$CDI = \frac{CDI(mg/kg/day)\times 10^{-6}\times(\text{risk/noncarcinogenic})}{15\,kg \times 2{,}190\,days} + \frac{CDI(mg/kg/day)\times 10^{-6}\times(\text{risk/noncarcinogenic})}{70\,kg \times 8{,}760\,days}$$

OR: $CDI = CS \times (1.26^{-6} + 1.71^{-6})$

OR: $CDI = CS \times 1.42E^{-5}$

Reference Dose for Cresols = .05 (mg/kg/day)

Table 1
List of #3A Aerated Lagoon Closure Analytes (Continued)

Ant. Hazard index = $\frac{CDI}{RfD_o}$

OR: $0.33 = \frac{CDI \times 1.428^{-7}}{RfD_o}$

OR: $CDI(0.0)$ = $0.33 \times RfD_o$

Non-Residential Non-Carcinogenic Ingestion Risk

$CDI = \frac{CR \times 350\ mg/day \times 10^{-6} \times 1 \times 250\ days/yr \times 25\ years}{70\ kg \times 9,125\ days}$

OR: $CDI = CR \times 9.798^{-7}$

Ant. Hazard index = $\frac{CDI}{RfD_o}$

OR: $0.33 = \frac{CR \times 9.798^{-7}}{RfD_o}$

OR: $CR(0.0)$ = $0.33(0.0) \times RfD_o$

Chemical Dose Intake

$CDI\ (mg/kg\text{-}day) = \frac{CR \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$

Explanation of Acronyms

Parameter	Value
CDI = chronical daily intake (mg/kg-day, mg/m^3-day)	
CR =	child: 400 mg/day Adult: 350 mg/day Worker: 350 mg/day
IR = ingestion rate	
CF = conversion factor	1000
FI = fraction ingested/absorbed	365 days/year 250 days/year
EF = residential exposure frequency	child: 6 years adult: 24 years
EF = non-residential exposure frequency	worker: 25 years
ED = residential exposure duration	
ED = non-residential exposure duration	
BW = body weight	child: 15 kg adult: 70 kg worker: 70 kg
AT = averaging time carcinogens - 70 years non-carcinogens - 6 years non-carcinogens - 24 years non-carcinogens - 25 years	25,550 days child: 2,190 days adult: 8,760 days worker: 6,125 days
RfD = oral slope factor	chemical specific

4.4 Closure Plan Approach

As a result of discussions with KDHE, Total will close the #3A Aerated Lagoon in accordance with 40 CFR §265.228, by removing soil impacted above the KDHE risk-based closure cleanup standards for soil, or alternate site specific risk based levels described in the contingent closure discussion in Section 4.13, with provisions for post closure care and monitoring. Risk-based closure of the soils will enable Total to construct over the unit in accordance with the provisions of 40 CFR §265.117(c)(1) . At this time there are no plans for post-closure construction on the unit. The post-closure plan will be modified and submitted to KDHE for approval when construction plans are prepared and before construction begins.

4.5 Risk-Based Soil Closure Criteria

The closure approach described in Section 4.4 is to remove soil that exceeds the KDHE risk-based non-residential closure clean-up standards (Table 1), or alternate clean-up goals discussed in the contingent closure, Section 4.13. If a clean-up level is less than the laboratory's practical quantitation limit (PQL) for an analyte, then the PQL will be used as the clean-up level.

KDHE has not developed risk-based cleanup goals for certain closure compounds presented on Table 1. The cleanup goal listed in Table 1 for these compounds is described as "background." Total will develop risk-based cleanup goals for compounds lacking a KDHE cleanup goal. For compounds without KDHE cleanup goals a structure activity relationship (SAR) will be used to estimate appropriate toxicity criteria.

The SAR approach is based on the concept that chemical and biological effects are the result of interactions between chemicals and one or more components of a biological system that are capable of reversible or covalent bonding with a xenobiotic (i.e., receptors or molecular sites of action) (Lipnick, 1995). Changes in chemical structure are interrelated with physicochemical properties of the chemical, and influence potency and type of physiological response resulting from exposure (Lipnick, 1995). The types of physicochemical properties typically used in SAR studies include hydrophobicity (e.g., octanol-water partition coefficient, water solubility), and steric parameters

(i.e., bulk or shape parameters) (Lipnick, 1995). Molecular weight is an example of a parameter used to define bulk.

A literature review will be performed to obtain the most current information regarding the toxicity and availability of toxicity criteria for the compounds of interest. The Integrated Risk Information System (IRIS) will be queried for information pertaining to various compounds. Data for other compounds for which EPA toxicity criteria are available will be reviewed as potential surrogates. The molecular formula and molecular weight of each chemical and potential surrogate compound will be reviewed.

The human health toxicity criteria obtained by the SAR methodology described above will be used to develop the residential and non-residential risk-based cleanup goals where the goal is listed as background, in Table 1.

4.6 Maximum Waste Inventory

The wastewater within the #3A Aerated Lagoon has not exhibited the TC for benzene (D018) or otherwise been a RCRA hazardous waste. Therefore, there has not been any inventory or any maximum inventory of hazardous waste within the #3A Aerated Lagoon over the active life of the lagoon (§265.112 (b)(3)).

The #3A Aerated Lagoon contained both wastewater and sludge. The maximum inventory of wastewater is estimated to have been 1.93 million gallons and the maximum sludge inventory is estimated to have been 2,500 cubic yards .

4.7 Summary of Closure Procedures

The approach for the risk-based soil closure for Total's #3A Aerated Lagoon shall consist of:

- Soil sampling and comparison of soil analytical results with KDHE risk-based clean-up standards;
- Removal of unsaturated zone soil which exceed the KDHE non-residential risk-based clean-up standards or above levels determined through the contingent closure;

- Place non-hazardous excavated soil on the land treatment unit according to the permit conditions. Excavated soil exhibiting hazardous characteristics will be disposed at a RCRA disposal facility;
- Collect soil samples to verify removal of unsaturated zone soil which exceeds the KDHE clean-up standards or above levels determined through the contingent closure. Verification sampling will consist of the collection of two discrete VOC soil samples and four discrete soil samples composited into one sample for SVOC and Inorganic analyses from each quadrant.
- Decontamination of all appurtenances and equipment;
- Backfill the impoundment with clean fill;
- Perform post closure care; and
- Submittal of required closure certification in accordance with 40 CFR §265.115.

4.8 Soil Sampling

The #3A Lagoon will be divided into four quadrants of approximately 10,000 square feet or less. KDHE will be notified a minimum of 14 days before the soil sampling is conducted. Four soil samples will be collected from each quadrant from each depth interval at uniformly spaced sample locations.

The soil samples will be collected from four depth intervals; at the surface, at 1, 2, and 3 feet below the surface unless phase separated hydrocarbon contaminated soil is encountered. The sampling will include a sample one foot below the bottom of any identifiable liner. However, sampling will not continue into soil contaminated by phase separated hydrocarbon.

One randomly selected discrete sample from each depth interval, within each quadrant; not including the surface, will be collected for VOC analysis. Four additional discrete samples will be collected at each depth interval from within each quadrant that will be composited into a single composite sample for SVOC and inorganic analyses. In other words, if four depth intervals are sampled, a total of 12 discrete samples will be submitted for VOC analyses, 16 composite samples will be collected for SVOC analyses, and 16 composite samples will be collected for inorganic analyses. These samples will be submitted to a KDHE certified laboratory for analysis.

In addition to the soil samples collected as described above, Total will be prepared to collect and analyze up to five additional discrete soil samples identified by KDHE's representative at the time of sampling.

The soil samples will be collected using a clean stainless steel hand auger or a trowel. Before other composite soil samples are collected and prepared, discrete VOC samples will be collected and placed directly into soil sample jars and sealed immediately. The discrete soil samples for the remaining analytical parameters (SVOC and inorganic sample fractions) will be composited in a stainless steel bowl. Sample volumes are summarized on Table 2. The sample volumes presented on Table 2 include the necessary additional volume for the laboratory to perform the method specified quality assurance/quality control tests. Additional sample volume will be collected for KDHE sample splits. The KDHE representative will provide the containers for their sample splits.

The sample locations will be backfilled with soil withdrawn from the respective locations. The backfilled location will be marked with a wooden surveyors stake for future reference.

The soil samples will be analyzed for the closure constituents presented in Table 1. The results will be compared with the clean-up standards described in Section 4.5.

Non-dedicated sampling equipment will be decontaminated before use as described in Section 4.11.

4.9 Risk-Based Soil Closure Procedures

To achieve the risk-based soil closure at the #3A Aerated Lagoon, the unsaturated zone soil which exceed the KDHE non-residential risk-based clean-up standards or above levels determined through the contingent closure will be removed. The residential and non-residential land use closure clean-up standards are included in Table 1. If non-residential risk-based standards are selected, future residential use of the property will be prevented through a restrictive covenant on the property deed as described in Section 5.2 of this plan.

Before soils are excavated under this closure, samples will be collected and analyzed using the Toxicity Characteristic Leaching Procedure (TCLP) method for a contaminant in an initial sample that has a total concentration that is greater than or equal to 20 times the level listed in 40 CFR §261.24, Table 1, to determine if it exhibits the toxicity characteristic.

TABLE 2
CLOSURE ANALYTICAL METHODS, PRESERVATION AND CONTAINERS

Laboratory Parameter	EPA Method*	Container	Preservative	Media	Maximum Holding Time	Minimum Sample Volume**
RCRA Toxicity Characteristic	1311 (TCLP)	As specified below for specific sample fractions	Cool to 4°C	Soil	14 days[1] (extraction)	4 oz. per fraction
VOCs	8260 GC/MS	Glass-amber TLC	Cool to 4°C	Soil	14 days	4 oz.
SVOCs	8270 GC/MS	Glass-amber TLC	Cool to 4°C	Soil	7/40 days[2]	4 oz.
Metals (total)		Glass Teflon-lined cap	Cool to 4°C	Soil	6 months	4 oz.
Antimony	200.7 ICP				6 months	
Arsenic	200.7 ICP				6 months	
Barium	200.7 ICP				6 months	
Cadmium	200.7 ICP				6 months	
Chromium	200.7 ICP				6 months	
Cobalt	200.7 ICP				6 months	
Lead	200.7 ICP				6 months	
Nickel	200.7 ICP				6 months	
Selenium	200.7 ICP				6 months	
Vanadium	200.7 ICP				6 months	
Mercury	245.1 CVAAS				28 days	

NOTES: * EPA Methods include USEPA SW-846 Test Methods for Evaluating Solid Waste, Third Edition, Update 3 (September 1994); USEPA Methods for Chemical Analysis of Water and Waste.

** The sample volume indicated includes the additional volume required for matrix spikes and duplicates.

1 Initial extraction within 14 days, then analyze extract within method-specific holding times.

2 Extraction within 7 days then another 40 days for analysis.

Acronym Definitions:

TLC = Teflon lined cap

TCLP = Toxicity characteristic leaching procedure

GC/MS = Gas Chromatography/Mass Spectrometry

ICP = Inductively coupled plasma

CVAAS = Cold Vapor Atomic Absorption Spectroscopy

4.10 APPURTENANCE CLOSURE ACTIVITIES (40 CFR § 265.114)

During the closure all contaminated equipment and structures will be properly decontaminated. The flume connecting the former #5A Aerated Lagoon and the #3B lagoon will be decontaminated by power washing. The decontamination will continue until the residual contamination is either removed or until the high pressure cleaning no longer reduces any residual stains. The rinsate will be immediately collected, either with a vacuum truck or by pumping into a container and transported to the waste water treatment plant at the refinery.

4.11 DECONTAMINATION OF EQUIPMENT (40 CFR § 265.114)

All equipment used during the closure activities will be decontaminated at the heat exchanger bundle cleaning area. This location is paved and curbed to prevent runoff. Water in the cleaning area drains to the wastewater treatment plant. The decontamination will be accomplished using high pressure water and will be performed until visual inspection reveals no residual contamination. The decontamination water in the heat exchanger bundle cleaning area will drain to the wastewater treatment system.

To minimize the potential for cross contamination between samples, all tools, sampling devices, and measuring instruments will be thoroughly decontaminated between sampling locations and depths. The general decontamination procedures that will be observed are as follows:

- Wash equipment with a laboratory grade non-phosphate solution (Alconox or equivalent) and a stiff brush in a 10-gallon (approximate) wash basin about half filled, to remove all visible particles;
- Rinse with tap water (potable supply) in a second 10-gallon wash basin about half filled;
- Rinse with 95 percent reagent grade methanol (hexane can be substituted for methanol, as necessary) over a third wash basin to contain the methanol rinse. The methanol will be dispensed from a one quart plastic squeeze bottle or garden sprayer, clearly labeled "Methanol";

- Rinse with deionized water over a fourth empty 10-gallon basin to contain the deionized water rinse. The deionized water will be dispensed from a one quart plastic squeeze bottle or garden sprayer, clearly labeled "Deionized Water";
- Allow sampling equipment to air dry; and
- Wrap air dryed sampling equipment in aluminum foil (shiny side facing out) if necessary, to prevent contamination prior to use. Equipment wrapped in aluminum foil may be placed in a plastic bag for additional protection.

A decontamination area may also be setup near the #3A Aerated lagoon to handle sampling equipment decontamination. The sampling equipment decontamination solutions generated will be transferred to the wastewater treatment system.

4.12 Sampling Recordkeeping and Field Quality Assurance/Quality Control

4.12.1 *Sample Preservation, Handling, and Chain of Custody*

Samples will be preserved, containerized and analyzed according to the methods described in the most current edition of the "Test Methods for Evaluating Solid Waste-Physical/Chemical Methods (SW-846)". Table 2 identifies the analytical methods, sample preservation, containerization, and holding times which were followed for soil samples.

Sample bottles and containers will be placed on ice in an ice chest immediately after collection. Packing material will be placed in the coolers to prevent breakage during shipment of samples to the laboratory.

Chain-of-custody (COC) procedures will be adhered to throughout the sampling activities. The COC program will allow the proper documentation of the status of the samples from the time of collection through the laboratory analysis.

As part of the COC program, labels will be affixed to the sample bottles. The labels will contain the following information :

- Sample location;
- Sample description;

- Parameter to analyze;
- Date and time of sampling;
- Signature of sampler;
- Preservative used; and
- Sample label serial number.

The COCs will contain the following information :

- Project name and site location;
- Sample location;
- Date and time of sampling;
- Parameter to analyze;
- Preservative used;
- Sample label serial number;
- Signature of sampler;
- Signature of transporters and receivers.

A record will be maintained of all information about each sample collected during the closure sampling program. Sample custody seals shall be used on all sample shipments to the laboratory. The laboratory will also maintain a logbook and record all pertinent information about the sample.

All samples will be analyzed by a KDHE certified laboratory as required by Kansas Administrative Regulation 28-31-4(b).

4.12.2 *Quality Assurance/Quality Control*

Quality Assurance/Quality Control shall be performed to assure collection of representative, and valid data and the accuracy and precision of the field collection and analytical procedures. The soil samples will be collected with non-dedicated sampling equipment. The field quality assurance/quality control program will consist of the collection of equipment rinseate blanks, trip blanks, and field duplicate samples.

4.12.3 *Soil Sampling Field Quality Assurance/Quality Control*

The following field quality control checks will be employed to document the collection of representative soil samples:

- **Trip Blanks** - Trip blanks shall be used during sampling events. Trip blanks will be provided by the laboratory. These samples will be collected at approximately a 10 percent frequency. These samples shall be used to detect any contamination originating from exposure during sample transport and/or potential bottle contamination. Trip blanks will be analyzed for VOCs of Table 1. Trip blanks shall be identified as TB followed by the trip blank number, i.e. TB-10.

- **Field Blanks** - Field blanks will be collected during the soil sampling event. These samples consist of sample bottles which will be filled at the sample collection site with reagent grade water provided by the laboratory. These samples will be collected at approximately a 5 percent frequency. These samples will be used to evaluate contamination from containers and airborne contaminants. The field blanks will be analyzed for VOCs of Table 1.

- **Equipment Rinseate Blanks** - Rinseate blanks will be collected during soil sampling event that employs non-disposable or non-dedicated sampling equipment. These samples will be collected at approximately a 10 percent frequency. The rinseate blanks will consist of sample bottles which are filled with distilled water poured over or pumped through the appropriate sampling devices after decontamination. Rinseate blanks will be used to detect any contamination from sampling equipment or cross contamination from previously collected samples. The rinseate blanks will be analyzed for the same parameter(s) (Table 1) as the samples.

- **Field Duplicates** - Field duplicates will be collected during the soil sampling event. These duplicate samples will documented field precision. These samples will be collected at approximately a 10 percent frequency.

The sample and duplicate will be analyzed by the same laboratory for the same parameter(s) (Table 1). Duplicate samples will be submitted as blind samples and will be identified by a unique sequential station number.

4.12.4 *Laboratory Quality Assurance/Quality Control*

The samples will be analyzed by a KDHE approved laboratory according to currently promulgated EPA SW-846 method(s). Specific method requirements will be followed by the laboratory to ensure the reliability and comparability of the chemical analyses. The laboratory shall comply with method criteria including instrument tuning, initial and continuing/daily calibrations.

4.13 CONTINGENT CLOSURE

In the event the results of the soil laboratory analyses indicate an exceedance of the clean-up standards, Total may perform a risk assessment on the analytes that exceed the standards. The risk assessment approach will be developed with KDHE to incorporate site specific exposure scenarios into the development of clean-up standards for the soil.

4.14 CLOSURE AND POST-CLOSURE CARE PROCEDURES

Total will close the #3A Aerated lagoon and provide post-closure care. This section describes how the #3A Aerated Lagoon will be covered to promote drainage and minimizing erosion or abrasion while accommodating settling and subsidence so that the cover's integrity is maintained. Total will maintain and monitor the ground-water monitoring system and prevent run-on and run-off from eroding or otherwise damaging the final cover.

4.14.1 *Backfill*

As work commences, some grading of the impoundment soils may be performed to minimize the amount of soil imported for backfill. The selected fill soil will also be tested to establish Standard Proctor Density (ASTM D698).

Backfilling of the impoundment will generally proceed from one side toward the other side across the lagoon. The initial lift will be compacted to establish a working surface approximately twelve (12) inches thick. After the initial lift, the remaining fill will be

placed in lifts of approximately six (6) inches compacted thickness. All lifts will be compacted to 95% Standard Proctor Density. Compacted fill will be tested in the field to verify adequate compaction. Fill will be placed within 24 inches of final grade.

4.14.2 *Protective Surficial Layer*

Placement of the protective surficial layer will begin following placement of the backfill. At least two (2) feet of loam or silty clay topsoil will be placed on the backfill. The topsoil will be placed in two (2) lifts and will be compacted to allow for construction of an above-ground tank on the protective surficial layer. Once the topsoil has been placed, it will be graded to slope 1% to 1.5% in all directions to promote surface drainage during precipitation events.

4.14.3 *Run-On and Run-Off Management*

During closure all run-on and precipitation which accumulates in the impoundment will be routed to the tank-based wastewater treatment system. The uppermost, final protective surficial layer will be sloped to encourage rapid run-off of precipitation and to minimize infiltration into the closed impoundment. The final slopes will be between 1% and 1.5%. Areas adjacent to the closed impoundment will be graded as necessary to prevent run-on onto the area of the final backfill.

In addition, grasses or other vegetation will be planted to prevent erosion from occurring before construction occurs on top of the backfilled lagoon.

4.15 Schedule for Closure (40 CFR § 265.112(b)(6), .113)

An estimated closure schedule is provided in Table 3. Clean soil closure of the impoundment, including waste inventory removal, sampling, analysis, and demonstration of satisfaction of closure performance standard presented in Section 4.3 of this plan, is scheduled to take approximately 180 days which will satisfy the requirements of 40 CFR § 265.113(b).

4.16 Post Closure Care

Total will perform post closure care as presented in Section 5.0.

4.17 Closure Certification (40 CFR § 265.115)

Within sixty (60) days of completion of final closure activities, the Facility operator will submit a certification by an independent registered professional engineer that the #3A Aerated Lagoon has been closed in accordance with the specifications of the approved closure plan and 40 CFR § 265.115. The certification will be signed by an authorized Total representative and by an independent registered professional engineer, and submitted to KDHE by registered mail. Supporting documentation will be maintained at the Arkansas City Refinery.

In addition to the closure certification, Total will submit a brief closure report, summarizing closure activities and including but not limited to the following:

- Results from all analytical tests, including laboratory analyses of confirmation samples performed during closure;
- Maps showing sample locations for all samples collected;
- Volume and disposal location of any excavated soil;
- A copy of the field notes and other documentation of the sampling event; and,
- Any deviations from the approved closure plan.

A complete copy of the current Closure Plan will be kept at the refinery. The Facility Manager will be responsible for circulating any plan updates. The person responsible for maintenance of the Closure Plan is:

Facility Manager
Total Petroleum, Inc.
1400 South "M" Street
Arkansas City, Kansas 67005
(316) 442-5100

TABLE 3
#3A AERATED LAGOON CLOSURE SCHEDULE

		Days to Task Completion From Start of Closure[1]
0.	Approval of Closure Plan	0
1.	Initiate Soil Sampling[2]	45
2.	Decontaminate Flume	45
3.	Report Results of Soil Analyses to KDHE	90
4.	Request Implementation of Contingent Closure - If Required	90
5.	Begin Soil Excavation - If Required	140
6.	Submit closure certification (265.120)	180
7.	Submit clean soil closure certification	240

NOTES: (1) The facility to request an extension of the 180-day closure period to cay 150 (40 CFR § 265.113(b) and (c)).
(2) Total will notify KDHE at least 14 (calendar) days in advance of the soil sampling.

5.0 #3A AERATED LAGOON POST CLOSURE PLAN AND NOTICES

5.1 POST-CLOSURE PLAN

The post-closure plan provided herein describes the post-closure maintenance activities described in 40 CFR § 265.228 to be carried out when the Post Closure Plan is implemented. Post-closure activities will commence at the end of the closure period. At that time the impoundment will have been clean soil closed as described in the Closure Plan procedures (Section 4.0). Post-closure activities will involve inspection, maintenance, and monitoring of the clean soil closed impoundment.

In accordance with 40 CFR § 265.310(b)(5) Total will protect and maintain surveyed benchmarks used in complying with 40 CFR § 265.309.

In accordance with 40 CFR § 265.309 Total will maintain on a map, the exact location and dimensions, including depth of the 3A Aeration Lagoon with respect to permanently surveyed benchmarks.

5.1.1 *Protective Surficial Layer Maintenance*

As described in the Closure Plan, a protective surficial layer will be established at the impoundment which will allow for construction of an above ground tank. The protective surficial layer will be inspected quarterly for signs of settling, subsidence, or erosion. All settling or subsidence will be corrected and all erosion damage will be repaired.

5.1.2 *Run-on and Run-off Control Structure Maintenance*

The closed impoundment will be inspected quarterly to assess the integrity of the dikes, roadways, and other structures used for run-on/run-off control. Any damage will be repaired.

5.1.3 *Security*

The fencing, gates, and locks at the Facility will be inspected quarterly. No public access will be allowed. Repairs to the fencing or gates will be made as needed.

5.1.4 *Post-Closure Care Inspection Log and Records*

All inspection and repairs made during the post-closure period will be documented and records will be kept on file at the facility. An example Post Closure Care Inspection Log for inspection of the protective surficial layer, the surface water run-on and run-off control structures and the benchmarks is presented in Figure 4.

5.1.5 *Ground Water Monitoring*

Until a post-closure care permit is issued, ground water monitoring will be conducted according to the current KDHE approved ground water sampling and analysis plan (SAP). A copy of the current SAP is included in Appendix B.

5.1.6 *Post-Closure Contact Person*

The contact person during the post-closure period will be the Facility Manager at the following address:

Total Petroleum, Inc.
1400 S. "M" Street
Arkansas City, Kansas 67005
(316) 442-5100

5.2 Post Closure Survey Plat and Notices

Total will prepare a survey plat indicating the location and dimensions of the closed #3A Aerated Lagoon (no later than submission of the closure certification). The plat will be referenced to a permanently surveyed benchmark and will be prepared and certified by a professional land surveyor. As required by 40 CFR §265.116, the plat will be filed with the Registrar of Deeds of Cowley County, Kansas. The plat will contain a note or accompanying notice that states the owner's obligation to restrict disturbance of the closed #3A Aerated Lagoon in accordance with 40 CFR §265 Subpart G regulations.

In accordance with 40 CFR §265.119 and within sixty (60) days of certification of closure, Total will also submit to the Registrar of Deeds a record of the type, location, and quantity of hazardous waste remaining in the closed #3A Aerated Lagoon.

Figure 4 RCRA Post Closure Care Inspection Log

Maintenance Inspection Log for the Protective Surficial Layer

The Closed #3A Aeration Lagoon Protective Surficial Layer will be inspected quarterly throughout the RCRA Post Closure Care Period. The inspector will check for signs of settling, subsidence, or erosion.

Instructions: Record your name and the date of the inspection. Describe on the form below if any of the conditions listed exist and where, and to what extent. Note the location using the Compass quadrants (NW, NE, SW, SE etc.). Also note what action was taken in the event either settling, subsidence or erosion was observed during the inspection.

Report findings to the facility's Environmental Manager promptly.

Inspector	Date	Settling	Subsidence	Erosion	Action

Maintenance Inspection Log for Run-on and Run-off Control Structures

The roadways, dikes, and other structures used for run-on and run-off control will be inspected quarterly throughout the RCRA Post Closure Care Period. Any damage to the structures will be repaired.

Instructions: Inspect the surface water control structures semi-annually. Note any damage and report findings promptly to the facility's Environmental Manager. Record your name and the date the inspection occurred on the form below. Indicate what structure is damaged and where it is located.

Inspector	Date	Structure Inspected	Condition	Action

Inspection of Benchmark(s)

Instructions: Inspector, inspect the benchmark(s) annually for signs of damage. Damaged benchmarks must be re-established at the original location by a Kansas licensed surveyor.

Inspector	Date	Benchmark	Condition	Action

Also within sixty (60) days of certification of closure, Total will record, in accordance with Kansas State law, a notation on the Facility property deed or other appropriate instrument normally examined during title search, indicating that the specific land area has been used to manage hazardous waste, that use is restricted under 40 CFR §265 Subpart G regulations, and that a survey plat and record of type, location, and quantity of disposed hazardous waste is on file with the Registrar of Deeds.

Within sixty (60) days of certification of closure, Total will submit a signed certification to KDHE that the notice required at 40 CFR §265.119(b)(1) has been filed. This certification will include a copy of the filed notice, as required by 40 CFR §265.119 (b)(2).

5.3 Certificate of Completion of Post-Closure Care (40 CFR § 265.120)

No later than 60 days after the completion of the established post-closure care period for the #3A Aeration Lagoon, the owner or operator will submit to the KDHE, by registered mail, a certification that the post-closure care period for the #3A Aeration Lagoon was performed in accordance with the specifications in the approved post-closure plan. The certification will be as specified in Section 270.11(b) and will be signed by the owner or operator and an independent registered professional engineer. Documentation supporting the independent registered professional engineer's certification will be furnished to the KDHE upon request until the owner or operator is released from the financial assurance requirements for post-closure care under Section 265.145(b).

6.0 Financial Requirements and Cost Estimate

The cost estimate for closure of the #3A Aerated Lagoon is estimated to be $219,457. This estimate detailed on Table 4, is based upon achieving clean soil closure in place with backfill and a protective surficial layer according to the methods presented in the Closure Plan herein. The cost estimate does include the potential cost for soil removal and disposal at a RCRA TSD facility. The cost estimate for post closure care of thirty (30) years is $767,040 and is presented in Table 5. Financial assurance documentation for the above cost estimates for closure of the #3A Aerated Lagoon is presented in Appendix C.

TABLE 4
CLEAN SOIL CLOSURE COST ESTIMATE

Item Description	Unit	Unit Cost	Quantity	Line Total
Closure Sampling, Certification, & Report	EA	$40,400	1	$40,400
Mobilization	LS	$5,300.00	1.00	$5,300.00
Soil Removal & Disposal (as Hazardous Waste)	10 YDs	$10,000	1	$10,000
Backfill				
Backfill	CU. YD.	7.95	10,780.00	85,701.00
Top Soil	CU. YD.	7.42	2,400.00	17,808.00
Run-on Control (Plugging)	1000 GAL	3.45	189.00	652.00
Appurtenance Decontamination	HR	43.00	40.00	1,720.00
Construction Equipment Decontamination	HR	43.00	40.00	1,720.00
Engineering Services				
Construction Supervision	HR	43.00	480.00	20,640.00
Engineering Supervision	HR	85.00	240.00	20,400.00
Surveying				
Construction Surveying	HR	80.00	64.00	5,120.00
As-built Survey	HR	80.00	16.00	1,280.00
Plat Survey	HR	80.00	16.00	1,280.00
Truck	DAY	50.00	80.00	4,720.00
Fencing				
Fence (Barbed Wire)	FT	1.86	760.00	1,414.00
Gate	EA	212.00	1.00	212.00
Legal Fees				
Notice to Deed Amendment	HR	106.00	8.00	848.00
Filing of Plat	HR	19.00	8.00	152.00
TOTAL				**$219,487.00**

TABLE 5
POST-CLOSURE CARE COST ESTIMATE

Item Description	Unit	Unit Cost	Quantity	Line Total
Inspections				
Quarterly Site Inspections				
Technician	HR	843	480	920,640
Truck	DAY	50	120	7,080
Miscellaneous	LS	27	120	3,240
Documentation Reports				
Engineer	HR	80	480	38,400
Word Processing	HR	39	240	6,080
Miscellaneous	LS	27	120	3,240
Maintenance				
Erosion Repair	HR	43	360	15,480
Drainage Structure Repair	HR	43	360	15,480
Fencing Repair	HR	43	360	15,480
Monitor Well Repair	HR	43	360	15,480
Groundwater Monitoring				
Project Management				
Principal	HR	101	120	12,120
Senior Hydrogeologist	HR	91	120	10,920
Sampling				
Hydrogeologist	HR	80	2400	192,000
Environmental Assistant	HR	43	2400	103,200
Truck	DAY	59	240	14,160
Sampling Equipment	LS	742	60	44,520
Miscellaneous	LS	239	60	14,340
Laboratory Analysis (Volatiles)	EA	270	480	132,480
Analysis of Data and Reporting				
Senior Hydrogeologist	HR	91	120	10,920
Hydrogeologist	HR	80	720	57,600
Drafting	HR	43	240	10,320
Word Processing	HR	29	180	5,220
Clerical	HR	27	120	3,240
Reproduction	LS	43	60	2,580
Miscellaneous	LS	199	60	11,040
TOTAL				**$787,040**

7.0 References

Lipnick, R.L. 1995. Structure-Activity Relationships. In: *Fundamentals of Aquatic Toxicology. Effects, Environmental Fate, and Risk Assessment.* 2nd edition. Ed. by G.M. Rand. Taylor and Francis. pp. 609-643.

Roberts/Schornick and Associates, Inc., November 13, 1992, Part B Permit Renewal Modification, Total Petroleum, Inc., Arkansas City, Kansas. Prepared for Total Petroleum.

Roberts/Schornick and Associates, Inc., September 30, 1993, Closure Plan #3A Aerated Lagoon, Total Petroleum, Inc., Arkansas City, Kansas. Prepared for Total Petroleum.

U. S. Environmental Protection Agency, August 1993. Test Methods for Evaluating Solid Waste -Physical/Chemical Methods. SW-846 3rd Edition, Update 1.

U. S. Environmental Protection Agency, April 1997. Integrated Risk Information System (IRIS). IRIS Database Search.

Appendix A

#3A Aerated Lagoon Liquid Wastewater and Sludge Historical Analytical Results

#3A AERATED LAGOON LIQUID WASTE ANALYSIS

TABLE 2.6-1: #3A AERATED LAGOON AND ASSOCIATED UNITS
WASTEWATER BENZENE CONCENTRATIONS (1)

DATE OF SAMPLING	IAP UNIT EFFLUENT UG/L	SURGE CONTROL TANK EFFLUENT (2) UG/L	TANK T121 EFFLUENT UG/L	#3A AERATED LAGOON EFFLUENT (3) UG/L
MARCH 14, 1991	---	---	8400	<10
MARCH 5, 1991	2300	---	---	---
FEBRUARY 1, 1991	2170	---	---	---
JANUARY 18, 1991	2950	2870	10.4	<1.0
JANUARY 7, 1991	567	---	---	<1.0
DECEMBER 19, 1990	---	1400	227	165 (4)
OCTOBER 4, 1990	715	775	719	<1.0
OCTOBER 17, 1990	4250	2360	10.9	<1.0
OCTOBER 1, 1990	---	704	888	<1.0

NOTES:
(1) THE RCRA BENZENE TC CONCENTRATION IS 0.5 MG/L (500 UG/L)
(2) SURGE CONTROL TANK EFFLUENT IS THE SAME AS #3A AERATED LAGOON INFLUENT AND MAY BE SHOWN AS SUCH ON CHAIN OF CUSTODY FORMS in APPENDIX B
(3) #3A AERATED LAGOON EFFLUENT IS THE SAME AS #3B AERATED LAGOON INFLUENT AND MAY BE SHOWN AS SUCH ON CHAIN OF CUSTODY FORMS in APPENDIX B
(4) THIS SAMPLING EVENT OCCURRED DURING UPSET CONDITIONS AT THE IAP UNIT AND IS, THEREFORE, REPRESENTATIVE OF WORST CASE CONCENTRATIONS IN #3A AERATED LAGOON

Accutech, Inc.
Environmental & Laboratory Services

December 21, 1993

Client: Total Petroleum Inc.
1400 South "M" Street
Arkansas City, KS 67005

Requested by: Richard Thomas

Site Name:	Total Petroleum Inc.
Site Location:	Arkansas City, KS
Project Name:	Benzene NESHAP
Client I.D.:	9303
Sample Location:	TK 7131
Date Sample Collected:	December 15, 1993
Time Sample Collected:	N/A
Date Sample Received:	December 17, 1993
Time Sample Received:	1015
Date Analysis Complete:	December 18, 1993
Sample Type:	Grab
Sample Matrix:	Water
Lab Log Number:	B2167
Oklahoma Certification:	OWRB-8316
Kansas Certification:	E-219
Method Ref.:	GC/MS Method 624-Modified

Analysis performed by L. Irvin on 12/18/93 at 1455.

Purgeable BTEX	Results, ug/L	Practical Quantitation Limits,ug/L
Benzene	28.4	5
Toluene	63.2	5
Ethylbenzene	BPQL	5
Xylenes (Total)	143	50

BPQL: Below Practical Quantitation Limits

George Onyi for A.P.
Ali Patel, Ph.D.
Director of Environmental Services

AP:lr

505 S. Lowry St. ▪ Stillwater, OK 74074 ▪ 405-372-5300 ▪ Fax: 405-372-5196 ▪ In Oklahoma City: 405-236-5133

Accutech, Inc.
Environmental & Laboratory Services

December 21, 1993

Client: Total Petroleum Inc.
1400 South "M" Street
Arkansas City, KS 67005

Requested by: Richard Thomas

Site Name:	Total Petroleum Inc.
Site Location:	Arkansas City, KS
Project Name:	Benzene NESHAP
Client I.D.:	9308
Sample Location:	3A off loader
Date Sample Collected:	December 15, 1993
Time Sample Collected:	N/A
Date Sample Received:	December 17, 1993
Time Sample Received:	1015
Date Analysis Complete:	December 18, 1993
Sample Type:	Grab
Sample Matrix:	Water
Lab Log Number:	B2170
Oklahoma Certification:	OWRB-8316
Kansas Certification:	E-219
Method Ref.:	GC/MS Method 624-Modified

Analysis performed by L. Irvin on 12/18/93 at 2106.

Purgeable BTEX	Results, ug/L	Practical Quantitation Limits,ug/L
Benzene	BPQL	5
Toluene	BPQL	5
Ethylbenzene	BPQL	5
Xylenes (Total)	BPQL	5

BPQL: Below Practical Quantitation Limits

George Onyi for A.P.
Ali Patel, Ph.D.
Director of Environmental Services

AP:lr

505 S. Lowry St. ▪ Stillwater, OK 74074 ▪ 405-372-5300 ▪ Fax: 405-372-5196 ▪ In Oklahoma City: 405-236-5133

Accu-Lab, Inc.
Environmental & Laboratory Services

December 22, 1993

QA/QC

Volatiles-Method 624-modified (MS/MSD RECOVERIES)

Compound	Sample Conc	Spike Added	Spike Result	Dupl Result	Spike % Recov	Dup % Recov	RPD	QC Limits RPD	QC Limits % Rec
BENZENE	1.5	50	48	50	91	97	4	15	75-125
TOLUENE	0.7	50	51	51	101	100	1	15	75-125
ETHYLBENZENE	1.2	50	51	50	100	98	2	15	75-125
m,p-XYLENE	3.2	50	51	51	96	97	1	15	75-125
o-XYLENE	0.9	50	52	50	101	99	2	15	75-125

George Doyle for A.P.
Ali Patel, Ph.D.
Director of Environmental Services
AP:ls

505 S. Lowry St. ■ Stillwater, OK 74074 ■ 405-372-5100 ■ Fax: 405-372-5296 ■ In Oklahoma City: 405-236-5133

Accu-Lab, Inc.
Environmental & Laboratory Services

May 31, 1994

Client: Total Petroleum, Inc.
1400 S. "M" Street
Ark City, KS 67005

Requested by: Richard Thomas

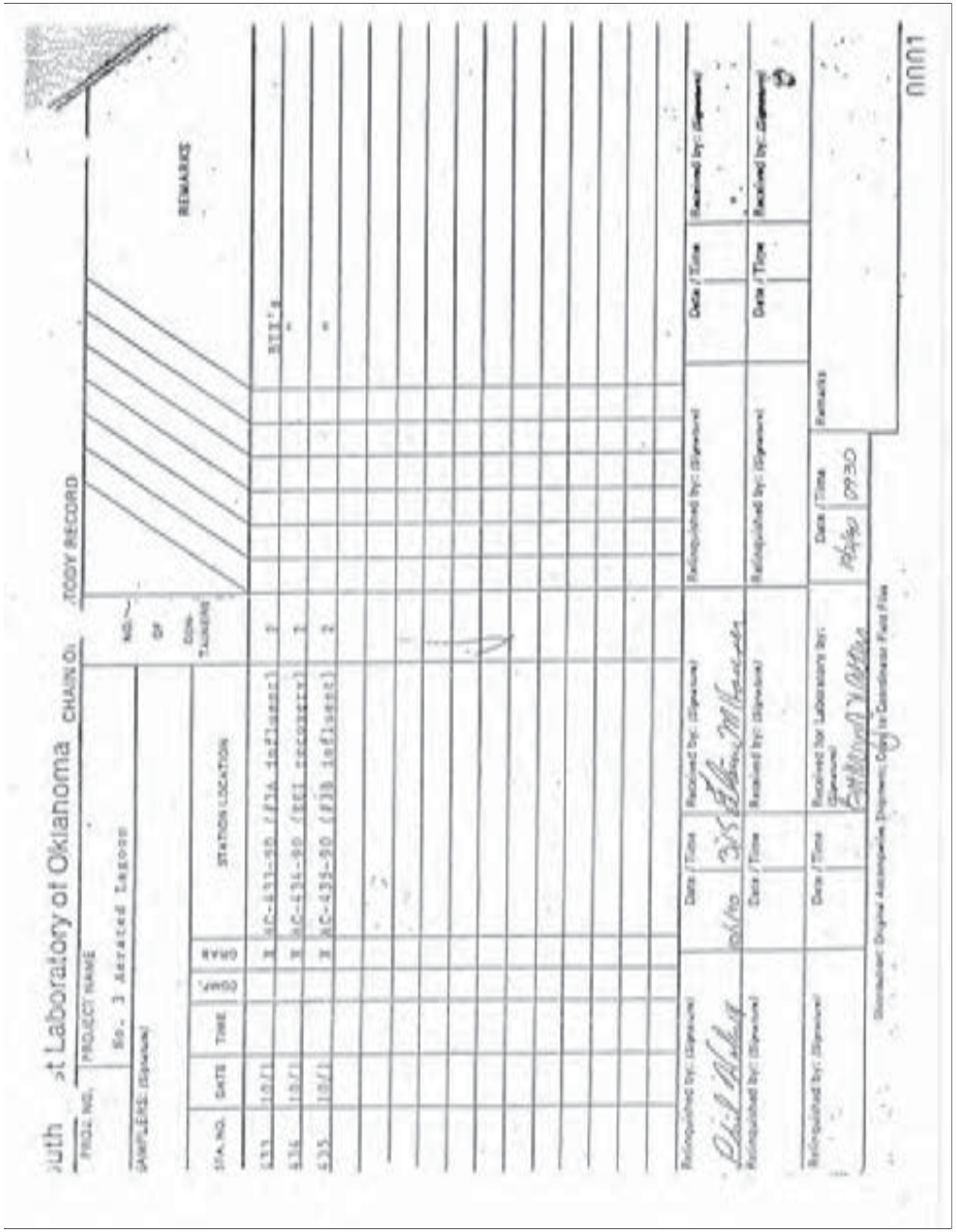
Site Name:	Total Petroleum, Inc. - Ark City
Project Name:	Benzene NESHAP
Sample Location:	3A Out
Date Samples Collected:	May 18, 1994
Time Samples Collected:	1500
Date Samples Received:	May 19, 1994
Time Samples Received:	1500
Date Analysis Completed:	May 31, 1994
Sample Type:	Grab
Sample Matrix:	Liquid
Lab Log Number:	B5183
Oklahoma Certification:	OWRD-8316
Kansas Certification:	E-219
Method Ref.:	40 CFR 136, GC Method 8260

Purgeable BTEX	Results, ug/L	Practical Quantitation Limits,ug/L
Benzene	BPQL	5.0
Toluene	BPQL	5.0
Ethylbenzene	BPQL	5.0
Xylenes (Total)	31.6	5.0

Analysis performed by L. Irvin on 05/26/94 at 0914.
* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.
BPQL: Below Practical Quantitation Limits (if applicable).

George Doyle
George Doyle,
Laboratory Manager
GDrjm

505 S. Lowry Street ■ Stillwater, OK 74074 ■ 405-372-5100 ■ Fax: 405-372-5296
Oklahoma City: 405-236-5133 ■ Tulsa: 918-587-5200 ■ Wichita: 316-683-1133



SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1720 W. Albany , Suite "C" , Broken Arrow, Oklahoma 74012 , 918-251-3858 , FAX 918-251-2399

CLIENT: TOTAL PETROLEUM, INC.
1400 SOUTH H STREET
ARKANSAS CITY, KANSAS 67005

REPORT: 3885.01BX

DATE: 10-10-90

SAMPLE MATRIX: WATER
SWLO # 3885.01
DATE SUBMITTED: 10-02-90
PROJECT: NO. 3 AERATED LAGOON
SAMPLE ID: AC-433-90

PARAMETER	DET. LIMIT	UNIT	RESULTS	DATE ANALYZED	METHOD REFERENCE
GAS CHROMATOGRAPHY					
BENZENE	50.0	ug/L	706	10-04-90	SW 8020
TOLUENE	50.0	ug/L	891	10-04-90	SW 8020
ETHYLBENZENE	50.0	ug/L	140	10-04-90	SW 8020
XYLENES	50.0	ug/L	1590	10-04-90	SW 8020

QA/QC SURROGATE RECOVERIES

BROMOFLUOROBENZENE(65-135) 105%

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION
* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS ON ORIGINAL RUN AND RERUN.
SW = TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION #SW846, THIRD EDITION, NOVEMBER 1986

CHAIN OF CUSTODY RECORD

PROJ. NO. 37-441 | PROJECT NAME Benzene Analysis | NO. OF CONTAINERS

SAMPLERS: (Signature)

LAB NO.	DATE	TIME	GRAB	COMP	STATION LOCATION	NO. OF CONTAINERS	REMARKS
437	10/17		X		AC-437-90 (API eff.)	2	
438	10/17		X		AC-438-90 (DAF eff.)	2	
439	10/17		X		AC-439-90 (PSA inf.)	2	
440	10/17		X		AC-440-90 (PEI Rec.)	1	
441	10/17		X		AC-441-90 (PSA inf.)	2	

Relinquished by: (Signature) Date / Time Received by: (Signature)

Relinquished by: (Signature) Date / Time Received by: (Signature)

Relinquished by: (Signature) Date / Time Received by: (Signature)

Relinquished by: (Signature) Date / Time Received for Laboratory by: (Signature) Date / Time Remarks

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

0001

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. Albany, Suite "C", Broken Arrow, Oklahoma 74012, 918-251-3838, FAX: 918-251-2399

CLIENT: TOTAL PETROLEUM, INC.
1400 SOUTH M. STREET
ARKANSAS CITY, KANSAS 67005
ATTN: PHIL HOLMES

REPORT: 4017.03BX
DATE: 10-26-90

SAMPLE MATRIX: WATER
SWLO # 4017.03
DATE SUBMITTED: 10-18-90
SAMPLE ID: AC-439-90

PARAMETER	DET. LIMIT	UNIT	RESULTS	DATE ANALYZED	METHOD REFERENCE
GAS CHROMATOGRAPHY					
BENZENE	500	ug/L	2240	10-20-90	SW 8020
TOLUENE	500	ug/L	2360	10-20-90	SW 8020
XYLENES	500	ug/L	679	10-20-90	SW 8020

QA/QC SURROGATE RECOVERY

BROMOFLUOROBENZENE (65-135) 73%

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION
* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS ON ORIGINAL RUN AND RERUN.
SW = TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION #SW846, THIRD EDITION, NOVEMBER 1986

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PROJ NO. 12-6-90 | PROJECT NAME BTX

SAMPLERS: (Signature)

LTA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	REMARKS
486	12/4			X	AC-486-90 #2 Desalter	2	BTX
487	12/4			X	AC-487-90 #3 Desalter	2	"
488	12/4			X	AC-488-90 LSR Treater	2	"
489	12/4			X	AC-489-90 API Outlet	2	"
490	12/4			X	AC-490-90 IAP Outlet	2	"
491	12/4			X	AC-491-90 #3A Inlet	2	"
492	12/4			X	AC-492-90 #3A Outlet	2	"
493	12/4			X	AC-493-90 #3B Outlet	2	"
494	12/4			X	AC-494-90 #4 Outlet	2	"
495	12/4			X	AC-495-90 EEI Recovery	2	"
496	12/4			X	AC-496-90 CTI Recovery	2	"
497	12/4			X	AC-497-90 Field Blank	2	"

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
[illegible]	12/5/90				
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature) [illegible]	Date / Time 12/6/90 0830	Remarks	

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

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SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. Albany • Suite "C" • Broken Arrow, Oklahoma 74012 • 918-251-8568 • FAX 918-251-4399

CLIENT: TOTAL PETROLEUM, INC.
POST OFFICE BOX 857
ARKANSAS CITY, KS 67005
ATTN: PHILLIP HOLMES

REPORT: 4506.06BX
DATE: 12-14-90

SAMPLE MATRIX: WATER
SWLO # 4506.06
DATE SUBMITTED: 12-06-90
SAMPLE ID: AC-491-90

PARAMETER	DET. LIMIT	UNIT	RESULTS	DATE ANALYZED	METHOD REFERENCE
GAS CHROMATOGRAPHY					
BENZENE	250	ug/L	776	12-07-90	SW 8020
TOLUENE	250	ug/L	1190	12-07-90	SW 8020
XYLENES	250	ug/L	438	12-07-90	SW 8020

SURROGATE RECOVERY

BROMOFLUOROBENZENE 145-155 BRX

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
D = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
J = ESTIMATED VALUE; CONCENTRATION BELOW LIMIT OF QUANTITATION
* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS ON ORIGINAL RUN AND RERUN.
SW = TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION #SW846, THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. Albany , Suite "C" , Broken Arrow, Oklahoma 74012 , 918-251-2858 , FAX 918-251-2599

CLIENT: TOTAL PETROLEUM, INC.
POST OFFICE BOX 857
ARKANSAS CITY, KS 67005
ATTN: PHILLIP HOLMES

REPORT: 4506.07BX
DATE: 12-14-90

SAMPLE MATRIX: WATER
SWLO # 4506.07
DATE SUBMITTED: 12-06-90
SAMPLE ID: AC-492-90

PARAMETER	DET. LIMIT	UNIT	RESULTS	DATE ANALYZED	METHOD REFERENCE
GAS CHROMATOGRAPHY					
BENZENE	1.0	ug/L	ND	12-11-90	SW 8020
TOLUENE	1.0	ug/L	19.5	12-11-90	SW 8020
XYLENES	1.0	ug/L	6.9	12-11-90	SW 8020

QA/QC SURROGATE RECOVERY

BROMOFLUOROBENZENE (65-135) 72%

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION
* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS ON ORIGINAL RUN AND RERUN.
SW = TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION #SW846, THIRD EDITION, NOVEMBER 1986

outhwe laboratory of Oklahoma CHAIN OF CU Y RECORD

PROJ. NO. | PROJECT NAME: BTX Analysis | SAMPLERS: (Signature)

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	REMARKS
507	12/13/90			X	AC-507-90 (Blk.)	2	BTX
508	12/13/90			X	AC-508-90 (API Outlet)	2	"
509	12/13/90			X	AC-509-90 (#3A Inlet)	2	"
510	12/13/90			X	AC-510-90 (#3A Outlet)	2	"
511	12/13/90			X	AC-511-90 (#3B Outlet)	2	"
512	12/13/90			X	AC-512-90 (EXT Rec. Well)	2	"

Relinquished by: (Signature) Date / Time 12/6/90 3:10 Received by: (Signature) Relinquished by: (Signature) Date / Time Received by: (Signature) Relinquished by: (Signature) Date / Time Received by: (Signature) Relinquished by: (Signature) Date / Time Received by: (Signature) Relinquished by: (Signature) Date / Time Received for Laboratory by: (Signature) Date / Time 12/6/90 1:30 Remarks

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

0001

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. Albany • Suite "C" • Broken Arrow, Oklahoma 74012 • 918-251-2858 • FAX: 918-251-2399

CLIENT: TOTAL PETROLEUM, INC.
1400 SOUTH M STREET
ARKANSAS CITY, KANSAS 67005
ATTN: PHIL HOLMES

REPORT: 4662.03BX
DATE: 01-01-91

SAMPLE MATRIX: WATER
SWLO # 4662.03
DATE SUBMITTED: 12-20-90
SAMPLE ID: AC-509-90

PARAMETER	DET. LIMIT	UNIT	RESULTS	DATE ANALYZED	METHOD REFERENCE
GAS CHROMATOGRAPHY					
BENZENE	100	ug/L	5690	12-29-90	SW 8020
TOLUENE	100	ug/L	5960	12-29-90	SW 8020
XYLENES	100	ug/L	1370	12-29-90	SW 8020

QA/QC SURROGATE RECOVERY

BROMOFLUOROBENZENE (65-135) 87%

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION
* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS ON ORIGINAL RUN AND RERUN.
SW = TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION #SW846, THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. Albany • Suite "C" • Broken Arrow, Oklahoma 74012 • 918-251-2858 • FAX: 918-251-2399

CLIENT: TOTAL PETROLEUM, INC.
1400 SOUTH M STREET
ARKANSAS CITY, KANSAS 67005
ATTN: PHIL HOLMES

REPORT: 4662.04BX
DATE: 01-01-91

SAMPLE MATRIX: WATER
SWLO # 4662.04
DATE SUBMITTED: 12-20-90
SAMPLE ID: AC-510-90

PARAMETER	DET. LIMIT	UNIT	RESULTS	DATE ANALYZED	METHOD REFERENCE
GAS CHROMATOGRAPHY					
BENZENE	50	ug/L	463	12-29-90	SW 8020
TOLUENE	50	ug/L	54.9	12-29-90	SW 8020
XYLENES	50	ug/L	275	12-29-90	SW 8020

QA/QC SURROGATE RECOVERY

BROMOFLUOROBENZENE (65-135) 87%

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION
* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS ON ORIGINAL RUN AND RERUN.
SW = TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION #SW846, THIRD EDITION, NOVEMBER 1986

uthwes. Laboratory of Oklahoma CHAIN OF CUST. ECORD

PROJ. NO. 1-91 | PROJECT NAME Benzene

SAMPLERS: (Signature)

LAB. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	REMARKS
13	1/7/91			X	AC-513-90 (API Outlet)	2	SYE
14	1/7/91			X	AC-514-90 (TAF Outlet)	2	"
15	1/7/91			X	AC-515-90 (#3A Outlet)	2	"

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Phil Holmes	1/8/91 3:10	Elaine M Hayes			
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	
		Bethany D Watts	1/9/91 10:00		

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

0001

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

7700 W. Albany • Suite "C" • Broken Arrow, Oklahoma 74012 • 918/251-2819 • FAX 918/251-2599

CLIENT: TOTAL PETROLEUM COMPANY
1400 S. M STREET
ARKANSAS CITY, KS 67005
ATTN: PHIL HOLMES

REPORT: 4735.03BX
DATE: 01-18-91

SAMPLE MATRIX: WATER
SWLO # 4735.03
DATE SUBMITTED: 01-09-91
PROJECT: TWANN/88-021-4-007-03
SAMPLE ID: AC-515-90

PARAMETER	DET. LIMIT	UNIT	RESULTS	DATE ANALYZED	METHOD REFERENCE
GAS CHROMATOGRAPHY					
BENZENE	1.0	ug/l	ND	01-17-91	SW 8020
TOLUENE	1.0	ug/l	ND	01-17-91	SW 8020
XYLENES	1.0	ug/l	ND	01-17-91	SW 8020

QA/QC SURROGATE RECOVERIES

4-BROMOFLUOROBENZENE (49-131) 91%

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
J = ESTIMATED VALUE; CONCENTRATION BELOW LIMIT OF QUANTITATION
* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS ON ORIGINAL RUN AND RERUN.
SW = TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO.846, THIRD EDITION, NOVEMBER 1986

thwest Laboratory of Oklahoma CHAIN OF CUSTODY RECORD

ROJ. NO. | PROJECT NAME: BTX

MPLERS: (Signature)

NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	REMARKS
02	1/18/91			X	AC-002-91 (APT Outlet)	2	BTX
03	1/18/91			X	AC-003-91 (TAF Outlet)	2	"
04	1/18/91			X	AC-004-91 (#3A Inlet)	2	"
05	1/18/91			X	AC-005-91 (#3A Outlet)	2	"
06	1/18/90			X	AC-006-91 (TET Recovery)	2	"

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
[illegible]	[illegible]	[illegible]			
			Relinquished by: (Signature)	Date / Time	Received by: (Signature)

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks
		Bethany Nobles	1/18/91	9:00

Distribution: Original Accompanies Shipment, Copy to Coordinator Field Files

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SOUTHWEST LABORATORY OF OKLAHOMA, INC.

7700 W. Albany • Suite "C" • Broken Arrow, Oklahoma 74012 • 918-251-2858 • FAX: 918-251-2899

REPORT: 4847.03BX

CLIENT: TOTAL PETROLEUM COMPANY
1400 S. M STREET
ARKANSAS CITY, KS 67005
ATTN: PHIL HOLMES

DATE: 01-29-91

SAMPLE MATRIX: WATER
SWLO # 4847.03
DATE SUBMITTED: 01-19-91
PROJECT: BTX MONITORING
SAMPLE ID: AC-004-91

PARAMETER	DET. LIMIT	LIMIT	RESULTS	DATE ANALYZED	METHOD REFERENCE
GRS CHROMATOGRAPHY					
BENZENE	100	ug/l	2870	01-25-91	SW 8020
TOLUENE	100	ug/l	2720	01-25-91	SW 8020
XYLENES	100	ug/l	1840	01-25-91	SW 8020

QA/QC SURROGATE RECOVERIES

4-BROMOFLUOROBENZENE 145-151 81%

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
J = ESTIMATED VALUE; CONCENTRATION BELOW LIMIT OF QUANTITATION
* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS ON ORIGINAL RUN AND RERUN.
SW = TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION #SW846, THIRD EDITION, NOVEMBER 1986

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 W. Albany • Suite "C" • Broken Arrow, Oklahoma 74012 • 918-251-2858 • FAX/ 918-251-2399

CLIENT: TOTAL PETROLEUM COMPANY
1400 S. M STREET
ARKANSAS CITY, KS 67005
ATTN: PHIL HOLMES

REPORT: 4847.04BX

DATE: 01-29-91

SAMPLE MATRIX: WATER
SWLO # 4847.04
DATE SUBMITTED: 01-19-91
PROJECT: DTX MONITORING
SAMPLE ID: AC-005-91

PARAMETER	DET. LIMIT	UNIT	RESULTS	DATE ANALYZED	METHOD REFERENCE
GAS CHROMATOGRAPHY					
BENZENE	1.0	ug/l	ND	01-28-91	SW 8020
TOLUENE	1.0	ug/l	ND	01-28-91	SW 8020
XYLENES	1.0	ug/l	18.9	01-28-91	SW 8020

QA/QC SURROGATE RECOVERIES

4-BROMOFLUOROBENZENE (63-135) 97%

ND = NOT DETECTED ABOVE QUANTITATION LIMIT
B = ANALYTE DETECTED IN BLANK AS WELL AS SAMPLE
J = ESTIMATED VALUE: CONCENTRATION BELOW LIMIT OF QUANTITATION
* = SURROGATE RECOVERY OUTSIDE OF QC LIMITS ON ORIGINAL RUN AND RERUN.
SW = TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION #SW846, THIRD EDITION, NOVEMBER 1986

FORMER #3 AERATED LAGOON SLUDGE ANALYSES

ACCL, Inc.
Environmental & Laboratory Services

February 17, 1994

Client: Total Petroleum Inc.
1400 South "M" Street
Arkansas City, KS 67005

Requested By: Richard Thomas

Project Name: Total Petroleum Inc., Ark City
Sample I.D.: 3 A Pond
Date Sample Collected: February 8, 1994 (Time:1430)
Date Sample Received: February 9, 1994 (Time: 0922)
Date Sample Completed: February 17, 1994
Sample Type: Grab
Sample Matrix: Sludge
Lab Log Number: B0111
Oklahoma Certification: OWRB-8316
Kansas Certification: E-1192
Method Ref.: US EPA 40 CFR Part 136, March 1990, Test Method 1311 and EPA SW 846; GC/MS Methods 8360-modified, 8270, and 8080; Metals Method 200's.

General Indicators

Parameter	Result, mg/Kg	PQL*, mg/Kg	Date/Time of Analysis	Analyst	Method
pH, s.u.	7.79	0-14	02/15/94 / 1910	Mindi	9045
Flashpoint	> 100°C	----	02/15/94 / 1630	B. E.	1010
Cyanide Reactivity	0.50	.25	02/15/94 / 0900	M.C.	335.3
Sulfide Reactivity	BPQL	1.0	02/15/94 / 1150	K.H.	9010

TCLP Extraction for Metals

Parameter	Results, ppm	PQL*, ppm	Regulatory Level, ppm	Date/Time of Analysis	Analyst
Arsenic (As)	BPQL	1.0	5.0	02/15/94 / 0930	S. W.
Barium (Ba)	BPQL	10.0	100.0	02/15/94 / 1113	S. W.
Cadmium (Cd)	BPQL	1.0	1.0	02/15/94 / 1000	S. W.
Chromium (Cr)	BPQL	1.0	5.0	02/15/94 / 1000	S. W.
Lead (Pb)	BPQL	1.0	5.0	02/15/94 / 1000	S. W.
Mercury (Hg)	BPQL	0.0002	0.2	02/16/94 / 1221	S. W.
Selenium (Se)	BPQL	1.0	1.0	02/15/94 / 0930	S. W.
Silver (Ag)	BPQL	1.0	5.0	02/15/94 / 1100	S. W.

ppm: mg/L of TCLP extract
Sample Preparation by S. Willard on 02/10/94 at 0800 (Method 1010).
* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.
BPQL: Below Practical Quantitation Limit (if applicable).

(cont.)

505 S. Lowry Street ■ Stillwater, OK 74074 ■ 405-372-5100 ■ Fax: 405-372-5396
Oklahoma City: 405-736-5331 ■ Tulsa: 918-587-5300 ■ Wichita: 316-683-1123

TCLP Extraction for Volatile Organics, ZHE
Method 8240-modified

Volatiles	Results, ppm	Det. Limits, ppm	PQL*, ppm	Reg. Level, ppm
Vinyl Chloride	BPQL	0.005	0.05	0.2
1,1-Dichloroethylene	BPQL	0.005	0.05	0.7
2-Butanone (MEK)	BPQL	0.025	0.25	200.0
Chloroform	BPQL	0.005	0.05	6.0
1,2-Dichloroethane	BPQL	0.005	0.05	0.5
Carbon Tetrachloride	BPQL	0.005	0.05	0.5
Benzene	BPQL	0.005	0.05	0.5
Trichloroethylene	BPQL	0.005	0.05	0.5
Tetrachloroethylene	BPQL	0.005	0.05	0.7
Chlorobenzene	BPQL	0.005	0.05	100.0

Analysis performed by L. Irvin on 03/10/94 at 2201.

TCLP Extraction for Semi-Volatile Organics
Method 8270

Semi-Volatiles	Results, ppm	Det. Limits, ppm	PQL*, ppm	Reg. Level, ppm
Pyridine	BPQL	0.01	0.10	5.0
Cresols (Total)	BPQL	0.01	0.10	200.0
1,4-Dichlorobenzene	BPQL	0.01	0.10	7.5
Hexachloroethane	BPQL	0.01	0.10	3.0
Nitrobenzene	BPQL	0.01	0.10	2.0
Hexachlorobutadiene	BPQL	0.01	0.10	0.5
2,4,6-Trichlorophenol	BPQL	0.01	0.10	2.0
2,4,5-Trichlorophenol	BPQL	0.01	0.10	400.0
Pentachlorophenol	BPQL	0.025	0.25	100.0
Hexachlorobenzene	BPQL	0.01	0.10	0.5
2,4-Dinitrotoluene	BPQL	0.01	0.10	0.13

Sample preparation by M. Baligh on 03/1/94 at 1750 (Method 3510).
Analysis performed by B. Hardberg on 03/13/94 at 1017.
ppm: mg/L of TCLP extract

* Practical Quantitation Limit - the method detection limit (MDL) *adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.*
BPQL: Below Practical Quantitation Limit (if applicable)

Ali Fassl, Ph. D.
Director of Environmental Services

AF:jm
encl.

Acculab, Inc. Environmental & Laboratory Services

February 17, 1994
QA/QC

Parameter	% Duplicate Recovery	% Spike Recovery
Flashpoint	100	100
Cyanide Reactivity	93	90
Sulfide Reactivity	N/A	106

METALS

Parameter	% Duplicate Recovery	% Spike Recovery
Arsenic	100	96
Barium	100	101
Cadmium	100	84
Chromium	100	92
Lead	100	74
Mercury	100	93
Selenium	118	78
Silver	100	N/A

Blank was run with each batch.

VOLATILES METHOD 8240 modified (SPIKED RECOVERIES)

COMPOUND	SAMPLE CONC	SPIKE ADDED	SPIKE RESULT	DUPL RESULT	SPIKE % RECOV	DUP % RECOV.	RPD	QC LIMITS RPD	QC LIMITS % REC
1,1-DICHLOROETHENE	0.0	500	512	518	102	103	1	14	61-145
BENZENE	0.0	500	516	494	103	100	3	13	76-127
TRICHLOROETHENE	0.0	500	490	482	98	97	1	14	71-120
TOLUENE	0.0	500	537	515	107	103	3	13	76-125
CHLOROBENZENE	0.0	500	509	493	102	97	3	11	75-127

505 S. Lowry Street ■ Stillwater, OK 74074 ■ 405-372-5300 ■ Fax: 405-372-5396
Oklahoma City: 405-236-5333 ■ Tulsa: 918-587-5300 ■ Wichita: 316-683-1133

Accurate, Inc. Environmental and Laboratory Services
505 South Lowry
Stillwater, Oklahoma 74074
(405) 372-5300 FAX (405) 373-5396 OSLC (405) 236-5333

CHAIN OF CUSTODY RECORD
Sampler or Deliver's Signature: [illegible]
Project Name: Total Petroleum, Ark City
Analysis Requested: Flt TCLP, Metals, Reactivity, Ignitability

Lab Log #	Time/Date Sample Taken	Client ID #	Grab	Composite	Sample Location	# of Containers	Sample Preservation	Flt TCLP	Metals	Reactivity	Ignitability				
	2-8-94														
B2112	1430		S		3A Pond	1		✓		✓					

Relinquished By:	Date/Time	Relinquished By:	Date/Time
[illegible]	2/8/94 2:30 pm	[illegible]	2-9-94 6:10
Relinquished to Lab By:	Date/Time	Received at Lab By:	Date/Time
		[illegible] STULAT	2-9-94 9:00

Client, Name, Address, Phone, Contact Person:	Send Results To:
	Send Invoice To:

Continental Analytical

S E R V I C E S , I N C .

Page: 5

Client: Total Petroleum, Inc.
Attn: Ryan Seyhert
1600 South M Street
Arkansas City, KS 67005

Date Sample Rcvd: 09/25/92
Date Sample Anal: 09/09/92
CAS File No: 93-5126
CAS Order No: 13162
Client P.O.: 02-38116

Lab Number: 92090496
Sample Description: AC-201-92 #3A Arr. Lag. Sludge

Date Sampled: 09/04/92
Time Sampled:

Analyte	Concentration	Units	Date Analyzed	Meth/Page
Fluride	109.	mg/kg	09/15/92	169 /55
TCLP Volatiles			09/19/92	
1,1,1,2-Tetrachloroethane	ND(10.)	ug/L		512 /110
1,1,1-Trichloroethane	ND(10.)	ug/L		512 /110
1,1,2,2-Tetrachloroethane	ND(10.)	ug/L		512 /110
1,1,2-Trichloroethane	ND(10.)	ug/L		512 /110
1,1-Dichloroethylene	ND(10.)	ug/L		512 /110
1,2-Dichloroethane	ND(10.)	ug/L		512 /110
Acrylonitrile	ND(90.)	ug/L		512 /110
Benzene	74.	ug/L		512 /110
Carbon Disulfide	ND(100)	ug/L		512 /110
Carbon Tetrachloride	ND(10.)	ug/L		512 /110
Chlorobenzene	ND(10.)	ug/L		512 /110
Chloroform	ND(10.)	ug/L		512 /110
Isobutanol	ND(100)	ug/L		512 /110
Methyl Ethyl Ketone	ND(50.)	ug/L		512 /110
Methylene Chloride	ND(10.)	ug/L		512 /110
Tetrachloroethylene	ND(10.)	ug/L		512 /110
Toluene	128.	ug/L		512 /110
Trichloroethylene	ND(10.)	ug/L		512 /110
Vinyl Chloride/Chloroethane	ND(10.)	ug/L		512 /110
TCLP Extractables			09/24/92	
2,3,4,6-Tetrachlorophenol	ND(25)	ug/L		787 /73
2,4,5-Trichlorophenol	ND(25)	ug/L		787 /73
2,4,6-Trichlorophenol	ND(25)	ug/L		787 /73
2,4-Dinitrotoluene	ND(25)	ug/L		787 /73
Bis(2-Chloroethyl) Ether	ND(25)	ug/L		787 /73
Hexachlorobenzene	ND(25)	ug/L		787 /73
Hexachlorobutadiene	ND(25)	ug/L		787 /73
Hexachloroethane	ND(25)	ug/L		787 /73
m-Cresol	ND(25)	ug/L		787 /73
Nitrobenzene	ND(25)	ug/L		787 /73
o-Cresol	ND(25)	ug/L		787 /73
o-Dichlorobenzene	ND(25)	ug/L		787 /73
p-Cresol	ND(25)	ug/L		787 /73
p-Dichlorobenzene	ND(25)	ug/L		787 /73
Pentachlorophenol	ND(25)	ug/L		787 /73
Phenol	ND(25)	ug/L		787 /73
Pyridine	ND(250)	ug/L		787 /73
Arsenic, TCLP	ND(1)	mg/L	09/15/92	1205/28
Barium, TCLP	4.	mg/L	09/15/92	1268/16

-Continued-

CONTINENTAL ANALYTICAL SERVICES, INC.

LABORATORY REPORT

Client: Total Petroleum, Inc.
Lab Number: 92090496

Analysis	Concentration	Units	Date Analyzed	Book/Page
Cadmium, TCLP	ND(0.5)	mg/L	09/15/92	1240/2
Chromium, TCLP	ND(0.4)	mg/L	09/15/92	1251/22
Lead, TCLP	ND(2)	mg/L	09/15/92	1240/28
Mercury, TCLP	ND(0.02)	mg/L	09/16/92	1242/18
Selenium, TCLP	ND(0.5)	mg/L	09/15/92	1201/36
Silver, TCLP	ND(0.5)	mg/L	09/15/92	1220/89

Analysis	Date Prepared	QC Batch	Analyst
Fluoride	NA	2	TLG
TCLP Volatiles	09/10/92	1	CDE
TCLP Extractables	09/14/92	1	BRE
Arsenic, TCLP	09/14/92	1	MLH
Barium, TCLP	09/14/92	1	MAC
Cadmium, TCLP	09/14/92	1	MAC
Chromium, TCLP	09/14/92	1	MAC
Lead, TCLP	09/14/92	1	MAC
Mercury, TCLP	09/14/92	1	MDB
Selenium, TCLP	09/14/92	1	MLH
Silver, TCLP	09/14/92	1	MAC

*Acid compounds are estimated values; acid surrogate values were below control limits. Samples being reprepped for confirmation of surrogate values.

Quality Control analyses were performed on samples at time of analysis in accordance with procedures published in Title 40 of the Code of Federal Regulations part 136, July 1, 1986 or in EPA Publication, SW-846, 3rd edition, Nov. 1986. ND(), where noted, indicates none detected with the detection limit in parentheses.

Samples will be retained for thirty days unless otherwise notified.

CONTINENTAL ANALYTICAL SERVICES, INC.

Clifford E. Baker
Laboratory Director

CAS

CONTINENTAL ANALYTICAL SERVICES, INC.

1804 GLENDALE - SALINA, KANSAS 67401 - (913)827-1273

LABORATORY REPORT

CLIENT: TOTAL PETROLEUM, INC.
ATTN:PHILLIP E. HOLMES
1400 SOUTH M STREET
ARKANSAS CITY, KS 67005

DATE SAMPLE RPTD: 08/10/90
DATE SAMPLE RECD: 08/08/90
CAS FILE NO: 90-5126
CAS ORDER NO: 4379
CLIENT P.O.:

LAB NUMBER: 90080321
SAMPLE DESCRIPTION: AC-350-90 #3 aerated lagoon
DATE SAMPLED: 08/07/90
TIME SAMPLED:

ANALYSIS	CONCENTRATION	UNITS	BOOK/PAGE
TCLP VOLATILES			/
VINYL CHLORIDE	ND(10.)	UG/L	266/1
TRICHLOROETHYLENE	ND(10.)	UG/L	266/1
TOLUENE	ND(10.)	UG/L	266/1
TETRACHLOROETHYLENE	ND(10.)	UG/L	266/1
METHYLETHYL KETONE	ND(50.)	UG/L	266/1
METHYLENE CHLORIDE	ND(10.)	UG/L	266/1
ISOBUTANOL	ND(100)	UG/L	266/1
CHLOROFORM	ND(10.)	UG/L	266/1
CHLOROBENZENE	ND(10.)	UG/L	266/1
CARBON TETRACHLORIDE	ND(10.)	UG/L	266/1
CARBON DISULFIDE	ND(100)	UG/L	266/1
BENZENE	65	UG/L	266/1
ACRYLONITRILE	ND(50.)	UG/L	266/1
1,2-DICHLOROETHANE	ND(10.)	UG/L	266/1
1,1-DICHLOROETHYLENE	ND(10.)	UG/L	266/1
1,1,2-TRICHLOROETHANE	ND(10.)	UG/L	266/1
1,1,2,2-TETRACHLORO ETHANE	ND(10.)	UG/L	266/1
1,1,1-TRICHLOROETHANE	ND(10.)	UG/L	266/1
1,1,1,2-TETRACHLORO ETHANE	ND(10.)	UG/L	266/1
TCLP EXTRACTABLES			/
PYRIDINE	ND(50.)	UG/L	267/1
PHENOL	ND(5.0)	UG/L	267/1
PENTACHLOROPHENOL	ND(5.0)	UG/L	267/1
P-DICHLOROBENZENE	ND(5.0)	UG/L	267/1
P-CRESOL	ND(5.0)	UG/L	267/1
O-DICHLOROBENZENE	ND(5.0)	UG/L	267/1
O-CRESOL	ND(5.0)	UG/L	267/1
NITROBENZENE	ND(5.0)	UG/L	267/1
M-CRESOL	ND(5.0)	UG/L	267/1
HEXACHLOROETHANE	ND(5.0)	UG/L	267/1
HEXACHLOROBUTADIENE	ND(5.0)	UG/L	267/1
HEXACHLOROBENZENE	ND(5.0)	UG/L	267/1
BIS(2-CHLOROETHYL) ETHER	ND(5.0)	UG/L	267/1

-CONTINUED-

CONTINENTAL ANALYTICAL SERVICES, INC.

LABORATORY REPORT

CLIENT: TOTAL PETROLEUM, INC.
LAB NUMBER: 90080321

ANALYSIS	CONCENTRATION	UNITS	BOOK/PAGE
2,4-DINITROTOLUENE	ND(5.0)	UG/L	267/1
2,4,6-TRICHLOROPHENOL	ND(5.0)	UG/L	267/1
2,4,5-TRICHLOROPHENOL	ND(5.0)	UG/L	267/1
2,3,4,6-TETRACHLOROPHENOL	ND(5.0)	UG/L	267/1
BARIUM, TCLP	4.1	MG/L	232/44
CADMIUM, TCLP	ND(0.05)	MG/L	260/14
CHROMIUM, TCLP	1.19	MG/L	233/54
LEAD, TCLP	ND(0.2)	MG/L	251/26
MERCURY, TCLP	ND(0.002)	MG/L	235/60
SELENIUM, TCLP	ND(0.5)	MG/L	208/80
SILVER, TCLP	ND(0.05)	MG/L	236/34

CONCLUSION OF LAB NUMBER: 90080321

ND(), WHERE NOTED, INDICATES NONE DETECTED WITH THE DETECTION LIMIT IN PARENTHESES.

QUALITY CONTROL ANALYSES WERE PERFORMED ON SAMPLES AT TIME OF ANALYSIS IN ACCORDANCE WITH PROCEDURES PUBLISHED IN TITLE 40 OF THE CODE OF FEDERAL REGULATIONS PART 136, JULY 1, 1986 OR IN EPA PUBLICATION, SW-846, 3RD EDITION, NOV. 1986.

SAMPLES WILL BE RETAINED FOR 30 DAYS UNLESS OTHERWISE NOTIFIED.

CONTINENTAL ANALYTICAL SERVICES, INC.

Kathleen A. Mitchell for

CLIFFORD J. BAKER
LABORATORY DIRECTOR

#3A AERATED LAGOON BOTTOM SOIL

ANALYSES AFTER CLEANOUT

CONTINENTAL ANALYTICAL SERVICES, INC.

1804 GLENDALE - SALINA, KANSAS 67401 - (913)827-1273

LABORATORY REPORT

CLIENT: TOTAL PETROLEUM, INC.
ATTN:PHILLIP E. HOLMES
1400 SOUTH K STREET
ARKANSAS CITY, KS 67005

DATE SAMPLE RPTD: 08/03/90
DATE SAMPLE RECD: 07/28/90
CAS FILE NO: 90-5126
CAS ORDER NO: 4297
CLIENT P.O.:

LAB NUMBER: 90070970
SAMPLE DESCRIPTION: AC-339-90 LAGOON SOIL

DATE SAMPLED: 07/27/90
TIME SAMPLED:

ANALYSIS	CONCENTRATION	UNITS	BOOK/PAGE
TCLP VOLATILES			/
VINYL CHLORIDE	ND(10)	UG/L	234/26
TRICHLOROETHYLENE	ND(10)	UG/L	234/26
TOLUENE	ND(10)	UG/L	234/26
TETRACHLOROETHYLENE	ND(10)	UG/L	234/26
METHYLETHYL KETONE	ND(50)	UG/L	234/26
METHYLENE CHLORIDE	ND(10)	UG/L	234/26
ISOBUTANOL	ND(100)	UG/L	234/26
CHLOROFORM	ND(10)	UG/L	234/26
CHLOROBENZENE	ND(10)	UG/L	234/26
CARBON TETRACHLORIDE	ND(10)	UG/L	234/26
CARBON DISULFIDE	ND(100)	UG/L	234/26
BENZENE	ND(10)	UG/L	234/26
ACRYLONITRILE	ND(50)	UG/L	234/26
1,2-DICHLOROETHANE	ND(10)	UG/L	234/26
1,1-DICHLOROETHYLENE	ND(10)	UG/L	234/26
1,1,2-TRICHLOROETHANE	ND(10)	UG/L	234/26
1,1,2,2-TETRACHLORO ETHANE	ND(10)	UG/L	234/26
1,1,1-TRICHLOROETHANE	ND(10)	UG/L	234/26
1,1,1,2-TETRACHLORO ETHANE	ND(10)	UG/L	234/26
TCLP EXTRACTABLES			/
PYRIDINE	ND(50)	UG/L	234/27
PHENOL	ND(5.0)	UG/L	234/27
PENTACHLOROPHENOL	ND(5.0)	UG/L	234/27
P-DICHLOROBENZENE	ND(5.0)	UG/L	234/27
P-CRESOL	ND(5.0)	UG/L	234/27
O-DICHLOROBENZENE	ND(5.0)	UG/L	234/27
O-CRESOL	ND(5.0)	UG/L	234/27
NITROBENZENE	ND(5.0)	UG/L	234/27
M-CRESOL	ND(5.0)	UG/L	234/27
HEXACHLOROETHANE	ND(5.0)	UG/L	234/27
HEXACHLOROBUTADIENE	ND(5.0)	UG/L	234/27
HEXACHLOROBENZENE	ND(5.0)	UG/L	234/27
BIS(2-CHLOROETHYL) ETHER	ND(5.0)	UG/L	234/27

-CONTINUED-

CONTINENTAL ANALYTICAL SERVICES, INC.

LABORATORY REPORT PAGE: 2

CLIENT: TOTAL PETROLEUM, INC.
LAB NUMBER: 90070970

ANALYSIS	CONCENTRATION	UNITS	BOOK/PAGE
2,4-DINITROTOLUENE	ND(5.0)	UG/L	234/27
2,4,6-TRICHLOROPHENOL	ND(5.0)	UG/L	234/27
2,4,5-TRICHLOROPHENOL	ND(5.0)	UG/L	234/27
2,3,4,6-TETRACHLOROPHENOL	ND(5.0)	UG/L	234/27
ARSENIC, TCLP	ND(1)	MG/L	237/38
BARIUM, TCLP	0.5	MG/L	232/36
CADMIUM, TCLP	ND(0.05)	MG/L	260/6
CHROMIUM, TCLP	ND(0.04)	MG/L	233/44
LEAD, TCLP	ND(0.2)	MG/L	251/13
MERCURY, TCLP	ND(0.002)	MG/L	235/50
SELENIUM, TCLP	ND(0.5)	MG/L	208/68
SILVER, TCLP	ND(0.05)	MG/L	236/24

CONCLUSION OF LAB NUMBER: 90070970

ND(), WHERE NOTED, INDICATES NONE DETECTED WITH THE DETECTION LIMIT IN PARENTHESES.

JALITY CONTROL ANALYSES WERE PERFORMED ON SAMPLES AT TIME OF ANALYSIS IN ACCORDANCE WITH PROCEDURES PUBLISHED IN TITLE 40 OF THE CODE OF FEDERAL REGULATIONS PART 136, JULY 1, 1986 OR IN EPA PUBLICATION, SW-846, 3RD EDITION, NOV. 1986.

SAMPLES WILL BE RETAINED FOR 30 DAYS UNLESS OTHERWISE NOTIFIED.

CONTINENTAL ANALYTICAL SERVICES, INC.

Clifford J. Baker

CLIFFORD J. BAKER
LABORATORY DIRECTOR

APPENDIX B

GROUND WATER SAMPLING AND ANALYSIS PLAN

Revised: April 28, 1997

EnecoTech

File#2996.10

TPI Sampling and Analysis Plan

This Sampling and Analysis Plan (SAP), is being prepared as a modification to the existing groundwater monitoring program presented in Attachment IX of TPI's RCRA Part B Permit, as well as the program submitted in Total's 1992 Part B Permit Application. In order to achieve consistent reproducible results all activities outlined in the SAP must and will be adhered to at all times.

GROUNDWATER MONITORING

Monitoring Well System

The monitoring well system at Total Petroleum's Arkansas City facility consists wells monitoring three regulated units. The regulated units, applicable regulations and description of monitoring systems are listed below. All pertinent well information is listed under Table 1. Well development logs are included as Attachment 1.

Land Treatment Unit: (LTU)
The monitoring system associated with the LTU consists of eight stainless steel well clusters surrounding the land treatment unit (LTU), identified as WN1-A through WN8-B. One well cluster (WN1-A&B), is upgradient from the LTU and serves as background. Each well cluster consists of two wells. The "A" series wells range from 42.5 to 47 feet in total depth. The "B" series wells range from 25 to 31 feet in total depth. The LTU and associated groundwater monitoring system is a permitted facility and is regulated under permitted facility standards (40 CFR 264).

Closed Oily Water Ponds:
The monitoring system associated with the closed oily water pond consisted of seven stainless steel wells around the two closed oily water ponds. The #1 pond was closed in place and the #2 pond was clean closed. Six of the wells are situated as three paired clusters, two upgradient (mw 6&13) and four down gradient (mw 10&3, mw 4&11). Each well cluster consists of two wells, one to monitor the shallow alluvial aquifer and one to monitor deep alluvial aquifer. In addition to the well clusters, one well (mw 5), a deep alluvial aquifer monitoring well is located down gradient of the ponds.

#3A Aeration Lagoon:
The monitoring system associated with the closed #3A aeration lagoon consists of four shallow alluvial aquifer monitoring wells. RCRA mw-1,2,3 wells are down gradient of the lagoon and RCRA mw-4 is upgradient. The #3A lagoon is an interim status facility.

Personnel Protection

A. Equipment

Each member of the sampling team will be equipped with the following:

a. Disposable protective gloves (one set per well sampled). The gloves should be of proper fit and should not have any rips, tears, or punctures.

b. Safety glasses in good condition which allow for unimpaired vision.

c. A hard hat that is adjusted to fit comfortably.

d. Tyvek suits that fit comfortably without excessive tightness or looseness. No rips, tears, or punctures should be evident.

e. Nomex coveralls that fit properly.

Tyvek suits should be changed as required to maintain cleanliness and to ensure safety.

Gloves will be changed after each well is sampled or more often to maintain cleanliness and reduce the possibility of cross contamination.

In addition to the above, the sampling team will be required to carry a two-way radio or cellular phone to summon help in case of an emergency.

Well Measurements

A. Order of Wells

To avoid any cross contamination, well measurements will be taken starting with those wells with the least potential for contamination and proceeding to those wells with the highest potential for contamination. It is difficult to determine if one well is more contaminated than another when both wells exhibit some contamination but no obvious large differences exist. The well order for measurement and sampling will be preset before each sampling event. Results from the previous quarter's sampling event and site knowledge will be used to determine the wells with the least potential for contamination from the wells with the highest potential for contamination and thus the fluid level measuring order. It should be noted that proper cleaning of the measuring probe between wells is as important or more important than the order in which the measurements are taken.

B. Water Level and Annual Depth Readings

I. Equipment will consist of an oil/water interface probe with an audible alarm that can distinguish the difference between hydrocarbons and water. The probe will be marked in a manner to accurately obtain static water level measurements of 0.01 ft. A carrying case for the probe will be provided for transportation of the probe to the different wells in an environmentally sound manner.

II. Total depth readings (to the nearest 1/8 inch or 0.01 foot) for each well will be taken annually using an interface probe. A check for light and dense phase immiscible liquids will be conducted at the same time. The depth readings will be taken in the following order:

1. Upon arrival at the first well on the schedule, the team observer will log the date, time, ambient temperature, general weather conditions, and individuals present at the sampling event, including team members and any observers. Plastic will be spread to minimize soil contamination.

2. After entering the general information, the team observer will note the condition of the well, including whether or not the lock was in place, and evidence of tampering, if there is any water standing near the well, and the condition of the apron.

3. The designated team member will put on clean latex gloves and proceed as follows:

   a. Remove lock and outer protective casing cap from well.

   b. Remove inner casing cap.

   c. Lower clean oil/water interface probe into the well until the liquid level is reached. Note and record depth to liquid (nearest 0.01 foot) from the permanently marked reference point at top of inner well casing and nature of liquid (e.g. hydrocarbon or water). Retrieve probe slowly until audible alarm ceases and again record depth to liquid.

   d. If the liquid encountered is hydrocarbon, again lower the probe until water level is reached and record depth in the same manner as above.

   e. On an annual basis, lower probe until dense phase organics are encountered or the bottom of the well is reached. The bottom of the well will be evident when the tension on the cable is relieved as the probe touches bottom. In either case record depth and thickness of the dense phase. Total depths of the wells will be determined to ascertain if silting in with fine grained sediment is occurring. At the point when the well will not efficiently yield a sample, a determination will be made to redevelop the well.

4. After the well measurements have been recorded, the interface probe and calibrated tape will be decontaminated. One member of the team will hold the interface probe housing over the well. The second team member will prepare a paper towel by soaking an area on one side of the towel with methanol and the other end of the towel with distilled water. The second team member wraps the upper most exposed portion of the tape with the towel, with the methanol soaked end of the towel downhole. The first team member then reels in the tape causing the downhole portion of the tape to be pulled through the towel and thereby removing the contaminates from the tape.

When the tape has almost been reeled up into the housing box, the probe is allowed to hang in the air and is decontaminated with methanol followed by distilled water. The probe is wiped dry, reeled into the housing box and stored in a clean container.

IV. After measurement is complete, check well ID number and static water level reference point to assure that the marks are clear. If the marks are faded or wrong, remark the well casing with the correct information.

Sampling Parameters

Each time ground-water samples are collected, the following parameters (Target Compounds), will be analyzed:

Volatile Organic Compounds	General Indicators
Benzene	pH
Toluene	Specific Conductivity
Ethylbenzene	Chloride
Total Xylenes	Total Dissolved Solids
Chlorobenzene	Temperature
Chloroform	
Methyl Ethyl Ketone	
Acetone	
Carbon Tetrachloride	
Trichloroethylene	
1,1-Dichloroethylene	

Metal (Total)

Chromium
Lead
Barium
Arsenic
Cadmium

Base, Neutral, and Acid Extractable Organics

Anthracene	1-Methylnaphthalene
Benzo(a)anthracene	Naphthalene
Benzo(b)fluoranthene	Phenanthrene
Benzo(a)pyrene	Pyrene
Bis(2-ethylhexyl)-phthalate	2,4-Dimethylphenol
Chrysene	Phenol
Dimethylphthalate	Dibenzofuran
Di(n)octylphthalate	Acenaphthylene
Flouranthene	2-Methylnaphthalene
	Fluorene

Note: The target compound list is the proposed analytical parameter list forwarded in the Revised Groundwater Monitoring Technical Work Plan Short-Term Program and Long-Term Program.

Sampling Schedule

Groundwater samples will be collected from all monitoring wells at the LTU, closed oily water ponds, #3A aerated lagoon four times per year according to the following schedule:

1. One complete set will be obtained between January and March, inclusive.
2. Second quarter samples will be taken between April and June, inclusive.
3. Third quarter sampling between July and September, inclusive.
4. Fourth quarter sampling between October and December, inclusive.

During the sampling event, a concurrent fluid level monitoring event will be performed at the entire facility. This information will be used to develop potentiometric surface maps for the sampling event.

Field Logbooks

Sampling personnel will record and retain pertinent data in a field log book. An example log sheet is included as Attachment II. Information to be included will consist of:

1. Sample description (e.g. groundwater, pore water)
2. Sampler's identity - chain of custody should be maintained; each time transfer of a sample occurs, a record including signatures of parties involved in transfer should be made.
   (This procedure can have legal significance.)
3. Time and date of sampling
4. Significant weather conditions
5. Sample laboratory number
6. Pertinent well data (e.g. depth to water surface)
7. Sampling method (e.g. vacuum, bailer, pressure)
8. Preservatives (e.g. H_2SO_4, HCl, or thermal)
9. Sample containers (e.g. type, size, and number)
10. Reason for sampling (e.g. initial sampling, annual sampling, quarterly sampling, special sampling).
11. Appearance of sample (e.g. color, turbidity, sediment, oil on surface, etc.)
12. Any other information which appears to be significant (e.g. sampled in conjunction with state, county, local regulatory authorities; samples for specific conductance value only; sampled for indicator analysis; resampled etc.)
13. Name and location of laboratory performing analysis.
14. Sample temperature upon sampling.
15. Analytical determinations performed in the field at the time of sampling and results obtained (e.g. pH, temperature, and specific conductance, etc.).
16. Analyst's identity and affiliation.

Well Purging

To obtain water samples which are characteristic of the underlying water bearing zone, the wells will be pumped and allowed to recharge. A minimum of three well casing volumes will be removed from each well prior to taking the actual samples for analysis. The purged water will be disposed of at the API separator for all monitoring wells. Barrels will be placed at the wells for temporary storage and after the wells are purged, the barrels will be transferred to the API separator for subsequent treatment. The barrels will be returned to the wells after dumping the contents at the API separator for future sampling events.

The majority of wells are fitted with a dedicated bladder pump. The pump is a bellows type pump and activated via a common air compressor (Well Wizard). The bladder pumps are used to purge the well and collect the sample.

If bladder pumps are not functioning or missing from the well, dedicated disposable bailers may be used to purge and sample well. To avoid cross contamination, the bailer should be disposed of following use.

Once each well is properly purged of standing water, it is allowed to recover to close to its previous static water level, if needed. Sufficient time is given, if needed, to allow prior wells to recover prior to sampling. This of course does not apply to low yield wells which could take days or weeks to fully recover. In this case they would be allowed to recover to levels that would allow adequate sample removal.

The well volume includes the volume of water within the well casing. A conservative estimate of the volume of water to be removed can be calculated by determining 3 times the entire volume of the casing in the saturated zone. The formula to be used is:

Gallons to remove = $(n)(3.1416)(r)^2 (d)(7.48)$ where

n = Number of well volumes (3)
r = Radius of well casing
d = Depth of water in feet

The above calculation is included in the field log book and is performed each time the static water levels are determined.

In Situ Measurements

1. Dedicated sampling equipment (bladder pumps &/or bailers) will be employed for each well sampled. However, the wells will be sampled in the same order as they were purged for repeatability and convenience. Beginning at the first well, team members will take adequate measures to insure that the sampling equipment does not touch the ground.

2. The protective well cap will be unlocked and removed and the casing cap will be set aside.

3. The team member responsible for field parameter measurements will set up the required analytical instrumentation and standardization materials.

4. Temperature, pH and specific conductivity measurements are made using a suitable Ph-Conductivity meter and a thermometer. Manufactures recommendations for calibration procedures of the pH-Conductivity meter will be followed. Calibrations will be performed for pH and Conductivity prior to sampling each individual well. The calibrations will be recorded for each sampling event on the field logs.

5. A sample will be obtained and placed in either a disposable beaker or a dedicated glass beaker. A small amount of sample will be transferred to the pH-Conductivity meter. Ph determination will be performed first followed by specific conductivity. The thermometer will be allowed to equilibrate and temperature measurement will be performed simultaneously with pH and conductivity.

6. After pH, specific conductance, and temperature are determined for each well, rinse the pH-Conductivity meter and the thermometer with DI water before proceeding to the next well.

Sampling Procedures

1. If an immiscible floating layer is present on the groundwater surface in the well it will be sampled annually prior to well evacuation. Also, if it is determined that heavier-than-water or dense phase organics are present, then the bottom discharge bailer will be lowered to the bottom of the well and a sample will be collected for analyses prior to well evacuation. The dedicated bailer will be cleaned prior to further sampling if an immiscible floating layer or dense phase organics are determined to be present.

2. Sample containers and coolers will come premarked from the laboratory identifying the appropriate container for analyses at each well.

3. After each sample is taken it is immediately iced down.

4. A team member will remove the cooler with the designated well sample containers which were received premarked from the laboratory and arrange them in the following order:

   a. Volatiles (2-40 ml septa sealed vials)

   b. Base/Neutral and Acid Organics (two 1-liter bottles)

   c. Total Metals

5. The first sample to be taken will be for volatile organic analyses. Carefully add the sample to the first VOA vial making sure to exclude all air from the sample. Fill vial completely, carefully cap vial, and turn vial upside down to check for any trapped air bubbles. If any bubbles are evident, discard sample and redo. Fill the other VOA vial in the same manner immediately following first sample. Place the vials in the cooler and continue with the next sample.

6. Next, one liter is collected in an amber glass container for base/neutral and acid extractable organics. Fill the bottle to the shoulder of the bottle, cap, and place it in the cooler.

7. Finally, collect samples for total metal analyses. Fill sample container to the neck. Seal the container and place it in the cooler.

In addition to the above, a 500 ml sample will be retrieved and transported in a polyethylene or glass container back to the laboratory for analysis of chlorides and total dissolved solids.

After all samples have been taken the well will be secured by replacing the casing cap and protective cap. Make sure any protective covers or caps have been put in place and secured. Before moving on to the next well, make sure well ID number and static water level measurement points are clearly marked on the well casing.

Sample Containers

All sample containers (except 500 ml polyethylene containers for chlorides and total dissolved solids) are provided by an outside contract laboratory certified in the state of Kansas. Any required preservatives (e.g. HNO_3 for metal analyses) are added to the sample containers before being shipped to TPI for sample collection. Prior to sample collection, all sample containers, will be labeled with sampling location, date of collection, and sample identification number.

Specific sampling parameters require specific container types. Volatile organics require 40 ml glass vials with teflon lined septums in the caps. Semi-volatile organic parameter samples are collected in 1 liter amber glass bottles with teflon-lined caps. Metals are collected in 500 ml polyethylene sample containers with polyethylene caps.

Decontamination

Cleaning and decontamination of equipment, whether new or used, is mandatory. Without it quality control is impossible.

Preliminary

The well sounder, well sounder cable, and oil/water interface probe are cleaned initially as described in the Well Measurement section B, II, 4.

The pH/ Conductivity meter is triple distilled water rinsed and calibrated in the laboratory.

Field

The well sounder and interface probe are cleaned as described in the Well Measurement section B, II, 4. Care is taken to dry the well sounder cable as it is wound on the reel.

The pH/ Conductivity meter is rinsed with distilled water between samples, then recalibrated prior to the next well.

Since the bladder pumps(or bailers), air hoses, and discharge tubing are dedicated for each well, no decontamination between wells is necessary.

Follow-up

After completion of all sampling, the equipment is brought back to the laboratory and cleaned as above.

Sample Shipping

After collection of groundwater samples, the sample containers will be packed into ice chests filled with ice to maintain an approximate shipping temperature of 4 degrees C. Sample bottles will be suitably packed in styrofoam to avoid breakage. After packing, the ice chests will be secured during shipment with reinforced packing tape.

All sample shipments will be shipped the same day of collection to the outside contract laboratory via guaranteed overnight or same day delivery by the laboratory, Pony Express or other suitable carrier.

Chain of Custody

All sample shipments will be accompanied by a chain of custody record. Chain of custody information includes sample location, identity of sampler(s), sample identification, date, type (grab or composite), number of samples, required analysis, and signatures of the person relinquishing the samples for shipment, the shipment driver, and the person receiving, the samples at the contact laboratory.

QA/ QC

To ensure the reliability and validity of field and analytical laboratory data, a QA/QC program will be implemented.

Field QA/QC Program

Two types of QC blanks will be collected: trip blanks and equipment blanks. These field blanks will be used to verify that the sample collection and handling process has not affected the quality of the samples. Trip blanks will be prepared for each sampling event. To prepare the trip blanks, fill one of each type of sample bottle to be used with DI water. Transport the bottles to the site, handle as samples, and ship them to the laboratory for analysis. The trip blanks should be subjected to the same analyses as the groundwater samples. One trip blank will be prepared during each sampling event.

Equipment blanks are collected to ensure that the non-dedicated purging and sampling equipment has been effectively cleaned. An equipment blank will be collected each day that groundwater monitoring wells are sampled. To collect the equipment blank, run DI water through and over all field apparatus that will contact the groundwater. One equipment blank will be prepared each day groundwater samples are collected.

One duplicate groundwater sample per sampling event will be prepared by collecting two complete sets of groundwater sample aliquots from the same well.

Other field QA/QC practices include instrument calibration and sampling equipment decontamination which are discussed in earlier sections.

Laboratory QA/QC Program

Standard QA/QC protocols are defined in the EPA-approved methods. Standards, laboratory blanks, duplicates, and spiked samples will be used for calibration and identification of potential matrix interferences.

ATTACHMENT I

TOTAL PETROLEUM - ARKCITY
MONITORING WELL INFORMATION

WELL ID NUMBER	WELL CASING DIAMETER OD - (IN)	WELL CASING DIAMETER ID - (IN)	OUTER CASING DIAMETER OD - (IN)	OUTER CASING DIAMETER ID -(IN)	TOTAL CASING LENGTH (FEET)	SCREENED INTERVAL (FEET)
WN1-A	2.37	2.00	8.69	7.88	31.00	15.00
WN1-B	2.37	2.00	8.69	7.88	16.00	15.00
WN2-A	2.37	2.00	8.69	7.88	28.00	20.00
WN2-B	2.37	2.00	8.69	7.88	15.00	15.00
WN3-A	2.37	2.00	8.69	7.88	25.00	20.00
WN3-B	2.37	2.00	8.69	7.88	15.00	15.00
WN4-A	2.37	2.00	8.69	7.88	30.00	20.00
WN4-B	2.37	2.00	8.69	7.88	20.00	15.00
WN5-A	2.37	2.00	8.69	7.88	30.00	20.00
WN5-B	2.37	2.00	8.69	7.88	15.00	15.00
WN6-A	2.37	2.00	8.69	7.88	32.00	15.00
WN6-B	2.37	2.00	8.69	7.88	15.00	15.00
WN7-A	2.37	2.00	8.69	7.88	34.00	15.00
WN7-B	2.37	2.00	8.69	7.88	19.00	15.00
WN8-A	2.37	2.00	8.69	7.88	32.00	15.00
WN8-B	2.37	2.00	8.69	7.88	20.00	15.00
MW-3	2.44	1.88	4.00	3.75	31.39	10.00
MW-4	2.44	1.88	4.00	3.75	28.85	10.00
MW-5	2.44	1.88	4.00	3.75	29.64	10.00
MW-6	2.44	1.88	4.00	3.75	20.72	10.00
MW-10	2.44	1.88	4.00	3.75	44.60	10.00
MW-11	2.44	1.88	4.00	3.75	44.56	10.00
MW-13	2.44	1.88	4.00	3.75	35.12	10.00
RCRA MW-1	2.44	1.88	4.00	3.75	33.43	10.00
RCRA MW-2	2.44	1.88	4.00	3.75	33.13	10.00
RCRA MW-3	2.44	1.88	4.00	3.75	33.17	10.00
RCRA MW-4	2.44	1.88	4.00	3.75	32.87	10.00

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

PAGE 1 OF 2

WELL NUMBER WN-1 A

PROJECT Total RCRA — OWNER Total Petroleum, Inc.
LOCATION Ark City, KS — PROJECT NUMBER 422-875-9023
DATE DRILLED 8-1-88 — TOTAL DEPTH OF HOLE 45.0 — DIAMETER 8.0"
SURFACE ELEVATION 1086.17 — WATER LEVEL INITIAL 18.0' — 24-HRS. 18.0'
SCREEN DIA. 2.0" — LENGTH 15.0' — SLOT SIZE 0.02"
CASING DIA. 2.0" — LENGTH 31.0' — TYP. Stainless Steel
DRILLING COMPANY GTI — DRILLING METHOD 8.0" Hollow Stem
DRILLER Frank Baker — LOG BY Barry McFarland

SURVEY MAP: N

NOTES: 10' W of RCRA #1

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	USCS	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
0		Concrete	SC		Clayey Sand: Dark Brown; 20-30% fines, dry, fine grained, medium dense.
		5' continuous sampler used from 0-20'	SP		Sand: Yellowish Brown-Light Brown; 0-10% fines, fine to medium grained, medium dense (with some clay seams to 2")
5		Volclay Grout			
10			SP		A.A. but medium grained and wet to very wet at 16.0'.
15					
20			SP		Sand- Light Grey; 0-10% fines, saturated medium and coarse grained, medium dense (slight fuel odor)
25		Bentonite Chips			

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

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WELL NUMBER WN-1-A

PROJECT Total/RCRA — OWNER Total Petroleum, Inc.
LOCATION Ark City, KS — PROJECT NUMBER 422-875-9023
DATE DRILLED 8-1-88 — TOTAL DEPTH OF HOLE 45.0 — DIAMETER 8.0"
SURFACE ELEVATION — WATER LEVEL INITIAL — 24-HRS.
SCREEN DIA. — LENGTH — SLOT SIZE
CASING DIA. — LENGTH — TYP.
DRILLING COMPANY — DRILLING METHOD
DRILLER — LOG BY

SURVEY MAP

NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	USCS	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
26			SP		A.A.
30					
35					
			SP		Gravelly Sand: Light Grey; 0-10% fines, saturated medium dense; coarse grained, (with limestone gravels to 3")
40					
45					Shale: Light Greyish Brown; medium hard

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

WELL NUMBER WN-1-B

PROJECT Total/RCRA OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS PROJECT NUMBER 422-875-9023
DATE DRILLED 8-10-88 TOTAL DEPTH OF HOLE 28.0' DIAMETER 8.0'
SURFACE ELEVATION 1065.12 WATER LEVEL INITIAL 18.0' FINAL 18.0'
SCREEN DIA. 2.0" LENGTH 15.0' SLOT SIZE 0.02"
CASING DIA. 2.0" LENGTH 16.0' TYP. Stainless Steel
DRILLING COMPANY GTI DRILLING METHOD Hollow Stem
DRILLER Frank Baker LOG BY Barry McFarland

SKETCH MAP

NOTES
7' NE of WN-1-A

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
0		Concrete			Same as WN-1-A
5		Volclay Grout			
		Bentonite			
10					
		Screen 13'-28'			
15					
20					
25					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

WELL NUMBER WN-1-B

PROJECT Total/RCRA OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS PROJECT NUMBER 422-875-9023
DATE DRILLED 8-10-88 TOTAL DEPTH OF HOLE 28.0' DIAMETER 8.0"
SURFACE ELEVATION WATER LEVEL INITIAL FINAL
SCREEN DIA. LENGTH SLOT SIZE
CASING DIA. LENGTH TYP.
DRILLING COMPANY DRILLING METHOD
DRILLER LOG BY

SKETCH MAP

NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
20					Same as WN-1-A

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

PAGE 1 OF 2

WELL NUMBER MW-2A

PROJECT Total/RCRA — OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS — PROJECT NUMBER 422-875-9023
DATE DRILLED 8-4-88 — TOTAL DEPTH OF HOLE 44.0' — DIAMETER 8.0'
SURFACE ELEVATION 1061.75 — WATER LEVEL INITIAL 15.0' — 24-HRS. 15.0'
SCREEN DIA. 2.0" — LENGTH 20.0' — SLOT SIZE 0.02"
CASING DIA. 2.0" — LENGTH 28.0' — TYP. Stainless Steel
DRILLING COMPANY GTI — DRILLING METHOD
DRILLER Frank Baker — LOG BY Barry McFarland

SITE MAP: MW-2 N; LAND FARM

NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
0		Concrete	CL		Sandy Clay: Dark Brown, 20-30% fine sand; dry, low plastic, medium stiff (top soil with roots in upper 6")
		Continuous Sampler used 0-20'	SP		Sand: Yellowish Brown; 0-10% fines; moist, fine grains, medium dense.
5		Composite Jar Samples 10-15 15-20			
			SP		A.A. but wet, medium grain size
10		1/2" Bentonite Pellets			
15		N-Nu 60-110 at Sampler (15-20')			Sand: Light Grey; 0-10% fines; saturated; medium and coarse grains; medium dense (w/ strong fuel odor)
20					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

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WELL NUMBER MW-2-A

PROJECT Total RCRA — OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS — PROJECT NUMBER 422-875-9023
DATE DRILLED 8-4-88 — TOTAL DEPTH OF HOLE 45.0' — DIAMETER 8.0"
SURFACE ELEVATION — WATER LEVEL INITIAL — 24-HRS.
SCREEN DIA. — LENGTH — SLOT SIZE
CASING DIA. — LENGTH — TYP.
DRILLING COMPANY — DRILLING METHOD
DRILLER — LOG BY

NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
24					
25		Sand Pack			A.A.
30					
35					A.A. but with some gravels to 2.0"(limestones gravels along with igneous river gravels)
40					
45					Shale: Light Grey to Olive; moist; high plastic, medium hard rock

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

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WELL NUMBER WN-2-B

PROJECT Total/RCRA OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS PROJECT NUMBER 422-875-9023
DATE DRILLED 8-9-88 TOTAL DEPTH OF HOLE 25.0' DIAMETER 8.0"
SURFACE ELEVATION 1065.22 WATER LEVEL INITIAL 15.0' 24-HRS. 15.0'
SCREEN DIA. 2.0" LENGTH 15.0' SLOT SIZE 0.02"
CASING DIA. 2.0" LENGTH 15.0' TYP. Stainless Steel
DRILLING COMPANY GTI DRILLING METHOD Hollow Stem
DRILLER Frank Baker LOG BY Barry McFarland

SKETCH MAP

NOTES
6' S of WN-2-A

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
0		Concrete			Same as WN-2-A
		Volclay Grout			
5		Bentonite Chips			
10		Sand Pack			
15					
20					
25					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

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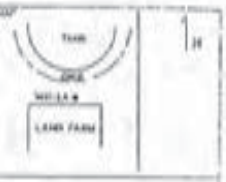
WELL NUMBER WN-3 A

PROJECT Total/RCRA OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS PROJECT NUMBER 422-875-9023
DATE DRILLED 8-9-88 TOTAL DEPTH OF HOLE 42.5' DIAMETER 8.0"
SURFACE ELEVATION 1061.71 WATER LEVEL INITIAL 16.0' 24-HRS. 16.0'
SCREEN DIA. 2.0" LENGTH 20.0' SLOT SIZE 0.02"
CASING DIA. 2.0" LENGTH 25.0' TYP. Stainless Steel
DRILLING COMPANY GTI DRILLING METHOD Hollow Stem
DRILLER Frank Baker LOG BY Barry McFarland

SKETCH MAP


NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
0		Concrete	SM		Silty Sand: Greyish Brown; 10-20% fines; moist; fine grained, medium dense (with roots upper 6")
		Sampler Used 0-20'			
		Volclay Grout			
5			SP		Sand: Yellowish Brown; 0-10% fines; moist, fine grained; medium dense.
10		(10-15' HNU=40-80 ppm @ sampler) Composite jar samples 10-15' and 15-20'			
		bentonite	SP		As above but medium and fine grained, wet to very wet (with slight odor)
15		HNU 100-160 ppm @ sampler 50-90 at drill)	SP		Sand: Light grey; 0-10% fines, saturated at 16', medium grained; medium dense (stained, rainbows on sampler; occasional river gravels to ½")
20		Sand Pack			
25					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

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WELL NUMBER WN-3-A

PROJECT Total/RCRA OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS PROJECT NUMBER 422-875-9023
DATE DRILLED 8-9-88 TOTAL DEPTH OF HOLE 42.5' DIAMETER 8.0"
SURFACE ELEVATION WATER LEVEL DATUM
SCREEN DIA. LENGTH SLOT SIZE 0.02
CASING DIA. LENGTH TYP.
DRILLING COMPANY DRILLING METHOD
DRILLER LOG BY

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
26					
35					A.A. but coarse grained with occasional gravels to 1"
40			SH		Shale: Light grey to olive, medium hard rock.
45					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

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WELL NUMBER WN-3-B

PROJECT Total/RCRA OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS PROJECT NUMBER 422-875-9023
DATE DRILLED 8-9-88 TOTAL DEPTH OF HOLE 26.0' DIAMETER 8.0"
SURFACE ELEVATION 1061.49 WATER LEVEL DATUM 16.0' 24-HRS. 15.0'
SCREEN DIA. 2.0" LENGTH 15.0' SLOT SIZE 0.02"
CASING DIA. 2.0" LENGTH 15.0' TYP. Stainless Steel
DRILLING COMPANY GTI DRILLING METHOD Hollow Stem
DRILLER Frank Baker LOG BY Barry McFarland

REMARKS: 8' W and 4' N of WN-3-A

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
0	Concrete; Volclay Grout				Same as WN-3-A
10	Bentonite Chips				
20	Sand Pack				
30					
40					
50					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

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WELL NUMBER MW-4-A

PROJECT Total Refinery/RCRA OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS PROJECT NUMBER 422-875-9023
DATE DRILLED 8-3-88 TOTAL DEPTH OF HOLE 47.0 DIAMETER 8.0"
SURFACE ELEVATION 1064.83 WATER LEVEL INITIAL 19.5' 24-HRS. 19.5'
SCREEN DIA. 2.0" LENGTH 20.0' SLOT SIZE 0.02
CASING DIA. 2.0" LENGTH 30.0' TYP. Stainless Steel
DRILLING COMPANY GTI DRILLING METHOD Hollow Stem
DRILLER Frank Baker LOG BY Barry McFarland

SURVEY MAP

NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
0		concrete 5' continuous sampler used 0-20'	SM		Silty Sand: Dark Brown; 10-20% fines; dry to moist; medium dense; fine grained
			Fill		Coke Fill: Black; dry, powdery (with some concrete rubble)
5		Volclay Grout	SP		Sand: pale Brown; 0-10% fines; moist; fine grained; medium dense
10					
15		Jar samples 10-15' ½" bentonite pellets 15-20'	SP		Sand: Light yellowish brown; 0-10% fines, wet; medium grained; medium dense (slight odor at 16')
20		50 ppm @ sample w/ HNU	SP		A.A. but light light grey, medium and coarse grained, saturated (with fuel odor)
25					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

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WELL NUMBER MW-4-A

PROJECT Total/RCRA OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS PROJECT NUMBER 422-875-9023
DATE DRILLED 8-3-88 TOTAL DEPTH OF HOLE 47.0' DIAMETER 8.0"
SURFACE ELEVATION ..... WATER LEVEL INITIAL ..... 24-HRS. .....
SCREEN DIA. ..... LENGTH ..... SLOT SIZE .....
CASING DIA. ..... LENGTH ..... TYP. .....
DRILLING COMPANY ..... DRILLING METHOD .....
DRILLER ..... LOG BY .....

SURVEY MAP

NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
25			SP		A.A.
10					
35					
40			SP		A.A. but with occasional gravels to 1.0".
45			CL(w/ sh)		Silty Clay: Light grey to olive, moist, high plastic, very stiff (weathered shale)
			SH		Shale: Light grey to olive; medium hard RX; moist
50					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

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WELL NUMBER WN-4-B

PROJECT Total/RCRA OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS PROJECT NUMBER 422-875-9023
DATE DRILLED 8-10-88 TOTAL DEPTH OF HOLE 30.0' DIAMETER 6.0'
SURFACE ELEVATION 1065.05 WATER LEVEL INITIAL 19.5' 24-HRS. 19.5'
SCREEN DIA. 2.0" LENGTH 15.0' SLOT SIZE 0.02"
CASING DIA. 2.0" LENGTH 20.0' TYP. Stainless Steel
DRILLING COMPANY GTI DRILLING METHOD Hollow Stem
DRILLER Frank Baker LOG BY Barry McFarland

NOTES
5' South of WN-6-A

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
0		Concrete			Same as WN-6-A
		Volclay Grout			
		Bentonite Chips			
20					
30		Sand Pack			
		Cave at 17'			
40					
50					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

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WELL NUMBER WN-5-A

PROJECT Total/RCRA OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS PROJECT NUMBER 422-875-9023
DATE DRILLED 8-3-88 TOTAL DEPTH OF HOLE 46.0' DIAMETER 8.0"
SURFACE ELEVATION 1062.82 WATER LEVEL INITIAL 17.0' 24-HRS. 17.0'
SCREEN DIA. 2.0" LENGTH 20.0' SLOT SIZE 0.02"
CASING DIA. 2.0" LENGTH 30.0' TYP. Stainless Steel
DRILLING COMPANY GTI DRILLING METHOD Hollow Stem
DRILLER Frank Baker LOG BY Barry McFarland

NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
0		Concrete	CL		Sandy Clay: Dark Brown; 20-30% fine sand; moist; low plastic, medium stiff
		Volclay Grout	SM		Silty Sand: Brown; 10-20% fines, moist, fine grained medium dense
5					
		Jar samples 10-15' 15-20'	SP		Sand: Light yellowish brown & light brown, 0-10% fines; moist to wet at 15.0', fine and medium grains, medium dense.
10					
		Bentonite Pellets			
15					
		HNU 70-110 ppm @ sampler	SP		Sand: Light grey; 0-10% fines; saturated, medium and coarse grained; medium dense (with fuel odor)
20					
25					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

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WELL NUMBER WN-5-A

PROJECT Total/RCRA OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS PROJECT NUMBER 422-875-9023
DATE DRILLED 8-3-88 TOTAL DEPTH OF HOLE 46.0' DIAMETER 8.0"
SURFACE ELEVATION WATER LEVEL INITIAL
SCREEN DIA. LENGTH SLOT SIZE
CASING DIA. LENGTH TYP.
DRILLING COMPANY DRILLING METHOD
DRILLER LOG BY

SKETCH MAP

NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
25			SP		As above
30		Sand Pack			
35		HNU 80-150 ppm at cuttings	SP		Sand: Light greyish brown; 0-10% fines; saturated; medium and coarse grain size; medium dense (with some gravels to 2.0")
40					
45			SH		Shale: Light grey to olive; moist; medium hard rock
50					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

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WELL NUMBER WN-5-B

PROJECT Total/RCRA OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS PROJECT NUMBER 422-875-9023
DATE DRILLED 8-9-88 TOTAL DEPTH OF HOLE 26.0' DIAMETER 8.0"
SURFACE ELEVATION 1062.86 WATER LEVEL INITIAL 17.0' 24-HRS. 17.0'
SCREEN DIA. 2.0" LENGTH 15.0' SLOT SIZE 0.02"
CASING DIA. 2.0" LENGTH 15.0' TYP. Stainless Steel
DRILLING COMPANY GTI DRILLING METHOD Hollow Stem
DRILLER Frank Baker LOG BY Barry McFarland

SKETCH MAP
7' S of WN-5-A

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
0		Concrete			Same as WN-5-A
		Volclay Grout			
10		Bentonite Chips			
		Sand Pack			
20					
30					
40					
50					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

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WELL NUMBER WN-6-A

PROJECT Total/RCRA OWNER Total Petroleum, Inc.
LOCATION Ark City, KS PROJECT NUMBER 422-875-9023
DATE DRILLED 8-4-88 TOTAL DEPTH OF HOLE 44.0' DIAMETER 8.0"
SURFACE ELEVATION WATER LEVEL INITIAL
SCREEN DIA. LENGTH SLOT SIZE
CASING DIA. LENGTH TYP.
DRILLING COMPANY DRILLING METHOD
DRILLER LOG BY

SKETCH MAP

NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
26					As above
30		Screen 29-44'			
35					
40					A.A. but with limestone gravels to 3" diameter.
45					Shale: Very Light Brown - Light Gray; moist, medium hard rock.
50					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

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WELL NUMBER WN-6-B

PROJECT Total/RCRA OWNER Total Petroleum, Inc.
LOCATION Arkansas, KS PROJECT NUMBER 422-875-9023
DATE DRILLED 8-9-88 TOTAL DEPTH OF HOLE 28.0' DIAMETER 8.0'
SURFACE ELEVATION 1062.79 WATER LEVEL INITIAL 18.0' 24-HRS. 18.0'
SCREEN DIA. 2.0" LENGTH 15.0' SLOT SIZE 0.02"
CASING DIA. 2.0" LENGTH 15.0' TYP. Stainless Steel
DRILLING COMPANY GTI DRILLING METHOD Hollow Stem
DRILLER Frank Baker LOG BY Barry McFarland

SKETCH MAP

NOTES
8' E of WN-4A

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
0		Concrete			Same as WN-4 A
		Volclay Grout			
		Bentonite Chips			
		Sand Pack			
20					
30					
40					
50					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

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WELL NUMBER WN-7-A

PROJECT Total/RCRA OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS PROJECT NUMBER 422-875-9023
DATE DRILLED 8-2-88 TOTAL DEPTH OF HOLE 46.0' DIAMETER 8.0"
SURFACE ELEVATION 1062.53 WATER LEVEL INITIAL 19.5' FINAL 19.5'
SCREEN DIA. 2.0" LENGTH 15.0' SLOT SIZE 0.02"
CASING DIA. 2.0" LENGTH 34.0' TYP. Stainless Steel
DRILLING COMPANY GTI DRILLING METHOD Hollow Stem
DRILLER Frank Baker LOG BY Harry McFarland

LOCATION MAP

NOTES
150' W; 351' N of RCRA #1

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION COLOR, MOISTURE, STRUCTURE
0		Concrete	SP		Sand: Very Pale Brown; 0-10% fines, dry-moist, fine grained; medium dense (with some black staining in upper 2.0')
		5' continuous sampler from 0-2U'			
5		Volclay Grout			
10		Jar Sample 10-15'	SP		Sand: Light Grey and light greyish brown, 0-10% fines, wet, fine to medium grained, medium dense (with fuel odor and staining)
15		Jar Sample 15'-20'			
20		100-130 ppm with HNU at sampler	SP		A.A. but medium & coarse grianed, saturated.
25		Sand Pack			

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

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WELL NUMBER WN-7A

PROJECT Total/RCRA OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS PROJECT NUMBER 422-875-9023
DATE DRILLED 8-2-88 TOTAL DEPTH OF HOLE 46.0' DIAMETER 8.0"
SURFACE ELEVATION WATER LEVEL INITIAL FINAL
SCREEN DIA. LENGTH SLOT SIZE
CASING DIA. LENGTH TYP.
DRILLING COMPANY DRILLING METHOD
DRILLER LOG BY

LOCATION MAP

NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION COLOR, MOISTURE, STRUCTURE
26					A.A.
27					
0					
35					
40			SP		A.A. but with some limestone gravels to 1" - 2".
45			CL (w/sh)		Silty Clay: Grey to Olive; moist-wet 1-10% fine sand high plastic; very stiff (weathered shale)
			Sh		Shale: Grey to Olive; soft-medium hard rock. (Auger Refusal)
50					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

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WELL NUMBER WM-2-R

PROJECT Total/RCRA OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS PROJECT NUMBER 422-875-9023
DATE DRILLED 8-10-88 TOTAL DEPTH OF HOLE 31.0' DIAMETER 8.0"
SURFACE ELEVATION 1062.27 WATER LEVEL INITIAL 19.5' 24-HRS. 19.5'
SCREEN DIA. 2.0" LENGTH 15.0' SLOT SIZE
CASING DIA. 2.0" LENGTH 19.0' TYP. Stainless Steel
DRILLING COMPANY GTI DRILLING METHOD Hollow Stem
DRILLER Frank Baker LOG BY Barry McFarland

SCREEN MAP

NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	USCS	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
0		Concrete			Sand: Very pale brown; 0-10% fines, dry-moist, fine grained, medium dense (with some black staining in upper 2.0')
		Volclay Grout			
10					Sand: Light grey and light greyish brown, 0-10% fines, wet, fine to medium grained, medium dense (with fuel odor and staining)
		Bentonite Chips			
20		Sand Pack			As above but medium and coarse grained, saturated.
30					
40					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

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WELL NUMBER WM-8-A

PROJECT Total/RCRA OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS PROJECT NUMBER 422-875-9023
DATE DRILLED 8-2-88 TOTAL DEPTH OF HOLE 44.0' DIAMETER 8.0"
SURFACE ELEVATION 1062.24 WATER LEVEL INITIAL 19.0' 24-HRS. 19.0'
SCREEN DIA. 2.0" LENGTH 15.0' SLOT SIZE 0.02"
CASING DIA. 2.0" LENGTH 32.0' TYP. Stainless Steel
DRILLING COMPANY GTI DRILLING METHOD 8¼" Hollow Stem
DRILLER Frank Baker LOG BY Barry McFarland

SCREEN MAP

NOTES
150' W and 600' N of RCRA #

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	USCS	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
0		Concrete	SM		Silty Sand: Dark Brown; 10-20% fines; dry to moist, fine grained; loose to medium dense (topsoil with roots upper 6")
		Volclay Grout			
5			SM		A.A. but fine to medium grained and brown.
			SM		Silty Sand: Light Grey; 10-20% fines wet; medium grained; medium dense
			SP		
10					Sand: Light Grey and light greyish brown; 0-10% fines; wet; fine and medium size grains; medium dense (with odor and staining)
		Bentonite Chips			
15					
		Sand Pack			
20			SP		As above but medium and coarse grains, saturated.
25					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

PAGE 2 OF 2

WELL NUMBER WN-8-A

PROJECT Total/RCRA
OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS
PROJECT NUMBER 422-875-9023
DATE DRILLED 8-3-88
TOTAL DEPTH OF HOLE 44.0'
DIAMETER 8.0"
SURFACE ELEVATION
WATER LEVEL INITIAL
TO-WHIRL
SCREEN DIA.
LENGTH
SLOT SIZE
CASING DIA.
LENGTH
TYP.
DRILLING COMPANY
DRILLING METHOD
DRILLER
LOG BY

NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	USCS	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
26			SP		As above
35					
40			SP		Sand: Light Grey; 0-10% fines; saturated medium and coarse grains; medium dense (with occasional river gravels up to 2.0")
45			SH		Shale: Light Grey; medium hard rock.
50					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

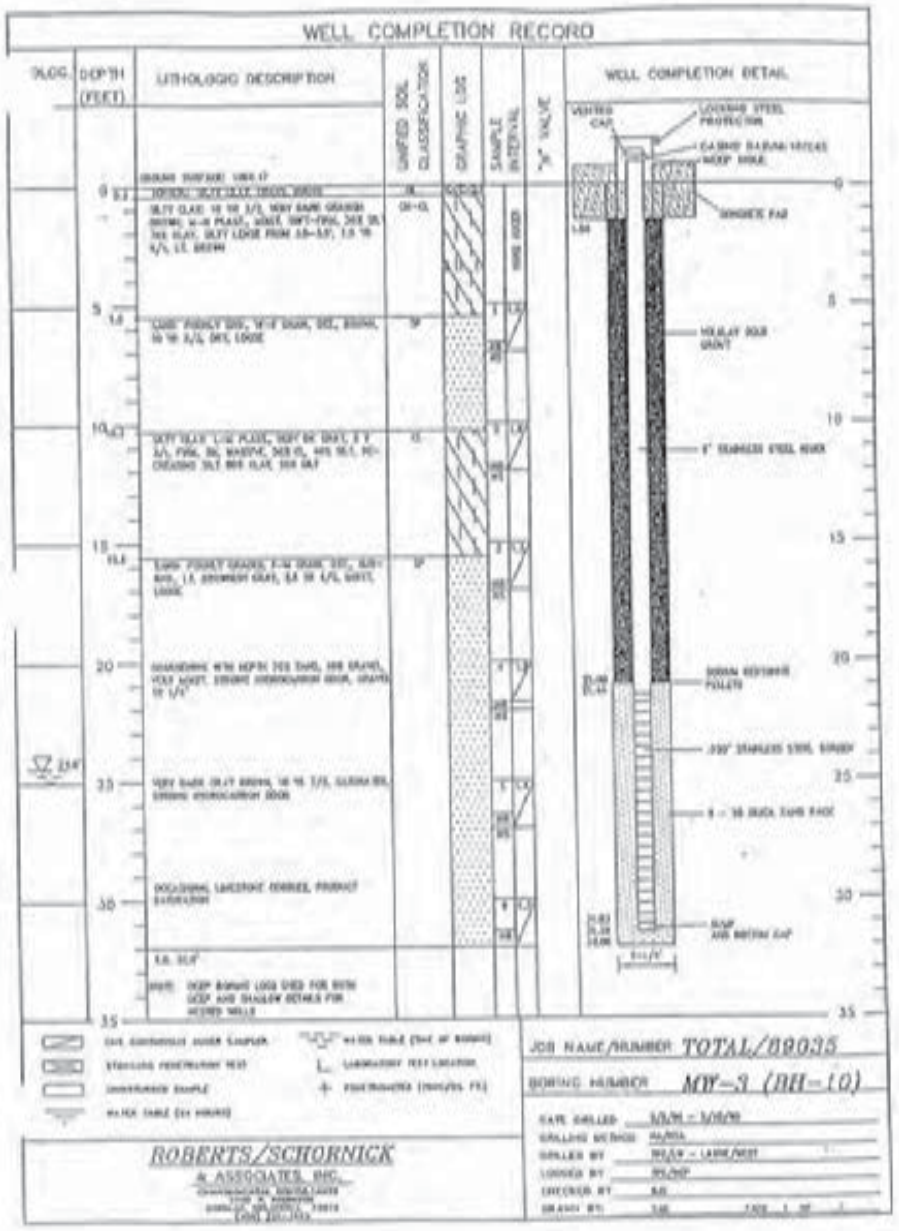
PAGE 1 OF 1

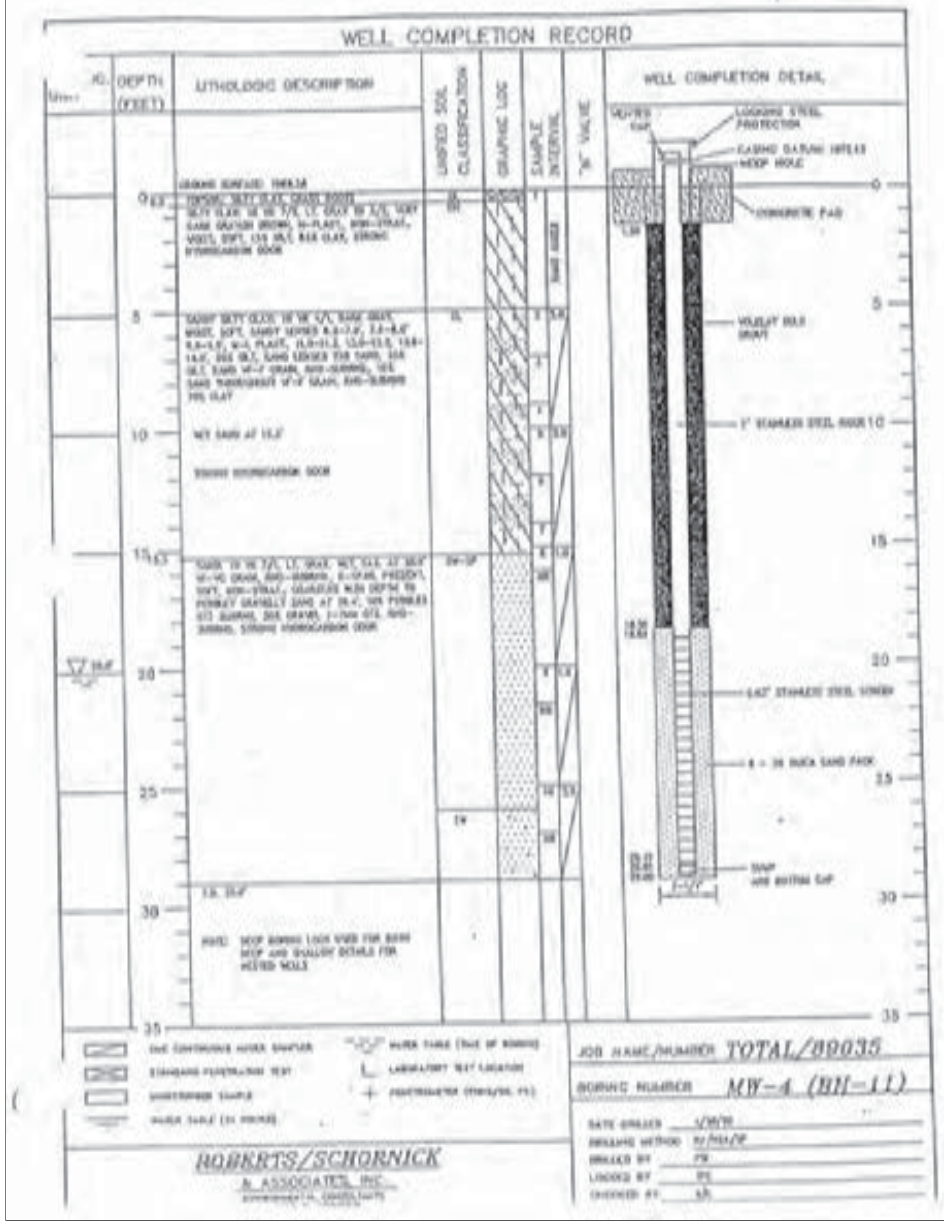
WELL NUMBER WN 8-B

PROJECT Total/RCRA
OWNER Total Petroleum, Inc.
LOCATION Ark City, KS
PROJECT NUMBER 422-875-9023
DATE DRILLED 8-10-88
TOTAL DEPTH OF HOLE 30.0'
DIAMETER 8.0"
SURFACE ELEVATION 1062.07
WATER LEVEL INITIAL 19.0'
TO-WHIRL 19.0'
SCREEN DIA. 2.0"
LENGTH 15.0'
SLOT SIZE 0.02"
CASING DIA. 2.0"
LENGTH 20.0'
TYP. Stainless Steel
DRILLING COMPANY GTI
DRILLING METHOD Hollow Stem
DRILLER Frank Baker
LOG BY Barry McFarland

NOTES
8' NE of WN-8-A

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
0		Concrete		Same as WN-8-A
		Volclay Grout		
10		Bentonite Chips		
		Sand Pack		
20				
30				
40				
50				

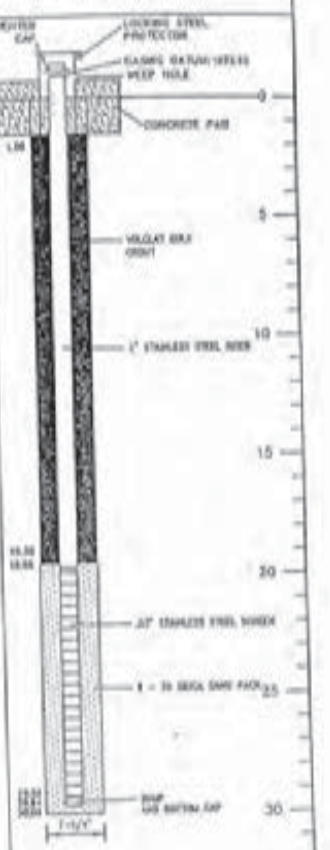

WELL COMPLETION RECORD
LITHOLOGIC DESCRIPTION
UNIFIED SOIL CLASSIFICATION
GRAPHIC LOG
SAMPLE INTERVAL
"N" VALUE
WELL COMPLETION DETAIL
JOB NAME/NUMBER TOTAL/89035
BORING NUMBER MW-3 (BH-10)
ROBERTS/SCHORNICK
& ASSOCIATES, INC.


WELL COMPLETION RECORD
LITHOLOGIC DESCRIPTION
UNIFIED SOIL CLASSIFICATION
GRAPHIC LOG
SAMPLE INTERVAL
"N" VALUE
WELL COMPLETION DETAIL
JOB NAME/NUMBER TOTAL/89035
BORING NUMBER MW-4 (BH-11)
ROBERTS/SCHORNICK
& ASSOCIATES, INC.

WELL COMPLETION RECORD

DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
0	GRADE SURFACE UNITS				
0.5	TOPSOIL: SILTY CLAY, DARK BROWN				
	SILTY CLAY, 10 YR 4/3, DARK BROWN, MOIST, SOFT-FIRM, 6-10 PLAST., SU-MOTTLED, 20% SILT, TOR CLAY	OH/CL			
5	SILTY SAND, 10 GRAIN, MED GRAIN, 15% SILT, 20 CLAY, POORLY GRADED, DARK GRAYISH BROWN 10 YR 4/2, DRY, LOOSE	SP			
7.5	SILTY CLAY, 70% CLAY, 30% SILT, MED PLAST., DEEP DARK GRAY 2.5 YR 3/0, SOFT, MODERATE, MOIST	CL			
10	SILTY SAND, POORLY GRADED, 10-1/4 GRAIN, MED GRAIN, 10% SILT, BLACK 10 YR 2/1, SU MOIST, LOOSE	SP			
10.5	SILTY CLAY, MED CLAY, 30% SILT, MED PLAST., BLACK 10 YR 2/1, SU, SOFT, MODERATE				
15	SAND, POORLY GRD, F-M GRAIN, 10% SAND, GLAUCO, SILT, CHERT, PALE BROWN 10 YR 6/3, SU MOIST, LOOSE	SP			
20	SAND, POORLY GRD, F-M GRAIN, 40% SAND, 20% CLAY, GLAUCO, BLACK 2.5 YR 1/0, SILT, SU MOIST	SP			
	SAND, POORLY GRD, F-M GRAIN, GLAUCO, SILT, PALE BROWN 10 YR 6/3, MOIST, LOOSE TO DARK GRAY 2 YR 1/1 AT 21.0				
25	SATURATED-STRONG HYDROCARBON ODOR				
30	T.D. 30.0'				
	NOTE: DEEP BORING LOG USED FOR BOTH DEEP AND SHALLOW DETAILS FOR MONITOR WELLS				
35					

WELL COMPLETION DETAIL



UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
POCKETPENETROMETER (TSF/KG/CM 2)

JOB NAME/NUMBER TOTAL/89035

BORING NUMBER MW-5 (BH-12)

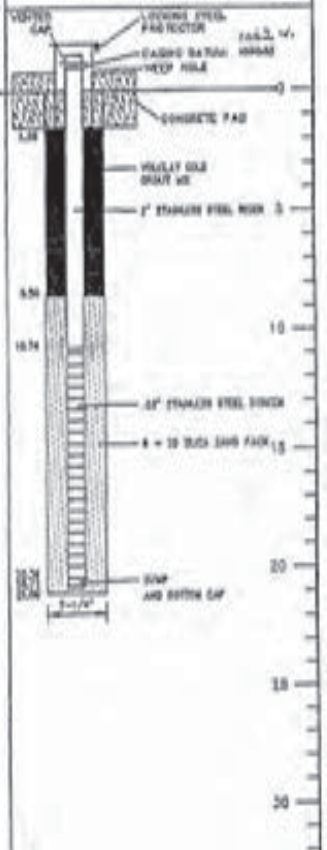
DATE DRILLED 3/3/89 - 3/3/89
DRILLING METHOD HA/HSA
DRILLED BY LAIRD/WILSON
LOGGED BY RG/MEP
CHECKED BY RG

ROBERTS/SCHORNICK & ASSOCIATES, INC.

WELL COMPLETION RECORD

DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
0	GRADE SURFACE 1004.34				
1.0	SILTY CLAY, 30% SILT, 7.5 YR 5/4, LT BROWN, MOIST, SOFT, 10% CLAY, 20% SAND, 10-1/4 GRAIN, MED-COARSE, 20% SILT, LO-PLAST.	CL			
3.0	SILTY CLAY, 7.5 YR 5/4, LT BROWN, MOIST, SOFT, 10% CLAY, 20% SAND, 10-1/4 GRAIN, MED-COARSE, 20% SILT, LO-PLAST.	CL			
3.5	SILTY SAND, 7.5 YR 5/4, GRAY, MOIST, SOFT, 60% SILT, 20% SAND, 10-1/4 GRAIN, FINE-COARSE	SM			
5	SAND, POORLY GRD, 10-1/4 GRAIN, MED SAND, LT GRAY 10 YR 7/1 TO 7/2, STRONG HYDROCARBON ODOR, LOOSE, DRY	SP			
10					
14.0	SILTY CLAY, 70% CLAY, 10% SILT, 20% SAND, 10-1/4 GRAIN, MED-COARSE, 2 YR 1/1, MOIST, FIRM	CL			
15.0	SAND, POORLY GRD, FINE TO COARSE GRAIN, BROWN, 10% SILT, CHERT, LT GRAY 10 YR 7/1, SAT, LOOSE, STRONG HYDROCARBON ODOR	SP			
20					
	T.D. 20.0'				
	NOTE: DEEP BORING LOG USED FOR BOTH DEEP AND SHALLOW DETAILS FOR MONITOR WELLS				
25					
30					
35					

WELL COMPLETION DETAIL



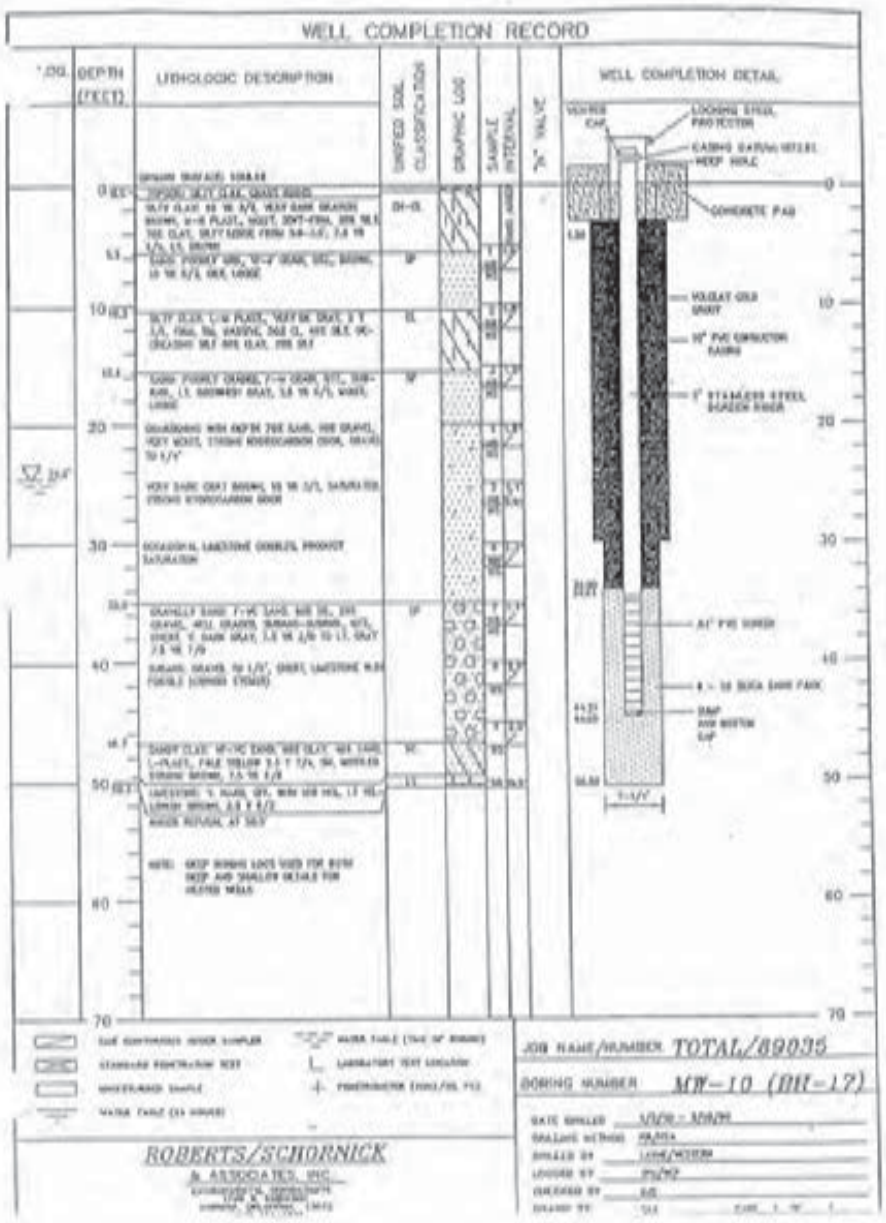
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
POCKETPENETROMETER (TSF/KG/CM 2)

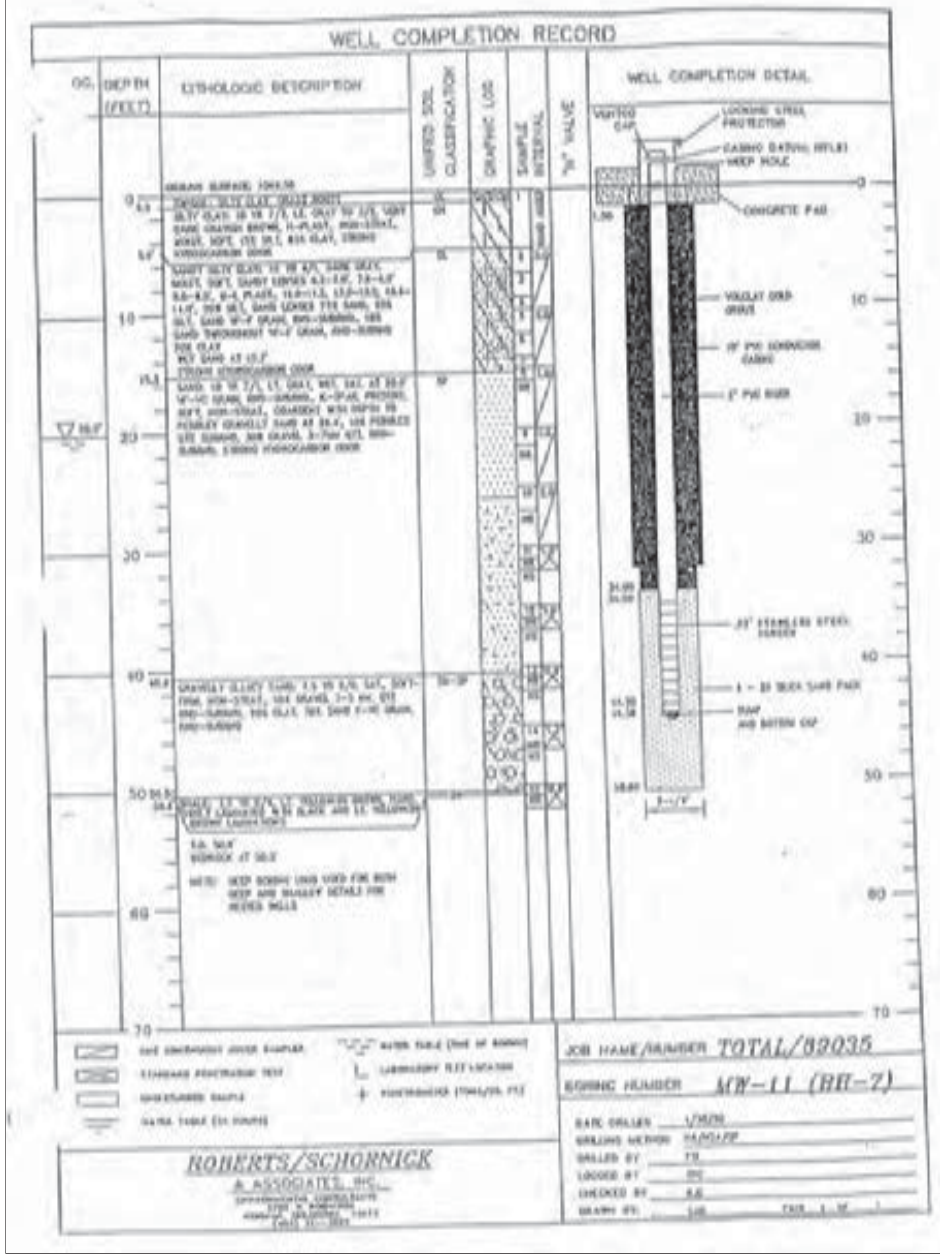
JOB NAME/NUMBER TOTAL/89035

BORING NUMBER MW-6 (BH-13)

DATE DRILLED 3/3/89 - 3/3/89
DRILLING METHOD HA/HSA
DRILLED BY LAIRD/WILSON
LOGGED BY RG/MEP
CHECKED BY RG
SCALE BY: FAX PAGE 1 OF

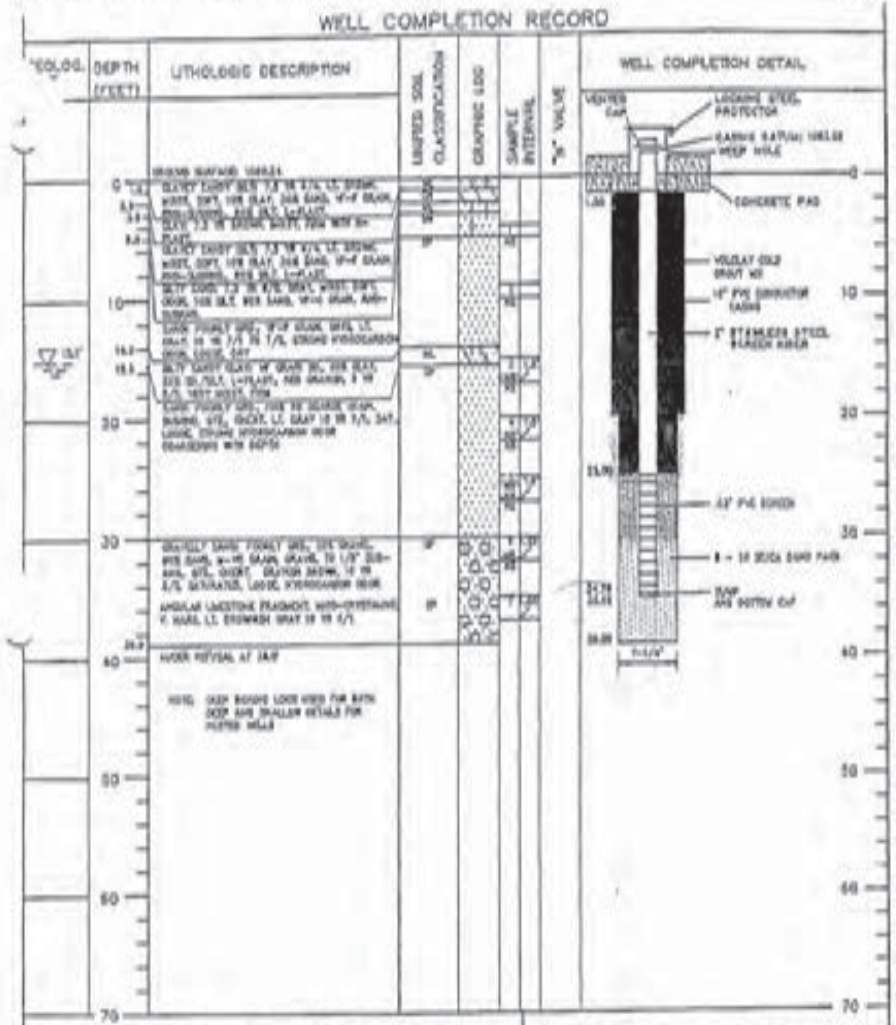
ROBERTS/SCHORNICK & ASSOCIATES, INC.


WELL COMPLETION RECORD
LITHOLOGIC DESCRIPTION
UNIFIED SOIL CLASSIFICATION
GRAPHIC LOG
SAMPLE INTERVAL
WELL COMPLETION DETAIL
LOCKING STEEL PROTECTOR
CASING DATUM (STEEL)
HEEP HOLE
CONCRETE PAD
VOLCLAY GRO GROUT
10" PVC CONDUCTOR CASING
2" STAINLESS STEEL SCREEN RISER
4" PVC SCREEN
#1 - 10 SILICA SAND PACK
SUMP AND BOTTOM CAP
JOB NAME/NUMBER TOTAL/89035
BORING NUMBER MW-10 (BH-17)
ROBERTS/SCHORNICK & ASSOCIATES, INC.


WELL COMPLETION RECORD
LITHOLOGIC DESCRIPTION
UNIFIED SOIL CLASSIFICATION
GRAPHIC LOG
SAMPLE INTERVAL
WELL COMPLETION DETAIL
LOCKING STEEL PROTECTOR
CASING DATUM (STEEL)
HEEP HOLE
CONCRETE PAD
VOLCLAY GRO GROUT
10" PVC CONDUCTOR CASING
2" PVC RISER
#1 - 20 SILICA SAND PACK
SUMP AND BOTTOM CAP
JOB NAME/NUMBER TOTAL/89035
BORING NUMBER MW-11 (BH-2)
ROBERTS/SCHORNICK & ASSOCIATES, INC.

WELL COMPLETION RECORD

GEOLOG.	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE	WELL COMPLETION DETAIL



JOB NAME/NUMBER TOTAL/89035

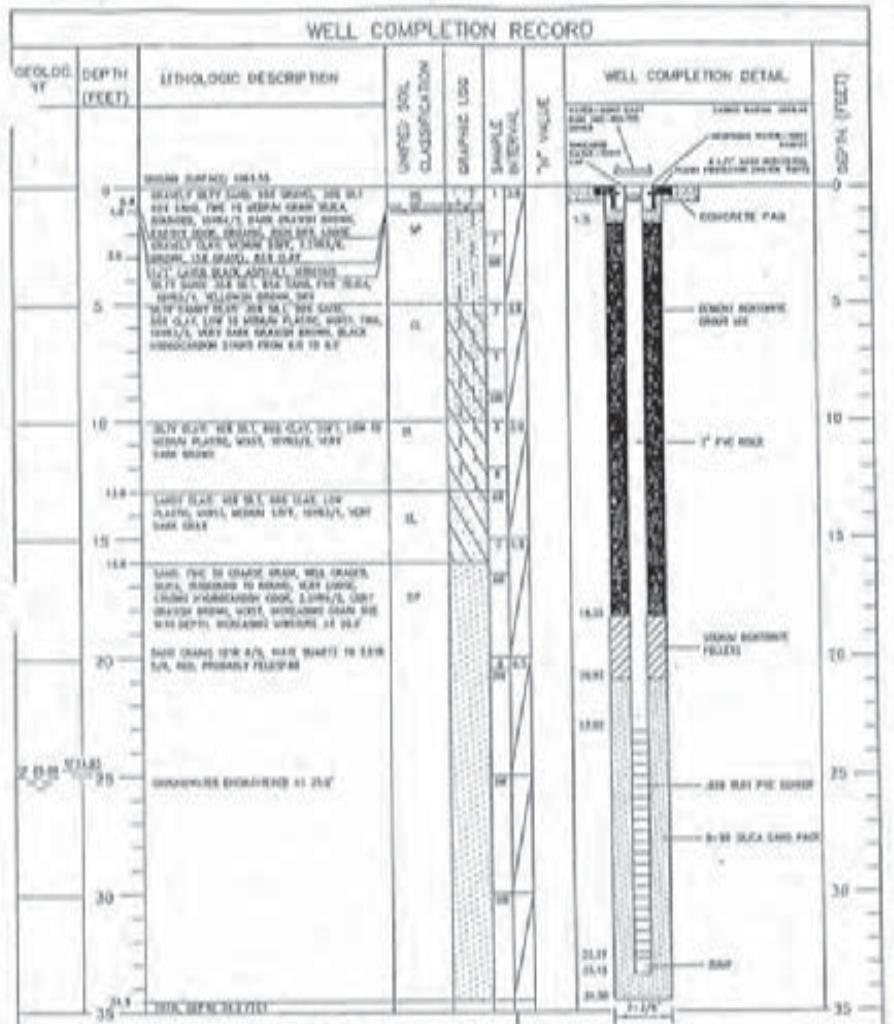
BORING NUMBER MW-13 (BH-13)

DATE DRILLED 1/3/94 - 1/11/94
DRILLING METHOD HSA/RSA
DRILLED BY
LOGGED BY
CHECKED BY
DRAWN BY

ROBERTS/SCHORNICK & ASSOCIATES, INC.

WELL COMPLETION RECORD

GEOLOG.	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE	WELL COMPLETION DETAIL	DEPTH (FEET)

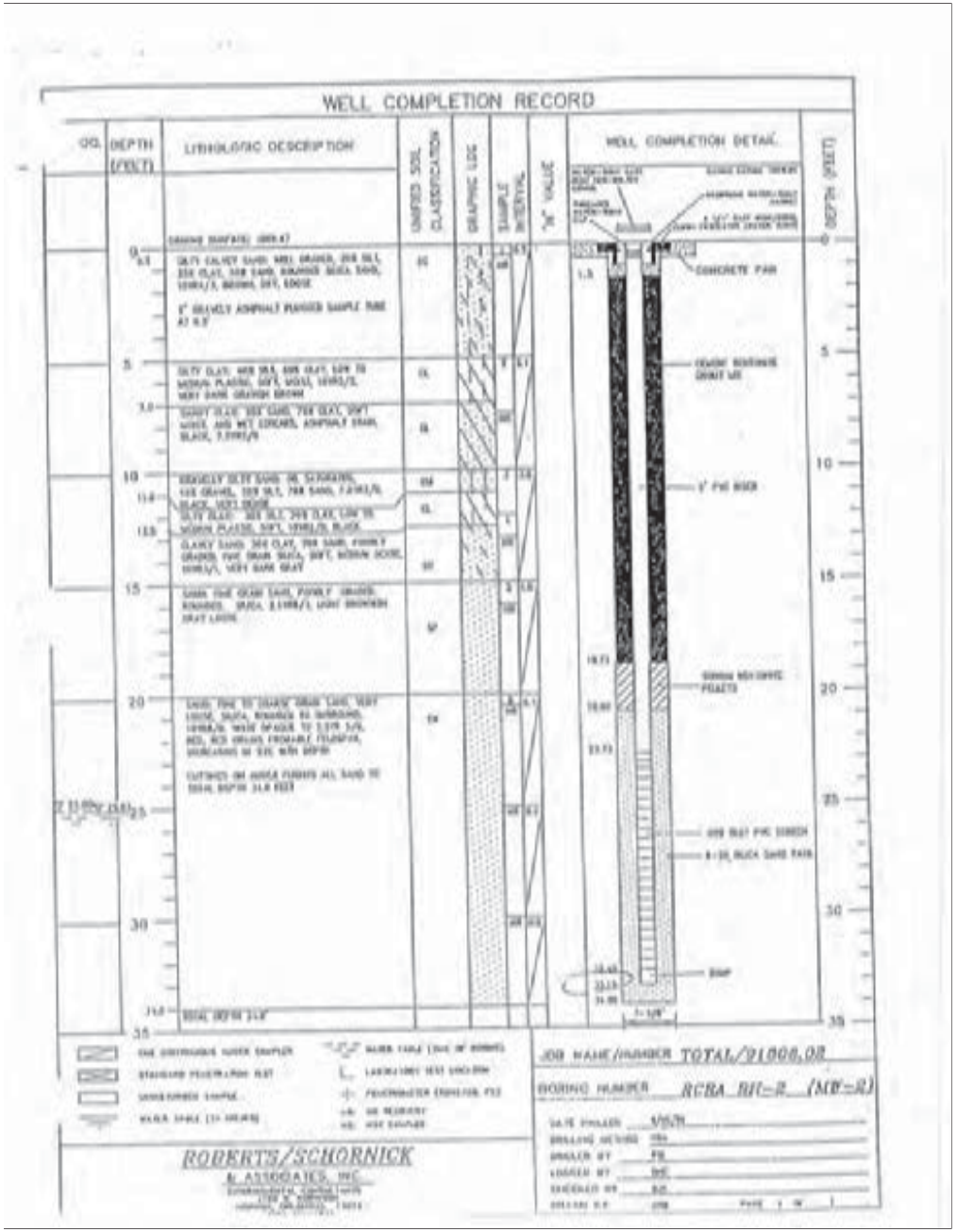


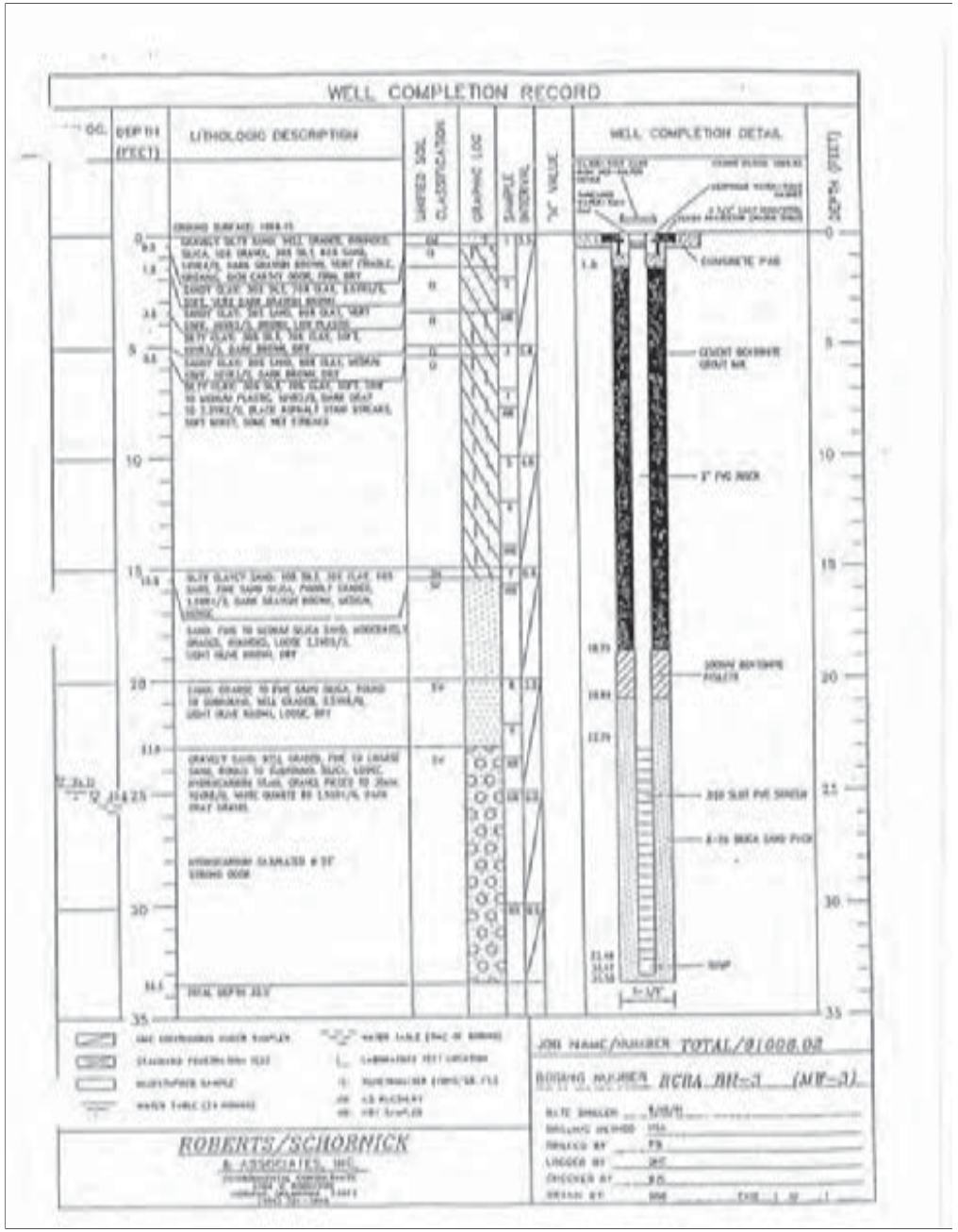
JOB NAME/NUMBER TOTAL/91008.02

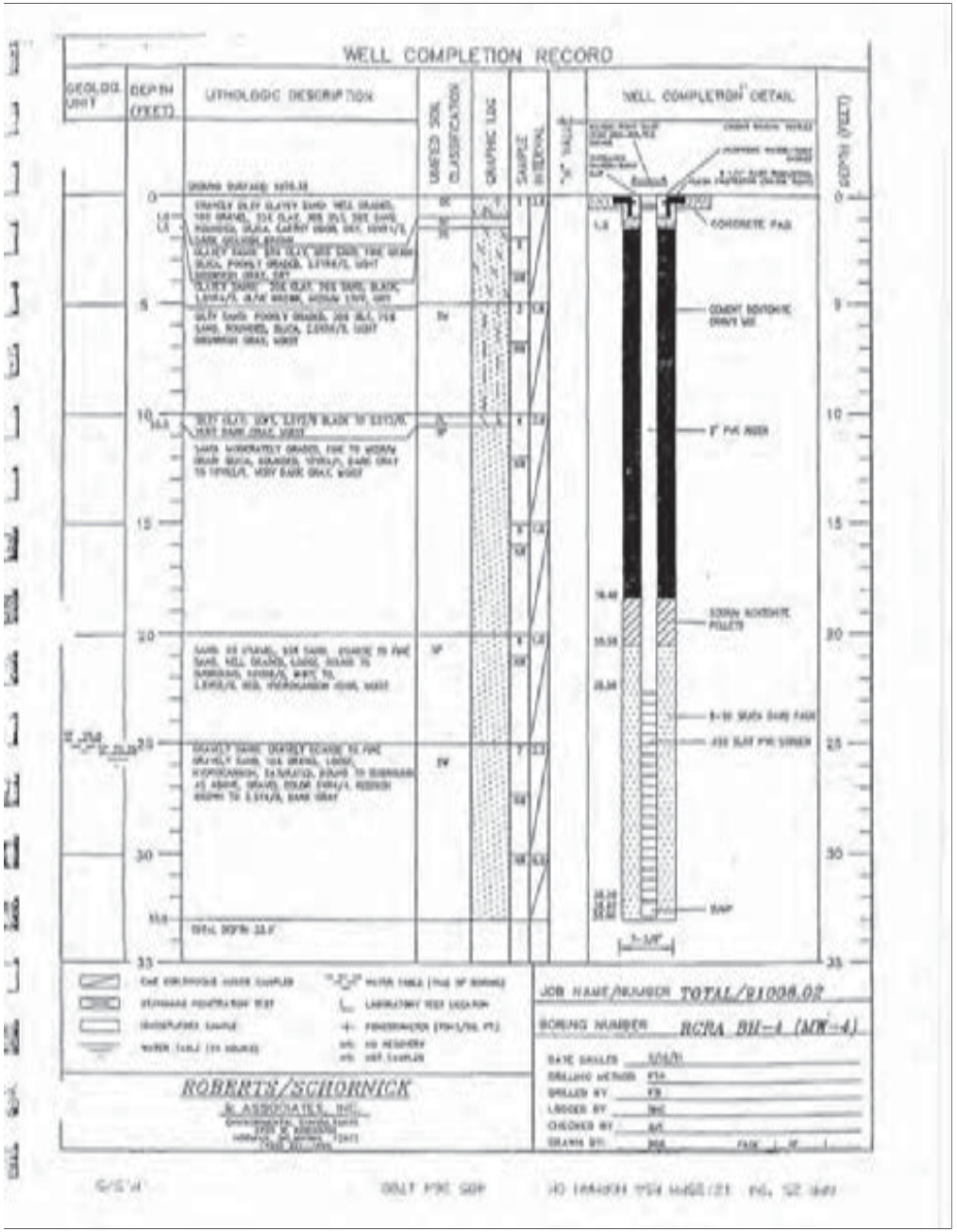
BORING NUMBER RCRA BH-1 (MW-1)

DATE DRILLED
DRILLING METHOD
DRILLED BY
LOGGED BY
CHECKED BY
DRAWN BY

ROBERTS/SCHORNICK & ASSOCIATES, INC.


WELL COMPLETION RECORD
GG.
DEPTH (FEET)
LITHOLOGIC DESCRIPTION
UNIFIED SOIL CLASSIFICATION
GRAPHIC LOG
SAMPLE INTERVAL
"N" VALUE
WELL COMPLETION DETAIL
DEPTH (FEET)
CONCRETE PAD
2" PVC RISER
SAMPLE
JOB NAME/NUMBER TOTAL/91008.08
BORING NUMBER RCBA BH-2 (MW-2)
ROBERTS/SCHORNICK
& ASSOCIATES, INC.


WELL COMPLETION RECORD
GG.
DEPTH (FEET)
LITHOLOGIC DESCRIPTION
UNIFIED SOIL CLASSIFICATION
GRAPHIC LOG
SAMPLE INTERVAL
"N" VALUE
WELL COMPLETION DETAIL
DEPTH (FEET)
CONCRETE PAD
CEMENT BENTONITE GROUT MIX
2" PVC RISER
JOB NAME/NUMBER TOTAL/91008.08
BORING NUMBER RCBA BH-3 (MW-3)
ROBERTS/SCHORNICK
& ASSOCIATES, INC.



Appendix C

Total Petroleum, Arkansas City Refinery
Financial Assurance Documentation

Revised: April 28, 1997

EnecoTech

TOTAL

TOTAL PETROLEUM, INC.

MELANIE S. KELLEY
VICE PRESIDENT, ENVIRONMENT,
SAFETY AND PUBLIC AFFAIRS

January 4, 1995

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Kansas Department of Health and Environment
Hazardous Waste Section
Bureau of Air and Waste Management
Building 7, Forbes Field
Topeka, Kansas 66620

RE: Financial Responsibility, EPA ID. No. KSD087418695

Dear Director:

Attached in conformance with 40 CFR Parts 264 & 265 and the corresponding State regulations are Total Petroleum's 1995 insurance certificates for its hazardous waste management facilities in the state of Kansas. Additional financial responsibility documents will be sent to you at a later date.

Should you have any additional questions relating to these documents, please do not hesitate to call me directly at (303) 291-2042.

Sincerely,

Melanie S. Kelley

MSK/th

attachments

cc: Mike Brown
Jack Martin/Greg Brown
Total Petroleum, Inc.
Arkansas City Refinery

U.S. Environmental Protection Agency
726 Minnesota Avenue
Kansas City, Kansas 66101

TOTAL

Hazardous Waste Facility Certificate of Liability Insurance

1. Name of Insurer: Steadfast Insurance Company

Address of Insurer: 1400 American Lane
Schaumburg, IL 60196-1056

hereby certifies that it has issued liability insurance covering bodily injury and property damage to:

Name of Insured: Total Petroleum (North America) Ltd., and/or
Total Petroleum, Inc., et al

Address of Insured: One Denver Place, Suite 2201
900-19th Street
Denver, CO 80202

in connection with Insured's obligation to demonstrate financial responsibility under 40 CFR 264.147 or 265.147. The coverage applies for "Sudden and Non-Sudden Accidental Occurrences" at:

Ark City Refinery
1400 South M Street
Arkansas City, Kansas
EPA ID# KSD087418695

The limits of liability are $4 million per each occurrence with annual aggregate of $8 million, exclusive of legal defense costs. The coverage is provided under policy number PLC 80-45-806-00 issued on January 1, 1995. The expiry date of said policy is January 1, 1996.

2. The Insurer further certifies the following with respect to the insurance described in Paragraph 1:

(a) Bankruptcy or insolvency of the Insured shall not relieve the Insurer of its obligations under the policy.

(b) The Insurer is liable for the payment of amounts within any deductible applicable to the policy, with a right of reimbursement by the Insured for any such payment made by the Insurer. This provision does not apply with respect to that amount of any deductible for which coverage is demonstrated as specified in 40 CFR 264.147 (f) or 265.147 (f).

(c) Whenever requested by a Secretary of the Kansas Department of Health and Environment, the Insurer agrees to furnish to the Secretary a signed duplicate original of the policy and all endorsements.

(d) Cancellation of the insurance, whether by the Insurer, the Insured, a parent corporation providing insurance coverage for its subsidiary, or by a firm having an insurable interest in and obtaining liability insurance on behalf of the owner or operator of the hazardous waste management facility, will be effective only upon written notice and only after the expiration of sixty (60) days after a copy of such written notice is received by the Secretary of the Kansas Department of Health and Environment.

(e) Any other termination of this insurance will be effective only upon written notice and only after the expiration of thirty (30) days after a copy of such written notice is received by the Secretary of the Kansas Department of Health and Environment.

I hereby certify that the wording of this instrument is identical to the wording specified in 40 CFR 264.151 (j) US EPA approved amendment for the State of Kansas, as such regulation was constituted on the date first above written, and that the insurer is licensed to transact the business of insurance, or eligible to provide insurance as an excess or surplus lines insurer, in one (1) or more states.

Authorized Representative of Steadfast Insurance Company of Schaumburg, IL.:

Name: Paul J. Kinni 12-28-94

Paul J. Kinni

Title: Authorized Representative

Address: 44 Montgomery Street
San Francisco, CA 94104-4801

State of Kansas

Reply to: (913) 296-0640
FAX: (913) 296-1592
Forbes Field, Building 740
Topeka, KS 66620-0001

Department of Health and Environment

February 11, 1994

Melanie S. Kelley, Vice President
Environment, Safety and Public Affairs
Total Petroleum, Inc.
P. O. Box 500
Denver, CO 80201 - 0500

RECEIVED
FEB 18 1994
Environment, Safety
& Public Affairs

Re: RCRA Financial Assurance
Arkansas City, KS Refinery
EPA I.D. KSD087418693

Dear Ms. Kelley:

The Hazardous Waste Facility Certificate of Liability Insurance transmitted with your letter of January 17, 1994 providing liability assurance for sudden and non-sudden accidental occurrences at the above referenced TSD facility has been reviewed by the Kansas Department of Health and Environment (KDHE).

The form of the certificate and the amount assured were found to be adequate. Therefore KDHE finds the Arkansas City, Kansas TSD facility of Total Petroleum, Inc. to be in compliance with the liability insurance requirements of 40 CFR 264.147.

Thank you for your cooperation with the Kansas hazardous waste management program. Please call me at the number above if you have questions or comments.

Sincerely,

James L. Gilliland

James L. Gilliland
Financial Assurance Accountant
Bureau of Waste Management

cc: Wes Bartley, EPA, Region VII
Mark Bradbury - DEA/SCDO/Waste Programs

TOTAL

TOTAL PETROLEUM, INC.
MICHAEL A. BROWN, P.E.
CORPORATE ENVIRONMENTAL MANAGER

May 31, 1995

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Kansas Department of Health and Environment
Hazardous Waste Section
Bureau of Air and Waste Management
Building 7, Forbes Field
Topeka, Kansas 66620

Gentlemen:

Attached in conformance with 40 CFR Parts 264 and 265 are Total Petroleum, Inc.'s ("Total") financial assurance documents for 1995. Enclosed are 1) Letter of Credit No. 930204IS439 demonstrating that Total complies with the financial assurance regulations and 2) Total's schedule of hazardous waste management facilities. Insurance documents were sent separately in January 1995.

Should you have any additional questions relating to these documents, please do not hesitate to call me directly at (303) 291-2288.

Sincerely,

Michael A. Brown, P.E.
Corporate Environmental Manager

MAB/lks

Attachments

cc: US EPA REGION VII
Melanie Kelley
Chris Quinn
Jack Martin
Greg Brown

TOTAL

TOTAL TOWER 950 17TH STREET DENVER, COLORADO 80202-5523 TELEPHONE 303 291-2000
P.O. BOX 188 DENVER, COLORADO 80201-0188 FAX 303 291-1154

SCHEDULE OF HAZARDOUS WASTE FACILITIES
(prepared April 4, 1995)

RCRA Hazardous Waste Facilities (40 CFR 264)		Cost $
Self-Test Demonstration		
1. ALMA REFINERY WASTEWATER PONDS E. Superior Street Alma, Michigan		
* EPA ID No. MID005358130		
Closure Cost Estimate		$2,693,592
Post-Closure Cost Estimate		$ 142,605
2. ALMA REFINERY LAND TREATMENT FACILITY Alma Michigan		
EPA ID No. MID005358130		
Closure Completed 1990		0
Post-Closure Cost Estimate		$1,843,050
UIC Injection Well (40 CFR 144)		
3. WDW #2 WELL Alma, Michigan		
EPA ID No. MI-057-1W-002		
Closure Cost Estimate		$ 115,091
	Subtotal	$4,794,338
Letter of Credit Standby Trust		
1. ARDMORE REFINERY 5 WASTEWATER TREATMENT PONDS P.O. Box 188 Ardmore, Oklahoma		
EPA ID No. OKD057705972		
Closure Cost Estimate		$1,646,235
Post-Closure Cost Estimate		$2,453,760
	Subtotal	$4,099,995

2. ARKANSAS CITY REFINERY TREATMENT FACILITY
1400 South M Street
P.O. Box 857
Arkansas City, Kansas

EPA ID No. KSD067418695

Closure Cost Estimate		$ 438,942
Post-Closure Cost Estimate		$4,825,895
	Subtotal	$5,264,837

3. COLORADO REFINING COMPANY
5800 Brighton Boulevard
Commerce City, Colorado 80022

EPA ID No. COD000109975

Closure Cost Estimate		$ 81,603**
Post-Closure Cost Estimate		—
Corrective Action Cost Estimate for 1994		$1,211,131**
	Subtotal	$1,292,734
	Grand Total	$15,457,904

Total Petroleum, Inc. is the owner or operator of all of the hazardous waste facilities listed on this schedule. Total Petroleum, Inc. is a wholly-owned subsidiary of Total Petroleum (North America) Ltd.

* We believe this facility carries same number as the Refinery Land Treatment Facility

** CRC financial responsibility also demonstrated via letter of credit (amount $3,200,000) to demonstrate compliance with Administrative Consent Order for RCRA Corrective Action.

U.S. Commerce 1994 Implicit Price Deflator 2.1% increase

TOTAL

TOTAL PETROLEUM, INC.

Environmental Policy & Public Affairs
MAY 10 1995

May 9, 1995

Mr. Brian Barth
Credit Lyonnais
1000 Louisiana, Suite 5360
Houston, TX 77002

Dear Brian:

Re: Irrevocable Standby Letter of Credit No. LAS-415 (your reference No. 930204IS439) in Favor of the Kansas Department of Health and Environment

Effective immediately, please increase Letter of Credit No. LAS-415 by $108,287 to a new total of $5,264,837.

All other terms and conditions remain the same.

Sincerely yours,

TOTAL PETROLEUM, INC.

By: Rose M. Robeson
Rose M. Robeson
Assistant Treasurer

TOTAL PETROLEUM, INC.

By: C. J. Q.
Christopher J. Quinn
Treasury Analyst

TOTAL

TOTAL TOWER 555 17TH STREET P.O. BOX 300 DENVER, COLORADO 80201-0300 DENVER, COLORADO 80201-0300 TELEPHONE 303 293-0300

CREDIT LYONNAIS

Very truly yours,

Credit Lyonnais, New York Branch

el:(212) 261-7000 Cable:Credlonais, New York 62410/02723
-ift Address. CRLYUS33

APPENDIX C

RCRA Closure Report for #3A

RCRA CLOSURE REPORT
AND CERTIFICATION
FOR THE No. 3A AERATED LAGOON
TOTAL PETROLEUM, INC.
ARKANSAS CITY REFINERY

Prepared for:

Ultramar Diamond Shamrock Corporation
6000 North Loop 1604 West
San Antonio, Texas 78249-1112

Prepared by:

EnecoTech, Inc.
1580 Lincoln Street, Suite 1000
Denver, Colorado 80203
(303) 861-2200

February 6, 1998

PROJECT NUMBER: 01-0138R-010

EnecoTech

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- 2.3 Facility Security 2
- 2.4 No. 3A Aerated Lagoon Description and Design Capability . . . 5
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D. PHOTOGRAPHS OF No. 3A AERATED LAGOON FINAL COVER

1.0 INTRODUCTION

The No. 3A Aerated Lagoon at Total Petroleum, Inc's. (Total) Arkansas City Refinery became a Resource Conservation and Recovery Act (RCRA) regulated unit as a result of the Toxicity Characteristic (TC) rule. The RCRA regulations required that the No.3A Aerated Lagoon be retrofitted to meet minimum technology requirements (MTR) by September 25, 1994 or close the unit. Total modified their wastewater treatment system by installing a new tank system (bio-reactors) to replace the No. 3A Aerated Lagoon between September 1993 and September 20, 1994. Total then discontinued treatment of potentially hazardous wastewater in the impoundment on September 21, 1994.

Total submitted a revised Closure Plan for the No. 3A Aerated Lagoon to the Kansas Department of Health and Environment (KDHE) on April 30, 1997. This revised closure plan incorporated comments from the KDHE. KDHE approved the closure plan on May 5, 1997.

The approved closure plan was designed to meet the closure requirements of 40 CFR § Part 265 Subpart G and the specific requirements for surface impoundments (40 CFR § 265.228). The approved closure plan was designed in a manner that minimizes both the need for maintenance and the potential for release of hazardous constituents from the unit after closure as required by the closure performance standard of 40 CFR § 265.111.

This report, which is the final step required in the closure plan before certification of closure, presents a description of the closure activities. The closure activities have been reviewed by an independent registered professional engineer in the State of Kansas, Mr. Al Oakes, P.E.

Recycled Paper

2.0 FACILITY DESCRIPTION

2.1 FACILITY LOCATION

Total Petroleum, Inc. (a wholly owned subsidiary of Ultramar Diamond Shamrock Corporation) is the current owner and operator of the Arkansas City Refinery located southeast of the incorporated limits of Arkansas City in southwestern Cowley County, Kansas. The Refinery was initially constructed in the 1920's and has had several different owners prior to purchase by Total Petroleum, Inc., in April, 1978. The Total Petroleum Refinery complex occupies approximately 300 acres and is located near the confluence for the Walnut River and the Arkansas River. A site location map is presented as Figure 1.

The facility is located within parts of Section 31 and 32 of Township 34 South and Range 4 East; and Section 5 of Township 35 South and Range 4 East, in Cowley County, Kansas. The No. 3A Aerated Lagoon is located near the east central boundary of the Refinery, adjacent to the Walnut River. The No. 3A Aerated Lagoon was utilized as part of the Refinery's wastewater treatment system until September 21, 1994, at which time it was replaced by the Refinery's wastewater treatment new tank system. The location of the No. 3A Aerated Lagoon is presented in Figure 2.

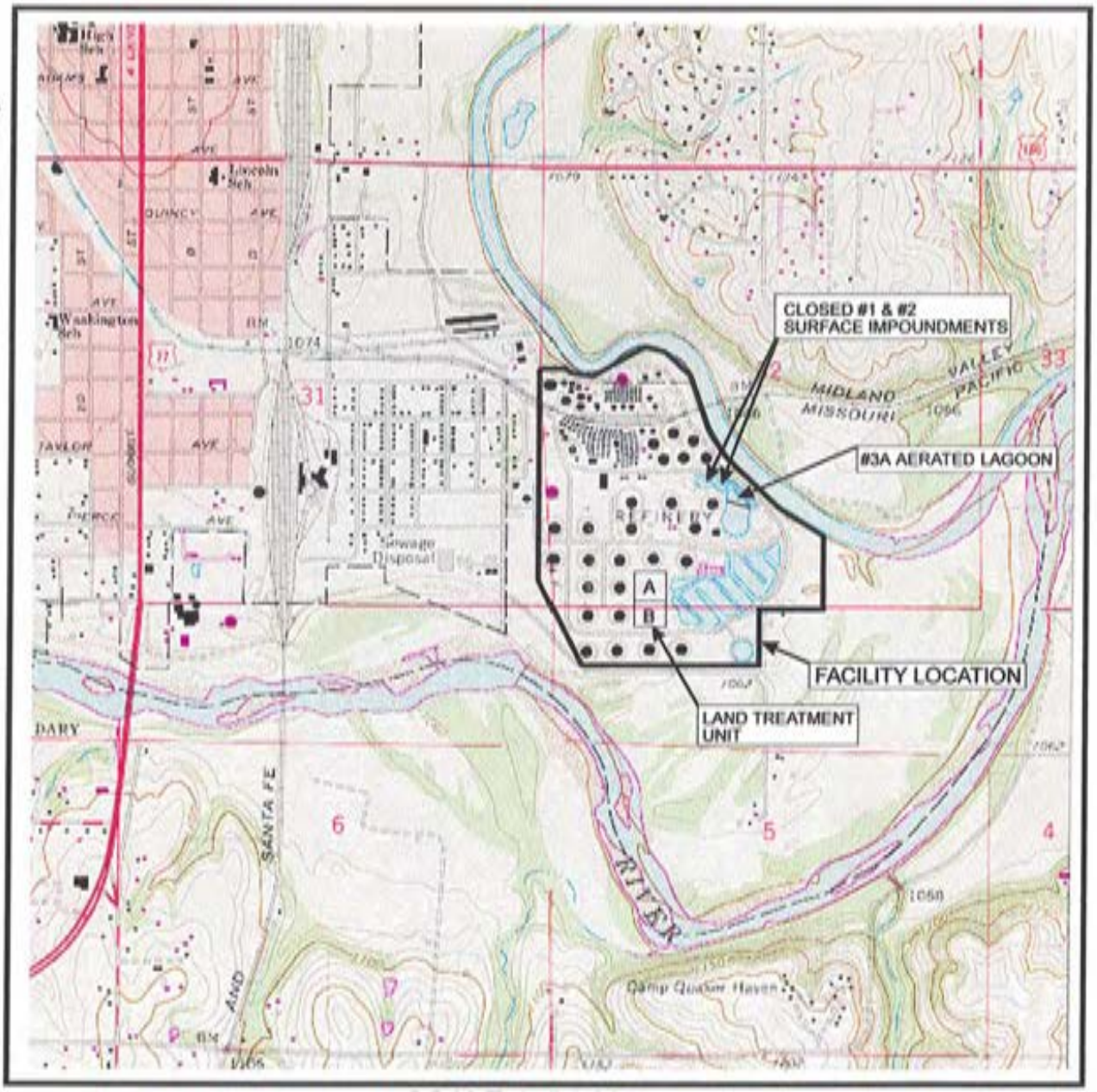
2.2 FACILITY PRODUCTS AND OPERATING CAPACITY

The Refinery, during the operation of the No. 3A Aerated Lagoon, had a nominal operating capacity of 60,000 barrels per stream day. Products produced at the Refinery included unleaded gasoline, liquefied petroleum gas (LPG), propylene, fuel oils, jet fuels, and asphalt. The Refinery received approximately 90% of its crude oil supply by pipeline and transported approximately 90% of its refined products by pipeline. The remaining crude and product was transported by truck. Presently, the facility operates as a product storage terminal with asphalt processing operations.

2.3 Facility Security

The No. 3A Aerated Lagoon is located within the interior of the Refinery. Total operates and maintains an established security system for the entire Refinery which is designed to prevent unknowing entry and to minimize the possibility for the unauthorized entry of persons or livestock into the Refinery, including the areas of permitted hazardous waste management units.

R 4 E



SCALE 1: 24,000

1 1/2 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

0 .5 0 1 KILOMETER

CONTOUR INTERVAL: 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ARKANSAS CITY, KANS.
N3700-W9700/7.5
1965
PHOTOREVISED 1979
AMS 6556 II SE-SERIES V878

QUADRANGLE LOCATION

EnecoTech®
ENVIRONMENTAL CONSULTANTS

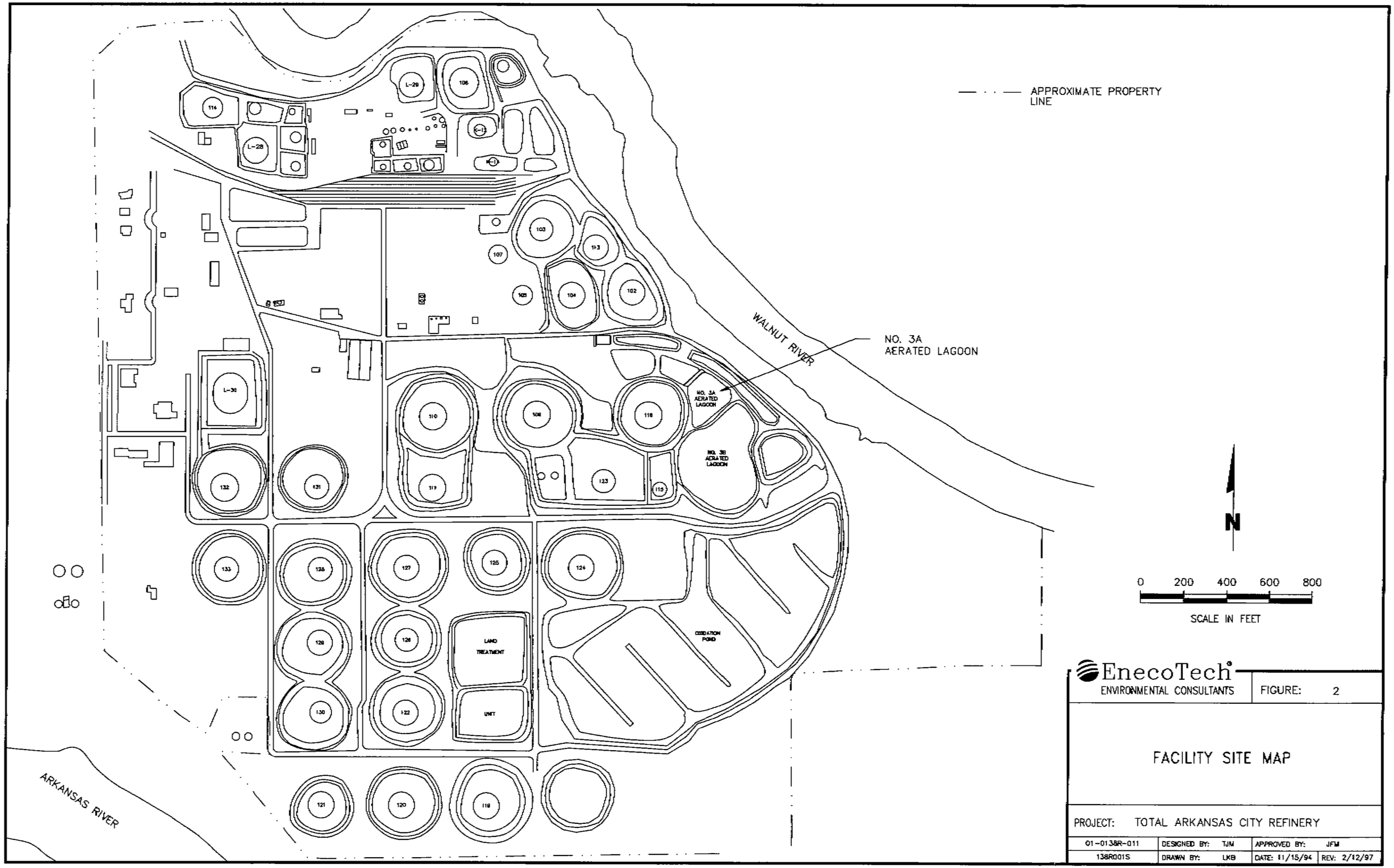
FIGURE: 1

SITE LOCATION MAP

TOTAL PETROLEUM, INC.
ARKANSAS CITY REFINERY

PROJECT: TOTAL PETROLEUM, INC.

1398-011	DRAWN BY	T J M	APPROVED BY
1398101.CDR	DRAWN BY	L K B	DATE: 05/06/97 REV:


APPROXIMATE PROPERTY LINE
WALNUT RIVER
NO. 3A AERATED LAGOON
NO. 3A AERATED LAGOON
NO. 3B AERATED LAGOON
L-29
106
114
L-28
103
107
113
105
104
102
L-30
110
108
118
117
123
115
132
131
133
128
127
125
124
129
126
LAND TREATMENT UNIT
OXIDATION POND
130
122
121
120
119
ARKANSAS RIVER
N
0 200 400 600 800
SCALE IN FEET
EnecoTech
ENVIRONMENTAL CONSULTANTS
FIGURE: 2
FACILITY SITE MAP
PROJECT: TOTAL ARKANSAS CITY REFINERY
01-0138R-011
DESIGNED BY: TJM
APPROVED BY: JFM
138R001S
DRAWN BY: LKB
DATE: 11/15/94
REV: 2/12/97

2.4 No. 3A Aerated Lagoon Description and Design Capability

The No. 3A Aerated Lagoon, an aggressive biological treatment unit, was a component of the Refinery's wastewater treatment system until September 21, 1994. The No. 3A Aerated Lagoon was an irregularly shaped surface impoundment approximately 200 feet by 200 feet and covering approximately 35,700 square feet. The lagoon had sloping walls which varied between a 2:1 and 4:1 ratio of horizontal to vertical.

The design capability of the No. 3A Aerated Lagoon at its maximum operating capacity was 252,634 cubic feet or 1,889,702 gallons. The lagoon had an influent rate of up to 900 gallons per minute, and a hydraulic retention time of approximately 1.5 days. The lagoon was equipped with three 10-horsepower (hp) aerators mounted on floating tri-pontoon assemblies.

2.5 Construction History of the No. 3A Aerated Lagoon

The No. 3A Aerated Lagoon was constructed in 1990 as a subunit of the former existing No. 3 Aerated Lagoon. Total reconstructed the former No. 3 Aerated Lagoon by subdividing it and constructing the No. 3A Aerated Lagoon and the No. 3B Aerated Lagoon, as shown in Figure 2. This reconstruction was completed before the effective date of the RCRA toxicity characteristic (TC) regulations of September 25, 1990. During reconstruction, the No. 3 Aerated Lagoon was drained, sludges removed, construction of the dike that separated the No. 3A Aerated Lagoon and the No. 3B Aerated Lagoon was completed, bottom soils were compacted, and construction of new appurtenant features and equipment was completed on or before September 24, 1990. The No. 3A Aerated Lagoon was an operating component of the Refinery's wastewater system from September 25, 1990 until September 21, 1994. The No. 3A Aerated Lagoon was replaced by the Refinery's new tank-based biological-reactor system in September 1994.

Recycled Paper

EnecoTech

3.0 No. 3A AERATED LAGOON CLOSURE

3.1 Closure Plan Approach

As a result of discussions with KDHE, Total closed the No. 3A Aerated Lagoon in accordance with 40 CFR §265.228, by removing soil impacted above the KDHE risk-based closure cleanup standards for soil, with provisions for post closure care and monitoring. Risk-based closure of the soils enables Total to construct over the unit in accordance with the provisions of 40 CFR §265.117(c)(1). At this time there are no plans for post-closure construction on the unit. The post-closure plan will be modified and submitted to KDHE for approval when construction plans are prepared and before construction begins. The closure approach described in Section 4.4 of the approved closure plan (EnecoTech, 1997) is to remove soil that exceeds the KDHE risk-based non-residential closure cleanup standards, or alternate cleanup goals discussed in the contingent closure.

3.2 Summary of Closure Procedures

The approach for the risk-based soil closure for Total's No. 3A Aerated Lagoon consisted of:

1. Soil sampling and comparison of soil analytical results with KDHE risk-based cleanup standards;
2. Decontamination of all appurtenances and equipment;
3. Backfill the impoundment with clean fill
4. Submittal of required closure certification in accordance with 40 CFR §265.115; and,
5. Perform post closure care.

Items 1 through 3 are discussed below. Item 4 is discussed in Section 4.0 of this report, and Item 5 is presented in Section 5.0 of the approved closure plan.

3.2.1 Soil Sampling

The soil sampling prescribed in the approved closure plan was performed on May 28 and May 29, 1997. The No. 3A Lagoon was divided into four quadrants. Four soil samples were collected from each quadrant from each depth interval at uniformly spaced sample locations as prescribed in the approved closure plan. The entire soil sampling event was

observed by Ms. Andrea Austin of the Kansas Department of Health and Environment (KDHE). The results of the soil sampling are presented in the soil sampling report for the No. 3A Aerated Lagoon submitted to KDHE on November 12, 1997. This report contains the summaries of the laboratory analytical data and the laboratory analytical reports.

3.2.2 Decontamination of Appurtenances and Equipment

The flume connecting the former No. 3A Aerated Lagoon and the No. 3B Lagoon was decontaminated by high pressure power washing. This work was performed on June 5, 1997 by RUST Industrial Cleaning Service located in Ponca City, Oklahoma.

The runoff and over spray from the power washing was collected and contained on a plastic sheeting setup to catch runoff. All liquid and solids were vacuumed into a vac-truck and then placed in the refinery wastewater treatment system. Approximately 450 gallons of potable water was used in the power washing.

3.2.3 Backfill and Construction of Vegetative Protective Cover

Based upon the results of the soil sampling and discussions with KDHE staff Total proceeded with the closure of the No. 3A Aerated Lagoon by backfilling with clean fill material as described in the approved closure plan.

L.G. Pike Construction of Arkansas City, Kansas was contracted to backfill the No. 3A Aerated Lagoon. The backfilling was supervised by Al Oakes, P.E. Mr. Oakes is a professional engineer registered in the State of Kansas. Samples of the compacted soil were tested using nuclear compaction density tests by Allied Laboratories in Wichita, Kansas. Results of the testing are included in this report in Appendix A.

The backfilling began on January 13, 1998 and was completed on January 23, 1998. Copies of the daily construction reports are included in Appendix B of this report.

The compaction testing indicates that the 95 percent proctor density requirement for the backfill was achieved. Following recommendations provided by Mr. Barry Barber, District Conservationist with the United States Department of Agriculture Natural Resources Conservation Service in Winfield Kansas, Ms. Andrea Austin of the KDHE agreed that the two-foot protective surficial layer specified in the approved closure plan could be changed

to one-foot in thickness. A copy of Mr. Barber's communication is included in Appendix C of this report, as well as the seed mixture used for the final cover.

The protective surficial layer was seeded on January 23, 1998 using a seed mix recommended by the Natural Resources Conservation Service. A copy of the seed mixture is included in Appendix C of this report. According to the Natural Resources Conservation Service the seed can be applied between December 1 and May 15.

Photographs of the final cover are included in Appendix D of this report. These photographs were taken on January 28, 1998 following the final cover seeding.

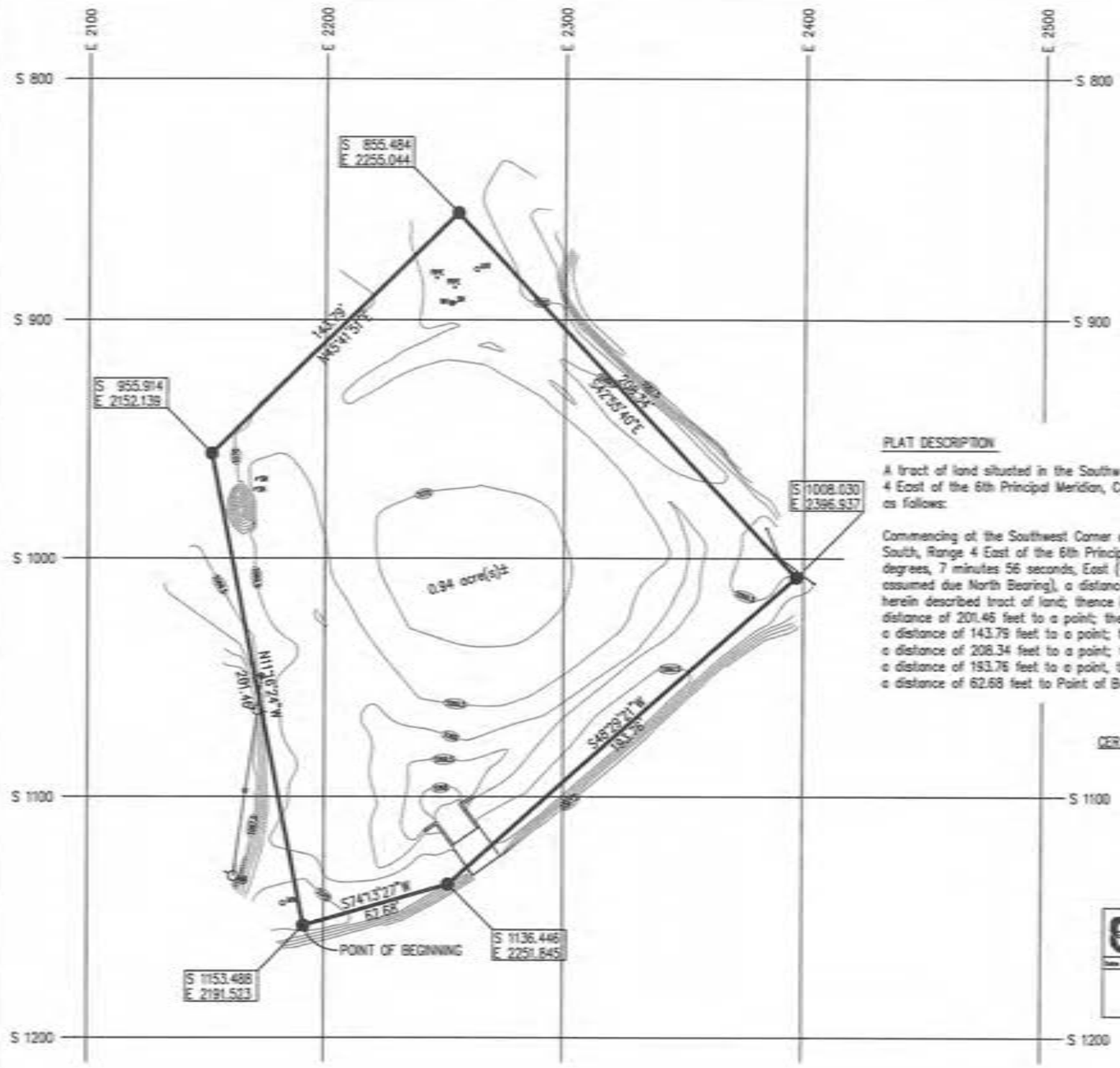
3.2.4 Final Contours and Legal Description

Final contours for the No. 3A Aerated Lagoon are presented on Figure 3. Figure 3 also contains a legal plat description for the No. 3A Aerated Lagoon as required by 40 CFR § 265.309 and certified by a Kansas licenced surveyor.

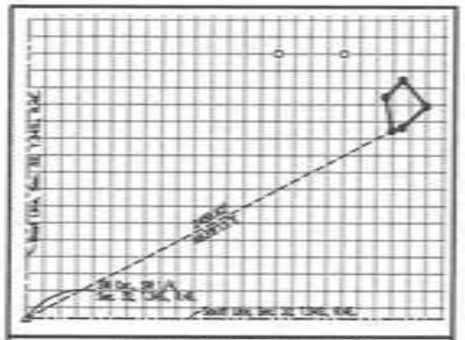
3.2.5 Deed Certification

The property deed will be amended within 60 days of KDHE's approval of this closure report and closure certification, in accordance with Kansas State law.

The Facility property deed will indicate that the specific land area has been used to manage hazardous waste, that use is restricted under 40 CFR §265 Subpart G regulations, and that a survey plat and record of type, location, and quantity of disposed hazardous waste is on file with the Registrar of Deeds.



△ SEC. COR.
● POINT SET (#4 rebar)
○ BRASS CAP



LOCATION MAP

BRASS CAP(S) (TOTAL PETROLEUM GRID SYSTEM)

S 700.00	S 700.00
E 1500.00	E 1900.00
ELEV. 1067.52	ELEV. 1068.43

SW Cor., SW 1/4, Sec. 32-34S-4E.
S 2263.53
E 0000.00

PLAT DESCRIPTION

A tract of land situated in the Southwest Quarter of Section 32, Township 34 South, Range 4 East of the 6th Principal Meridian, Cowley County, Kansas being more particularly described as follows:

Commencing at the Southwest Corner of the Southwest Quarter of Section 32, Township 34 South, Range 4 East of the 6th Principal Meridian, Cowley County, Kansas; thence North 63 degrees, 7 minutes 56 seconds, East (with the West Line of said Southwest Quarter on an assumed due North Bearing), a distance of 2456.62 feet to the Point of Beginning of the herein described tract of land; thence North 11 degrees, 16 minutes, 24 seconds West, a distance of 201.46 feet to a point; thence North 45 degrees, 41 minutes, 51 seconds East, a distance of 143.79 feet to a point; thence South 42 degrees, 55 minutes, 40 seconds East, a distance of 208.34 feet to a point; thence South 48 degrees, 29 minutes, 21 seconds West, a distance of 193.76 feet to a point, thence South 74 degrees, 13 minutes, 27 seconds West, a distance of 62.68 feet to Point of Beginning, containing 0.94 acre(s) more or less.

CERTIFICATION: The undersigned hereby certifies that the survey information as shown hereon was obtained by field methods and investigations under his direction and supervision and that all information as shown hereon is correct to the best of his knowledge and belief.

A.J. OAKES, KANSAS LS #953

A. J. OAKES REGISTERED KANSAS LAND SURVEYOR

EnecoTech
ENVIRONMENTAL CONSULTANTS

AS-BUILT DRAWING #3a AERATED LAGOON
ARKANSAS CITY REFINERY - TOTAL PETROLEUM INC.
ARKANSAS CITY, KANSAS

		Date
Design:		
Drawn:	LKB	
Checked:		
Approved:		

Project: TOTAL PETROLEUM, INC.
ARKANSAS CITY REFINERY
ARKANSAS CITY, KANSAS

Title: AS-BUILT DRAWING/FINAL PROTECTIVE COVERING & PLAT DESCRIPTION No.3A AERATED LAGOON CLOSURE

File No.: 0138R-010	Date: 1/28/98	Figure No.:	3
ACAD File No.: 14SURVEY	Rev.: 2/04/98	Sheet 1 of 1	

4.0 CLOSURE CERTIFICATION

40 CFR Section 265.115 Certification of Closure for the Aeration Lagoon

We hereby certify that we have reviewed the steps taken during closure of the No. 3A Aerated Lagoon and questioned those individuals who supervised those steps and found that the No. 3A Aerated Lagoon was closed in accordance with the closure plan approved for that unit by the Kansas Department of Health and Environment.

OWNER/OPERATOR CERTIFICATION

2-5-98

Brenda B Manterola Date

Ultramar Diamond Shamrock Corporation

PROJECT MANAGER CERTIFICATION

2-5-98

Joseph F. Mednick Date

EnecoTech Inc.

SMITH & OAKES
ENGINEERS/SURVEYORS, P.A.
P.O. Box 696 107 N. Summit Arkansas City, Kansas 67005
P.O. Box 193 Winfield, Kansas 67156
(316) 442-4756 (Voice/Fax) e-mail: smitoak@horizon.hit.net

Al J. Oakes, P.E., L.S.
President

January 27, 1999

CERTIFICATION of Closure for No. 3A Aerated Lagoon, Total Petroleum, Inc.

As of this date, I have personally observed the construction activities conducted during implementation of the above referenced closure plan. The Closure Plan Activities under my observation began with the collecting of soil samples on 01/09/98 and completed with seeding on 01/23/98.

Therefore having observed these construction activities in accordance with No. 3A Aerated Lagoon Closure Plan, I make the following certification:

I hereby certify that all closure construction activities under my observation, of the No. 3A Aerated Lagoon have been conducted using sound engineering principles in accordance with the plans and requirements as submitted to me.

Al J. Oakes, P.E.

A. J. OAKES
LICENSED
11940
KANSAS
PROFESSIONAL ENGINEER

5.0 REFERENCES

EnecoTech, April 30, 1997. RCRA Interim Status Closure Plan No. 3A Aerated Lagoon. Prepared for Total Petroleum, Inc. Arkansas City Refinery, Arkansas City, Kansas.

EnecoTech, November 12, 1997. Soil Sampling Report, No. 3A Aerated Lagoon. Prepared for Ultramar Diamond Shamrock Corporation Arkansas City Refinery, Arkansas City, Kansas.

APPENDIX A
NUCLEAR DENSITY COMPACTION TEST DATA

ALLIED LABORATORIES
DEPARTMENT OF PROFESSIONAL ENGINEERING CONSULTANTS, P.A.
Located At 350 S. Washington • Wichita, Kansas 67202
Mailing Address 303 S. Topeka • Wichita, Kansas 67202
(316) 262-6457 FAX (316) 262-6592

REPORT OF MOISTURE - DENSITY RELATIONSHIP

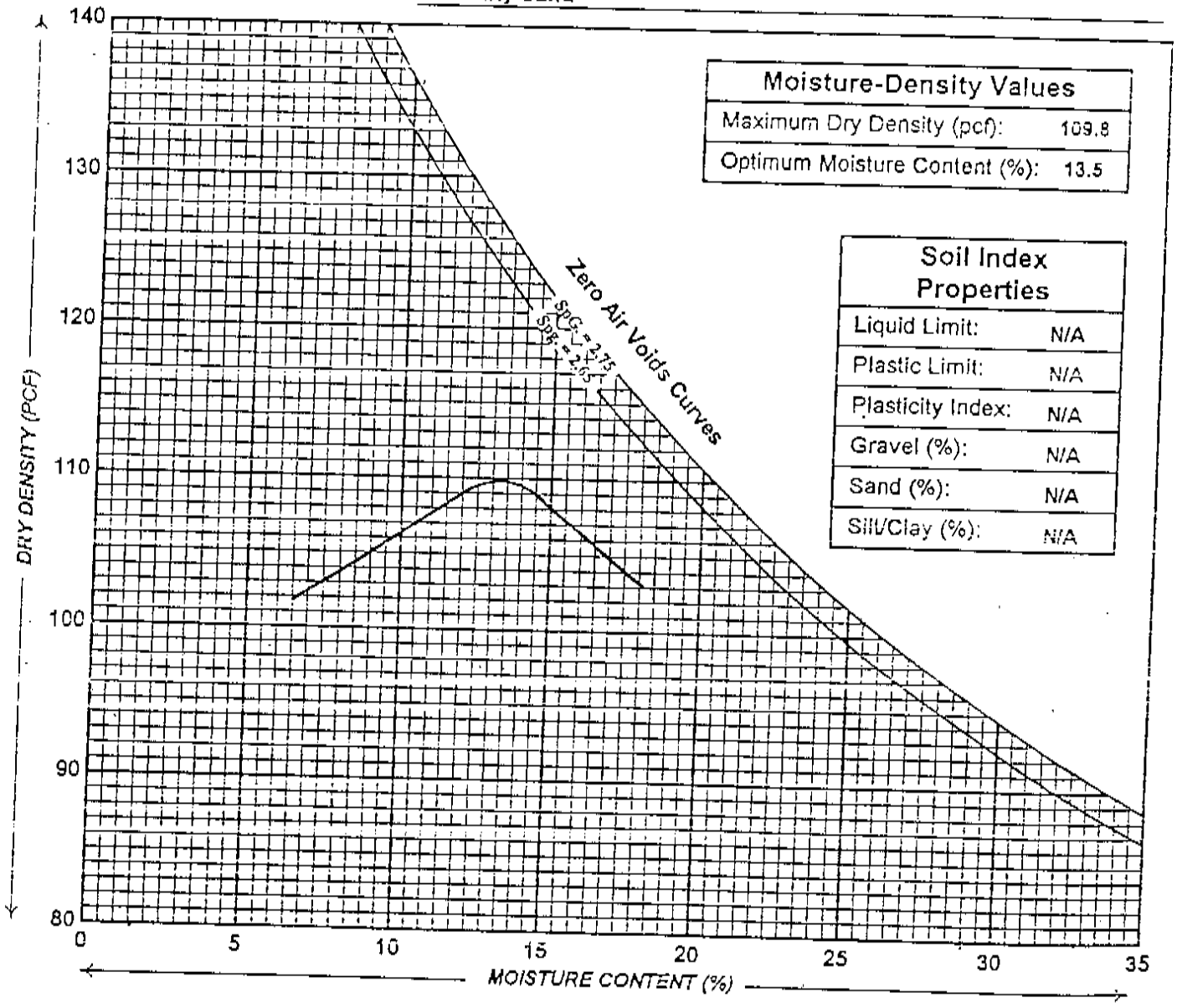
Curve No: 3766

Project No: 98021 Project Name: Total Refinery - Smith and Oakes Date Tested: 01/12/98

Sample ID: 4393A Sampled By: Al Oakes - Smith and Oakes Date Sampled: 01/09/98

Sample Location: #3A Lagoon Closure

Sample Description/Classification: Silty Sand



Moisture-Density Values	
Maximum Dry Density (pcf):	109.8
Optimum Moisture Content (%):	13.5

Soil Index Properties	
Liquid Limit:	N/A
Plastic Limit:	N/A
Plasticity Index:	N/A
Gravel (%):	N/A
Sand (%):	N/A
Silt/Clay (%):	N/A

AASHTO Designation: T-99 ASTM Designation: D-698

Weight of Hammer (lbs) 5.5 Height of Drop (in.) 12 Number of Lifts: 3

Blows per Lift: 25 Diameter of Cylinder (in.): 4 Volume of Cylinder (ft^3): 0.0333

ALLIED LABORATORIES
DEPARTMENT OF PROFESSIONAL ENGINEERING CONSULTANTS, P.A.
Located At 350 S. Washington • Wichita, Kansas 67202
Mailing Address 303 S. Topeka • Wichita, Kansas 67202
(316) 262-6457 FAX (316) 262-6592

REPORT OF MOISTURE - DENSITY RELATIONSHIP

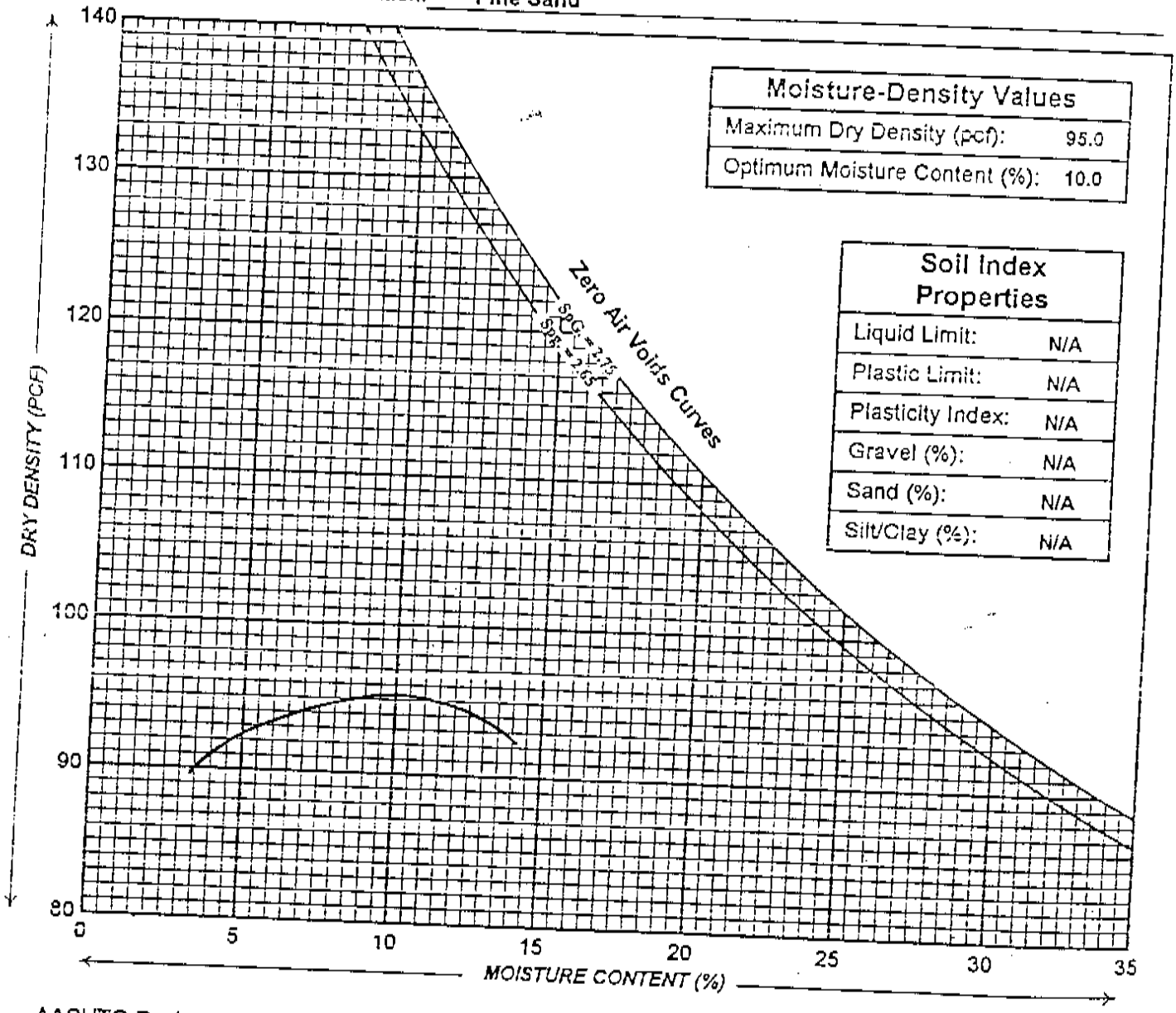
Curve No: 3765

Project No: 98021 Project Name: Total Refinery - Smith and Oakes Date Tested: 01/12/98

Sample ID: 4393B Sampled By: Alan Oakes - Smith and Oakes Date Sampled: 01/09/98

Sample Location: #3A Lagoon Closure

Sample Description/Classification: Fine Sand



Moisture-Density Values	
Maximum Dry Density (pcf):	95.0
Optimum Moisture Content (%):	10.0

Soil Index Properties	
Liquid Limit:	N/A
Plastic Limit:	N/A
Plasticity Index:	N/A
Gravel (%):	N/A
Sand (%):	N/A
Silt/Clay (%):	N/A

AASHTO Designation: T-99 ASTM Designation: D-698

Weight of Hammer (lbs) 5.5 Height of Drop (in.) 12 Number of Lifts: 3

Blows per Lift: 25 Diameter of Cylinder (in.): 4 Volume of Cylinder (ft^3): 0.0333

ALLIED LABORATORIES
Located At 350 S. Washington · Wichita, Kansas 67202
Mail to 303 S. Topeka · Wichita, Kansas 67202
(316) 262-6457

NUCLEAR RELATIVE COMPACTION TEST DATA

(ASTM D-2922, ASTM D-3017)

PROJECT Total Refinery-Smith & Oakes

JOB NO. 98021

TEST NUMBER	1	2	3	4	5	6	7	8	9	10
LOCATION All tests taken at #3A Lagoon	33' N and 60' E of SW corner of lagoon 12.5' below grade 3-4' fill in lagoon	39' E and 65' N of SW corner of lagoon 12.5' below grade 3-4' fill	15' S and 38' W of NE corner of lagoon 12.5' below grade 3-4' fill in lagoon							
MODE & DEPTH	6"	6"	6"							
WET DENSITY PCF	113.7	111.0	118.0							
DRY DENSITY	103.3	103.2	108.5							
% MOISTURE	10.0	7.5	8.7							
MAXIMUM DRY DENSITY	95.0	95.0	95.0							
OPTIMUM MOISTURE	10.0	10.0	10.0							
CURVE NUMBER	3765	3765	3765							
SPEC COMPACT REQUIREMENT	95	95	95							
MOISTURE SPEC	Workable	Workable	Workable							
% RELATIVE COMPACTION	100	100	100							
*	Pass	Pass	Pass							

STANDARD COUNT	
DENSITY	MOISTURE

REPORTED IN FIELD TO Al Oakes

DATE 1/13/98

TESTED BY G. Cardenas

REVIEWED BY Allen Ward

ALLIED LABORATORIES
Located At 350 S. Washington · Wichita, Kansas 67202
Mail to 303 S. Topeka · Wichita, Kansas 67202
(316) 262-6457

NUCLEAR RELATIVE

COMPACTION TEST DATA

(ASTM D-2922, ASTM D-3017)

PROJECT Total Refinery-Smith & Oakes

JOB NO. 98021

TEST NUMBER	1	2	3	4	5	6	7	8	9	10
LOCATION All tests taken at #3A Lagoon	20' E and 20' N of SW corner of lagoon 6.5' below grade 11' of fill	20' w and 20' N of SE corner of lagoon 6.5' below grade 11' of fill	18' S and 20' W of NE corner of lagoon 6.5' below grade 11' of fill	20' E and 20' S of NW corner of lagoon 6.5' below grade 11' of fill	Center of lagoon 6.5' below grade 11' of fill					
MODE & DEPTH	12"	12"	12"	12"	12"					
WET DENSITY PCF	117.4	115.7	113.0	111.0	105.2					
DRY DENSITY	104.6	104.6	103.1	99.9	98.6					
% MOISTURE	12.2	10.6	9.5	11.1	6.7					
MAXIMUM DRY DENSITY	95	95	95	95	95					
OPTIMUM MOISTURE	10.0	10.0	10.0	10.0	10.0					
CURVE NUMBER	3765	3765	3765	3765	3765					
SPEC COMPACT REQUIREMENT	95	95	95	95	95					
MOISTURE SPEC	Workable	Workable	Workable	Workable	Workable					
% RELATIVE COMPACTION	100	100	100	100	99					
•	Pass	Pass	Pass	Pass	Pass					

STANDARD COUNT	
DENSITY	MOISTURE
2225	652

REPORTED IN FIELD TO Al Oakes

DATE 1/15/98 TESTED BY G. Cardenas

REVIEWED BY Alan Ward

ALLIED LABORATORIES
Located At 350 S. Washington · Wichita, Kansas 67202
Mail to 303 S. Topeka · Wichita, Kansas 67202
(316) 262-6457

NUCLEAR RELATIVE COMPACTION TEST DATA

(ASTM D-2922, ASTM D-3017)

PROJECT Total Refinery-Smith & Oakes

JOB NO. 98021

TEST NUMBER	1	2	3	4	5	6	7	8	9	10
LOCATION All tests taken at #3A Lagoon	20' N and 25' W of SE corner of lagoon final grade	35' E and 18' S of NW corner of lagoon final grade	20' E and 15' N of NW corner of lagoon final grade							
MODE & DEPTH	12"	12"	12"							
WET DENSITY PCF	114.3	118.0	116.7							
DRY DENSITY	105.3	107.3	107.6							
% MOISTURE	8.5	10.0	8.4							
MAXIMUM DRY DENSITY	95	95	95							
OPTIMUM MOISTURE	10.0	10.0	10.0							
CURVE NUMBER	3765	3765	3765							
SPEC COMPACT REQUIREMENT	95	95	95							
MOISTURE SPEC	Workable	Workable	Workable							
% RELATIVE COMPACTION	100	100	100							
*	Pass	Pass	Pass							

STANDARD COUNT	
DENSITY	MOISTURE
2281	651

REPORTED IN FIELD TO Al Oakes

DATE 1/19/98

TESTED BY G. Cardenas

REVIEWED BY Alan D Ulas

APPENDIX B

DAILY CONSTRUCTION REPORTS

DAILY CONSTRUCTION REPORT

DATE January 12, 1998

DAY	S	M	T	W	TH	F	S
		X					

PROJECT #3A Lagoon
JOB NO. 01-0138R-10 (17-AC17-135)
CLIENT EnecoTech, Inc.
CONTRACTOR L.G. Pike Construction
PROJECT MANAGER Ted Biggs

WEATHER	Brite Sun	Clear	Overcast	Rain	Snow X
TEMP.	To 32	32-50 X	50-70	70-85	85 up
WIND	Still	Moder X	High	Report No.	
HUMIDITY	Dry	Moder	Humid	1	

AVERAGE FIELD FORCE

Name of Contractor	Non-manual	Manual	Remarks
L.G. Pike Construction P.O. Box 912 Arkansas City, KS 67005	7		

VISITORS

Time	Representing	Representing	Remarks

EQUIPMENT AT THE SITE

1-D7 Bulldozer, 2 Volvo Dump Trucks (to increase to 3)
1 Motor Grader (to maintain haul road), 1 Tractor Pulled Sheeps Foot Roller (arrived 1:00 p.m.)

CONSTRUCTION ACTIVITIES

Lower Fence at South End Total Property for Access
Construct Haul Road thru Fence
Construct Ramp to bottom of fill site (#3A Lagoon)
Commence Fill Sand Operations

NOTES: Sheeps Foot Roller on site at 1:00 p.m.
Time between trucks: Minimum - 1 minute
Maximum - 8 minutes

Average - 3 minutes

DISTRIBUTION:
1. Proj. Mgr.
2. Field Office
3. File
4. Client

PAGE 1 OF 1 PAGES

BY [signature] TITLE

Wiley-Fisk Form 8-1

DAILY CONSTRUCTION REPORT

DATE January 13, 1998

DAY	S	M	T	W	TH	F	S
			X				

PROJECT #3A Lagoon
JOB NO. 01-0138R-10 (17-AC17-135)
CLIENT EnecoTech, Inc.
CONTRACTOR L.G. Pike Construction
PROJECT MANAGER Ted Biggs

WEATHER	Brite Sun	Clear	Overcast X	Rain	Snow
TEMP.	To 32 X	32-50	50-70	70-85	85 up
WIND	Still	Moder X	High	Report No.	
HUMIDITY	Dry	Moder	Humid	2	

AVERAGE FIELD FORCE

Name of Contractor	Non-manual	Manual	Remarks
L.G. Pike Construction P.O. Box 912 Arkansas City, KS 67005	7		

VISITORS

Time	Representing	Representing	Remarks
12:00pm	Allied Laboratories		Run Nuclear Compaction/ Density Tests

EQUIPMENT AT THE SITE
1 D7 Dozer, 3 Volvo Dump Trucks, 1 Motor Grader (maintain haul road)
1 Tractor Pulled Sheeps Foot Roller

CONSTRUCTION ACTIVITIES

Maintain Haul Road
Continue to fill #3A Lagoon with sand
Depth at start of day approximately 4'-0" / Lifts have been less than 8" max loose lift.

NOTES: Allied Labs will be at main gate by 12:00 p.m.. Will run Nuclear Densometer Tests. Arrived at 11:30 a.m.. Allied conducted 3 Nuclear Density Test all were at or was 99% of standard proctor.
Made arrangements to have Allied return on 01/15/98 at 12:00p.m. for another series of densities and moistures.

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Wiley-Fisk Form 8-1

DAILY CONSTRUCTION REPORT

DATE January 14, 1998

DAY: S | M | T | W X | TH | F | S

PROJECT #3A Lagoon
JOB NO. 01-0138R-10 (17-AC17-135)
CLIENT EnecoTech, Inc.
CONTRACTOR L.G. Pike Construction
PROJECT MANAGER Ted Biggs

WEATHER	Brite Sun	Clear	Overcast	Rain X	Snow
TEMP.	To 32 X	32-50	50-70	70-85	85 up
WIND	Still	Moder X	High	Report No.	
HUMIDITY	Dry	Moder	Humid	3	

AVERAGE FIELD FORCE

Name of Contractor	Non-manual	Manual	Remarks
L.G. Pike Construction P.O. Box 912 Arkansas City, KS 67005	7		

VISITORS

Time	Representing	Representing	Remarks

EQUIPMENT AT THE SITE
1 D7 Dozer, 3 Volvo Dump Trucks, 1 Motor Grader (maintain haul road)
1 Tractor Pulled Sheeps Foot Roller.

CONSTRUCTION ACTIVITIES

Continue to fill lagoon with tested and approved sand material from designated borrow site.
Maintain haul road and keep clear of ice
Excavated "edge brush" and compacted into sand at SW corner - some has been spread at a depth of approximately 6.7 ft.

NOTES: No concrete removal has commenced as of 1:00 p.m. 01/14/98
No Compaction/Density/Moisture Tests were run today
Plan on testing on 01/15/98
Received hard copies of densities from Allied today
No structure removal attempted - to slick to mobilize equip.

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Wiley-Fisk Form B-1

DAILY CONSTRUCTION REPORT

DATE January 15, 1998

DAY	S	M	T	W	TH	F	S
					X		

PROJECT #3A Lagoon
JOB NO. 01-0138R-10 (17-AC17-135)
CLIENT EnecoTech, Inc.
CONTRACTOR L.G. Pike Construction
PROJECT MANAGER Ted Biggs

WEATHER	Brite Sun	Clear	Overcast	Rain	Snow
TEMP.	To 32 X	32-50	50-70	70-85	85 up
WIND	Still	Moder X	High	Report No.	
HUMIDITY	Dry	Moder	Humid	4	

AVERAGE FIELD FORCE

Name of Contractor	Non-manual	Manual	Remarks
L.G. Pike Construction P.O. Box 912 Arkansas City, KS 67005	8		

VISITORS

Time	Representing	Representing	Remarks
12:00pm	Allied Laboratories		Run Nuclear Compaction/ Density Tests

EQUIPMENT AT THE SITE

1 D7 Dozer, 3 Volvo Dump Trucks, 1 Motor Grader (maintain haul road)
1 Tractor Pulled Sheeps Foot Roller, 1 Back Hoe with Hammer

CONSTRUCTION ACTIVITIES

Continue to fill #3A Lagoon
Lifts are generally less than 5" loose, never more than 8" loose - this is due to spreading process and delay between trucks.
Ample time for rolling, which probably why compaction has been 100% and over.
Also moisture range has been at optimum - nearly 10%

NOTES: Compaction tests run at 12:00 p.m. today by Allied
See Allied report (5 tests)
Last test was at a location not fully rolled by Sheep's Foot
will (more than likely) begin demolition work with backhoe on 01/16/98.

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BY _____ TITLE _____

Wiley-Fisk Form 8-1

DAILY CONSTRUCTION REPORT

DATE January 16 1998

DAY	S	M	T	W	TH	F	S
						X	

PROJECT #3A Lagoon
JOB NO. 01-0138R-10 (17-AC17-135)
CLIENT EnecoTech, Inc.
CONTRACTOR L.G. Pike Construction
PROJECT MANAGER Ted Biggs

WEATHER	Brite Sun	Clear	Overcast	Rain X	Snow
TEMP.	To 32 X	32-50	50-70	70-85	85 up
WIND	Still	Moder X	High	Report No.	
HUMIDITY	Dry	Moder	Humid	5	

AVERAGE FIELD FORCE

Name of Contractor	Non-manual	Manual	Remarks
L.G. Pike Construction P.O. Box 912 Arkansas City, KS 67005	8 (+3)	1	

VISITORS

Time	Representing	Representing	Remarks

EQUIPMENT AT THE SITE

1 D7 Dozer, 3 Volvo Dump Trucks, 1 Motor Grader (maintain haul road)
1 Tractor Pulled Sheeps Foot Roller, 1 Back Hoe with Hammer.

CONSTRUCTION ACTIVITIES

Continue to fill #3A Lagoon, at start of day grade was 6' to final. Maintain haul road lifts not exceeding 6'. Rolling procedure has produced compaction of near 100 and over. Demolition start today. Demolition completed. All material removed was hauled to waste dump at Total Refinery.

NOTES: Told Ted to "cut off " protruding efficient pipe rather than "blending them down:.

New equipment arrived on-site: Back Hoe with Chisel, 1 Loader, 1 10 Wheel Dump Truck.

Additional Personnel - 1 Driver, 2 Operators, 1 Laborer (pipe cutter)

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Wiley-Fisk Form 8-1

DAILY CONSTRUCTION REPORT

DATE January 19, 1998

DAY	S	M	T	W	TH	F	S
		X					

PROJECT #3A Lagoon
JOB NO. 01-0138R-10 (17-AC17-135)
CLIENT EnecoTech, Inc.
CONTRACTOR L.G. Pike Construction
PROJECT MANAGER Ted Biggs

WEATHER	Brite Sun X	Clear	Overcast	Rain	Snow
TEMP.	To 32 X	32-50	50-70	70-85	85 up
WIND	Still	Moder X	High	Report No.	
HUMIDITY	Dry	Moder	Humid	6	

AVERAGE FIELD FORCE

Name of Contractor	Non-manual	Manual	Remarks
L.G. Pike Construction P.O. Box 912 Arkansas City, KS 67005	8		

VISITORS

Time	Representing	Representing	Remarks
12:00pm	Allied Laboratories		

EQUIPMENT AT THE SITE

2 Dump Truck (10Whl), 3 Dump Truck (4WD), Bulldozer(s) -D3, D4, D7
1 Sheeps Foot Roller - Tractor Pulled (removed from site)
D7 Dozer removed from site

CONSTRUCTION ACTIVITIES

Began loading, hauling, spreading and compacting sandy loam finish material, completed fill, cut drainage ditch. Work was done on 01/17/98 even though it had been mentioned that no work would be done.

NOTES: No tests shall be conducted on "sandy loam".

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DAILY CONSTRUCTION REPORT

DATE January 20, 1998

DAY: S | M | T X | W | TH | F | S

PROJECT #3A Lagoon
JOB NO. 01-0138R-10 (17-AC17-135)
CLIENT EnecoTech, Inc.
CONTRACTOR L.G. Pike Construction
PROJECT MANAGER Ted Biggs

WEATHER	Brite Sun X	Clear	Overcast	Rain	Snow
TEMP.	To 32	32-50 X	50-70	70-85	85 up
WIND	Still	Moder	High X	Report No.	
HUMIDITY	Dry	Moder	Humid	7	

AVERAGE FIELD FORCE

Name of Contractor	Non-manual	Manual	Remarks
L.G. Pike Construction P.O. Box 912 Arkansas City, KS 67005	3		

VISITORS

Time	Representing	Representing	Remarks

EQUIPMENT AT THE SITE

Tractor Pulled Finish Box Blade, 1 Dozer, 1 Motor Grader (still working on haul road)

CONSTRUCTION ACTIVITIES

Clean and finish, grade out drainage ditches promoting positive drainage.

Sent field survey crew out at 1:00 p.m. to run "As-Built" survey as a means of checking grade and compliance with plans. Survey was completed same date.

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DAILY CONSTRUCTION REPORT

DATE January 21, 1998

DAY	S	M	T	W	TH	F	S
				X			

PROJECT #3A Lagoon
JOB NO. 01-0138R-10 (17-AC17-135)
CLIENT EnecoTech, Inc.
CONTRACTOR L.G. Pike Construction
PROJECT MANAGER Ted Biggs

WEATHER	Brite Sun	Clear X	Overcast	Rain	Snow
TEMP.	To 32	32-50 X	50-70	70-85	85 up
WIND	Still	Moder X	High	Report No.	
HUMIDITY	Dry	Moder X	Humid	8	

AVERAGE FIELD FORCE

Name of Contractor	Non-manual	Manual	Remarks
L.G. Pike Construction P.O. Box 912 Arkansas City, KS 67005	4		

VISITORS

Time	Representing	Representing	Remarks

EQUIPMENT AT THE SITE
Box Blade, Skid Loader, Motor Grader, Finish Dozer (D3)

CONSTRUCTION ACTIVITIES

Cut ditch and finished "sandy loam" cap.
Repaired haul road by placing and spreading on crushed rock where needed. Haul road has been repaired to original condition, if not somewhat better.

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DAILY CONSTRUCTION REPORT

DATE January 22, 1998

DAY	S	M	T	W	TH	F	S
					X		

PROJECT #3A Lagoon
JOB NO. 01-0138R-10 (17-AC17-135)
CLIENT EnecoTech, Inc.
CONTRACTOR L.G. Pike Construction
PROJECT MANAGER Ted Biggs

WEATHER	Brite Sun	Clear X	Overcast	Rain	Snow
TEMP.	To 32	32-50	50-70 X	70-85	85 up
WIND	Still X	Moder	High	Report No.	
HUMIDITY	Dry	Moder	Humid	9	

AVERAGE FIELD FORCE

Name of Contractor	Non-manual	Manual	Remarks
L.G. Pike Construction P.O. Box 912 Arkansas City, KS 67005	0		

VISITORS

Time	Representing	Representing	Remarks

EQUIPMENT AT THE SITE
NONE

CONSTRUCTION ACTIVITIES

No work.

DISTRIBUTION:
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DAILY CONSTRUCTION REPORT

DATE January 23, 1998

DAY | S | M | T | W | TH | F X | S

PROJECT #3A Lagoon
JOB NO. 01-0138R-10 (17-AC17-135)
CLIENT EnecoTech, Inc.
CONTRACTOR L.G. Pike Construction
PROJECT MANAGER Ted Biggs

WEATHER	Brite Sun X	Clear	Overcast	Rain	Snow
TEMP.	To 32	32-50	50-70 X	70-85	85 up
WIND	Still X	Moder	High	Report No.	
HUMIDITY	Dry X	Moder	Humid	10	

AVERAGE FIELD FORCE

Name of Contractor	Non-manual	Manual	Remarks
L.G. Pike Construction P.O. Box 912 Arkansas City, KS 67005	3		

VISITORS

Time	Representing	Representing	Remarks

EQUIPMENT AT THE SITE
1 Seed Caster, 1 D3 Dozer

CONSTRUCTION ACTIVITIES

Seeding Completed. Job Completed.

DISTRIBUTION:
1. Proj. Mgr.
2. Field Office
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APPENDIX C
CORRESPONDENCE WITH NATURAL RESOURCES CONSERVATION SERVICE

United States
Department of
Agriculture

Natural Resources
Conservation
Service

2118 E. Ninth
Winfield, KS 67156
(316)221-1850

Date: Nov. 18, 1997

To: Jay Mednick
EnecoTech

Subject: Total Petro. site-
Project #01-0138R010

Concerning the project you called about in Cowley County, KS. I offer the following recommendations:

1. Apply 9 to 12 inches of good Sandy Loam topsoil with a paddle scraper or similar device. The equipment will provide adequate compaction.

2. Prepare a firm seedbed with a disc, field cultivator or similar equipment. Seed may be drilled or broadcast and covered lightly (1/4 to 3/4 " deep) with a harrow, weighted bedspring or similar device.

3. Apply 2 tons per Acre of late cut, weed free, prairie hay after seeding grass and anchor with straight set, weighted disc. Be careful not to bury seed more than 3/4 inch.

You will also find 2 copies of the aerial photos for this site and a grass seeding sheet with the recommended mixture for this soil type.

Sincerely;

Barry N. Barber
District Conservationist

w/attachments

TABLE 1
SEED MIXTURE - VEGETATIVE COVER
No. 3A AERATED LAGOON CLOSURE

	PLANNED							APPLIED			
	(1) Species	(2) Variety	(3) Lbs. PLS/ Acre	(4) % of Mix	(5) PLS Lbs./ Acre	(6) Acres	(7) Total PLS Lbs.	(8) Bulk Lbs. Seeded	(9) PLS*	(10) Total PLS Lbs. Seeded	Remarks
SEED	Big Bluestem	Kaw	12	15	1.8	0.7	1.3	20	.09	1.8	
	Indiangrass	Osage	12	15	1.8	0.7	1.3	20	.09	1.8	
	Switchgrass	Blackwell	6	30	1.8	0.7	1.3	20	.09	1.8	
	Sideoats Grama	El Reno	12	20	2.4	0.7	1.7	20	.12	2.4	
	Western Wheatgrass	Barton	20	20	4.0	0.7	2.8	20	.28	5.5	

FERTILIZER	Kind	Rate per Acre (Available)	Acres	Total Lbs. Fertilizer Planned (Available)	Bulk Lbs., Applied	Percent Available	Total Available Applied	Remarks
	18-46-0	65	.7	45.5				

* PLS (pure live seed) from seed tag

or

$$\frac{((\% \text{ Germ.} + \% \text{ Firm Seed}) \times \text{Purity})}{100}$$

Producer's Statement:

I certify that I have seeded .7 acres as described on this form and in accordance with specifications.

Signature

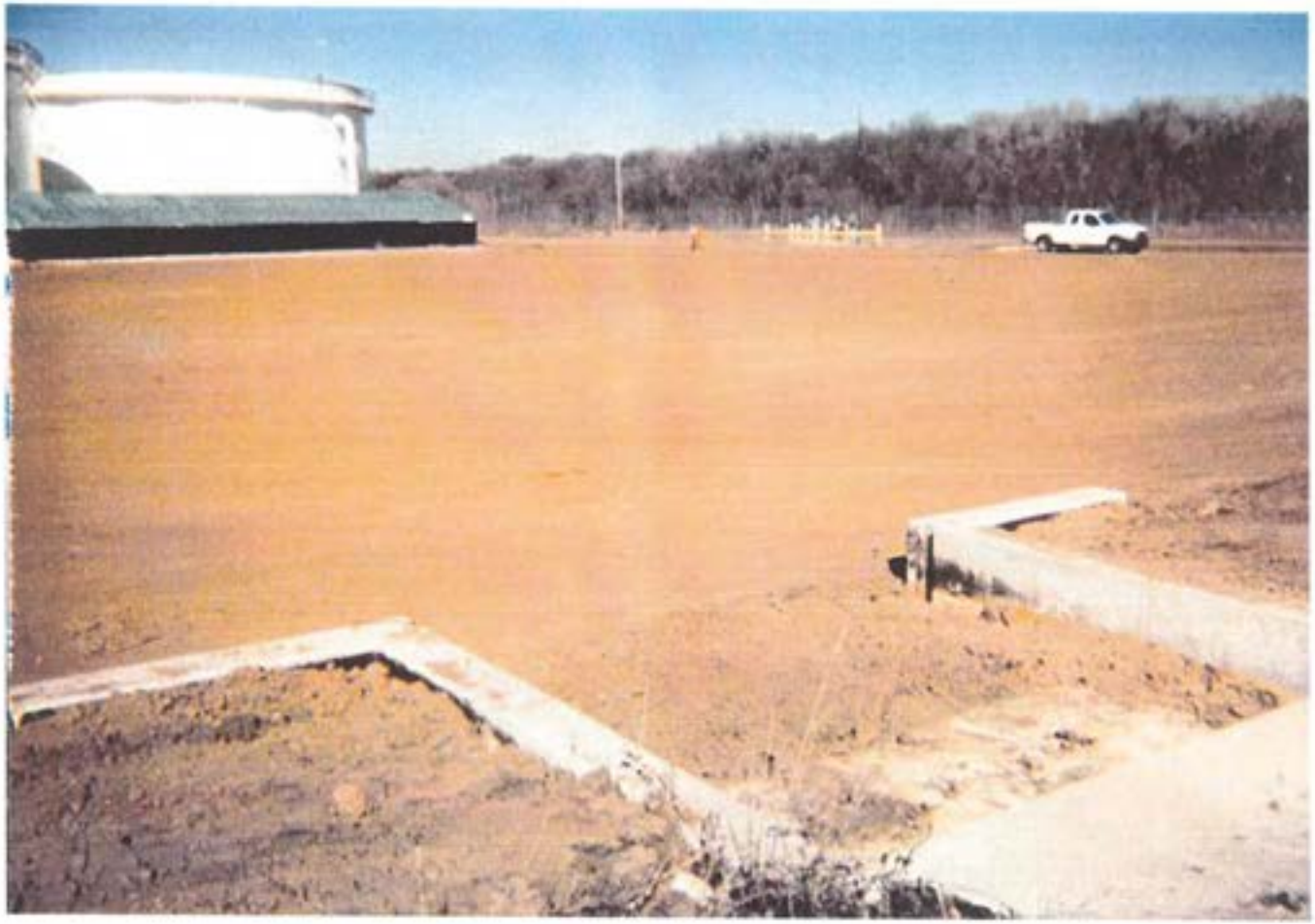
1-28-98

Date

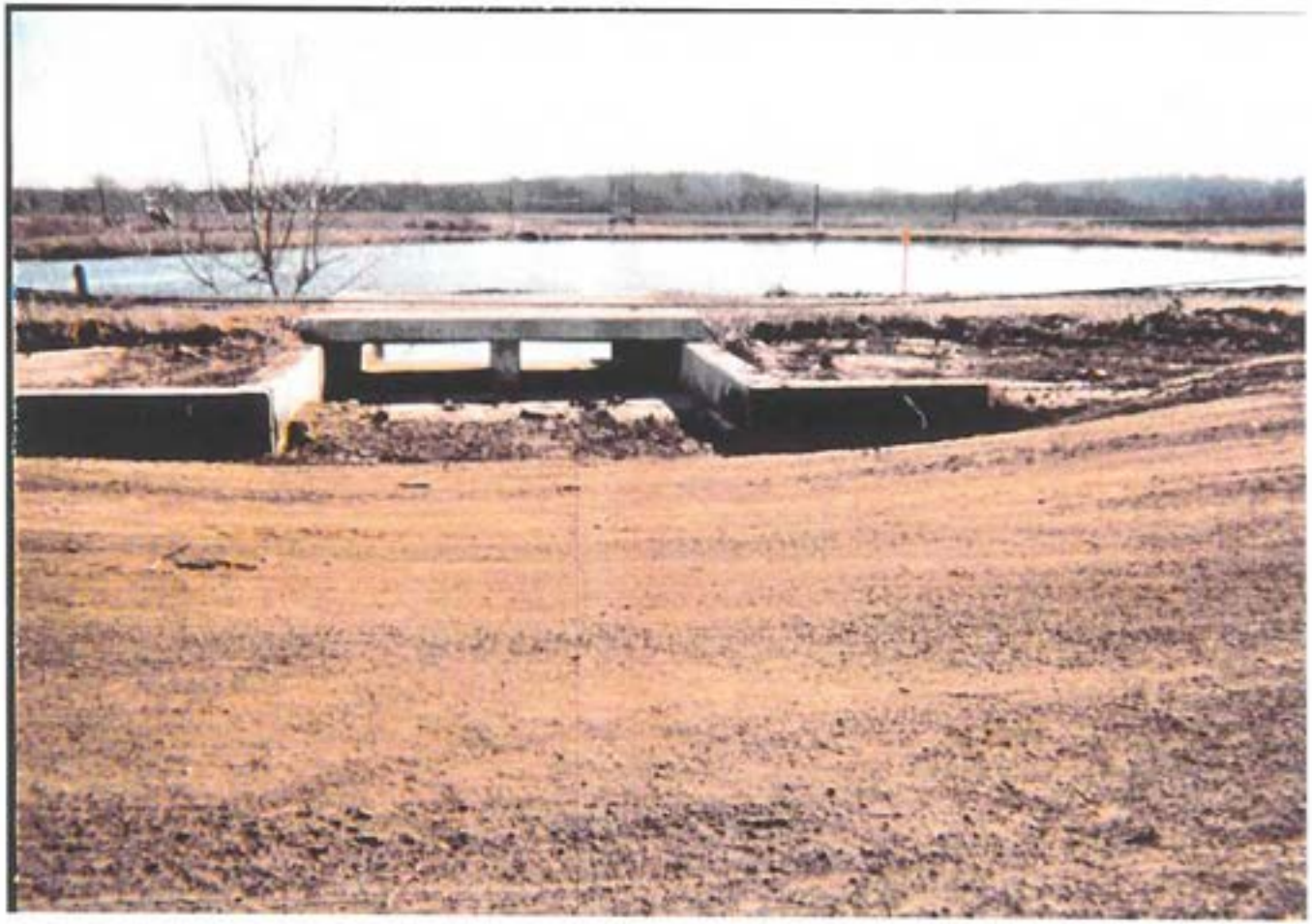
(1) To be obtained from specifications.
(2) May be obtained from Plant Materials Technical Notes.
(3) To be obtained from specifications.
(4) To be obtained from specifications after on-site investigation of needs.
(5) Multiply columns 3 and 4 and enter in column 5.
(6) Acres to be seeded.
(7) Multiply columns 5 and 6 and enter in column 7.
(8) Enter bulk pounds actually seeded.
(9) Enter PLS (pure live seed) obtained from seed tag.
(10) Multiply columns 8 and 9 and enter in column 10. (Column 10 should equal or exceed column 7 or an appropriate adjustment made in the mixture.

APPENDIX D

PHOTOGRAPHS OF No. 3A AERATED LAGOON FINAL COVER



Photograph of No. 3A Aerated Lagoon final cover. View from the southeast toward the northwest. Concrete structure in the foreground drains runoff from the cover into the No. 3B Aerated Lagoon. Photo date, January 29, 1998.



Photograph of No. 3A Aerated Lagoon final cover. View toward the east, No. 3B Aerated Lagoon in the distance.
Photo date, January 29, 1998.

Photograph of No. 3A Aerated Lagoon final cover. View from the southwest toward the northeast. Photo date, January 29, 1998.

APPENDIX D

Waste Analysis for API Separator Solids and Slop Oil

TABLE 13-1

API SEPARATOR SOLIDS ANALYSIS:

A sample was collected in April, 1984 and was analyzed by Rocky Mountain Analytical (RMAL) Laboratories, Results were:

air dried solids	53%
hexane extractable	5.0%

metals content =

	Total Metals (mg/kg "as sampled"	Oily EP mg/l extract)
Arsenic	6.8	ND
Barium	220.	3.5
Cadmium	1.1	ND
Chromium	680.	0.35
Lead	67.	ND
Mercury	1.2	ND
Selenium	ND	ND
Silver	ND	ND
Antimony	7.2	ND
Beryllium	ND	ND
Chromium (+6)	ND	ND
Cobalt	4.5	0.021
Nickel	25.	0.11
Vanadium	21.	0.12

ND: NOT DETECTED AT METHOD DETECTION LIMITS

TABLE 13-1 CONTINUED

TOTAL PETROLEUM ARKANSAS CITY, KANSAS REFINERY
WASTE ANALYSES APRIL, 1984

API SEPARATOR SLUDGE - VOLATILE ORGANICS

Parameter, mg/kg-dry wt.	
Acetonitrile	ND
Acrolein	ND
Acrylonitrile	ND
Benzene	ND
Bis(chloromethyl)ether	ND
Chlorobenzene	ND
Chloroform	ND
Chloromethane	ND
Crotonaldehyde	ND
1,1-Dichloroethane	ND
1,2-Dichloroethane	ND
1,1-Dichloroethylene	ND
1,2-Dichloroethylene	ND
Dichloromethane	ND
Dichloropropane	ND
1,4-Dioxane	ND
Ethyleneimine**	---
Ethylene dibromide	ND
Ethylene oxide**	---
Methyl ethyl ketone	ND
Styrene	ND
Tetrachloroethanes	ND
Tetrachloroethylene	ND
Toluene	ND
Trichloroethanes	ND
Trichloroethylene	ND

API SEPARATOR SLUDGE - VOLATILE SULFUR COMPOUNDS

Hydrogren sulfide	0.20
Methyl mercaptan	ND
Carbon disulfide	1.1

**Not recovered using Method 8240

ND: NOT DETECTED AT METHOD DETECTION LIMITS

TABLE 13-1 CONTINUED

TOTAL PETROLEUM ARKANSAS CITY, KANSAS REFINERY
WASTE ANALYSES APRIL, 1984

API SEPARATOR SLUDGE - BASE/NEUTRAL ORGANICS

Parameter, mg/kg-dry wt.	
Aniline	ND
Anthracene	48
Benz(c)acridine***	ND
Benz(a)anthracene	ND
Benzidine	ND
Benzo(b)fluoranthene	ND
Benzo(j)fluoranthene***	ND
Benzo(k)fluoranthene	ND
Benzo(a)pyrene	ND
Benzylchloride	ND
Bis(2-chloroethyl)ether	ND
Bis(2-chloroisopropyl)ether	ND
Bis(2-ethylhexyl)phthalate	ND
Butylbenzylphthalate	ND
2-Chloronaphthalene	ND
Chrysene	21
Dibenz(a,h)acridine***	ND
Dibenz(a,j)acridine***	ND
Dibenz(a,h)anthracene	ND
7H-Dibenzo(c,g)carbazole	ND
7,12-Dimethylbenz(a)anthracene	ND
Dibenzo(a,e)pyrene***	ND
Dibenzo(a,h)pyrene***	ND
Dibenzo(a,i)pyrene***	ND
Di-n-butylphthalate	ND
Dichlorobenzenes	ND
Diethylphthalate	ND

***Standard not available, concentration estimated, not confirmed

ND: NOT DETECTED AT METHOD DETECTION LIMITS

TABLE 13-1 CONTINUED

TOTAL PETROLEUM ARKANSAS CITY, KANSAS REFINERY
WASTE ANALYSES APRIL, 1984

API SEPARATOR SLUDGE - BASE/NEUTRAL ORGANICS

Parameter, mg/kg-dry wt.	
Dimethylphthalate	ND
Dinitrotoluene	ND
Di-n-octylphthalate	ND
1,2-Diphenylhydrazine****	ND
Fluoranthene	ND
Hydroquinone	ND
Indene	ND
Indeno(1k,2,3-c,d)pyrene	ND
Isophorone	ND
2-Methylaziridine**	---
Methylbenz(c)phenanthrene	ND
3-Methylcholanthrene	ND
Methylchrysene***	ND
1-Methylnaphthalene	630
Naphthalene	240
Naphthylamine	ND
5-Nitroacenaphthene***	ND
p-Nitroaniline	ND
Nitrobenzene	ND
N-nitrosodiethylamine	ND
Phenanthrene	310
Pyrene	91
Pyridine	ND
Quinoline	ND
Trichlorobenzenes	ND
Trimethylbenz(a)anthracene***	ND

** Not recovered using Method 8270
*** Standard not available, concentration estimated, not confirmed
**** Measured as azobenzene

ND: NOT DETECTED AT METHOD DETECTION LIMITS

TABLE 13-1 CONTINUED

TOTAL PETROLEUM ARKANSAS CITY, KANSAS REFINERY
WASTE ANALYSES APRIL, 1984

API SEPARATOR SLUDGE - ACID ORGANICS

Parameter, mg/kg-dry wt.	
Benzenethiol	ND
p-Chloro-m-cresol	ND
2-Chlorophenol	ND
Cresols	ND
Dichloropropanol	ND
2,4-Dimethylphenol	ND
4,6-Dinitro-o-cresol	ND
2,4-Dinitrophenol	ND
Nitrophenols	ND
Pentachlorophenol	ND
Phenol	ND
Trichlorophenols	ND

ND: NOT DETECTED AT METHOD DETECTION LIMITS

TABLE 13-2

SLOP OIL EMULSION SOLIDS ANALYSIS:

A sample collected in April, 1984 and analyzed by RMAL Laboratories gave the following results:

air dried solids	55%
hexane extractables	6.5%

metals content =

	Total Metals (mg/kg "as sampled"	Oily EP mg/l extract)
Arsenic	14.	ND
Barium	370.	0.39
Cadmium	4.4	ND
Chromium	1400.	1.9
Lead	3900.	5.3
Mercury	3.8	ND
Selenium	ND	ND
Silver	ND	ND
Antimony	2.4	ND
Beryllium	0.29	ND
Chromium (+6)	ND	---
Cobalt	7.8	ND
Nickel	39.	0.078
Vanadium	39.	0.089

ND: NOT DETECTED AT METHOD DETECTION LIMITS

TABLE 13-2 CONTINUED

TOTAL PETROLEUM ARKANSAS CITY, KANSAS REFINERY
WASTE ANALYSES APRIL, 1984

SLOP OIL EMULSION SOLIDS - BASE/NEUTRAL ORGANICS

Parameter, mg/kg-dry wt.	
Dimethylphthalate	ND
Dinitrotoluene	ND
Di-n-octylphthalate	ND
1,2-Diphenylhydrazine****	ND
Fluoranthene	ND
Hydroquinone	ND
Indene	ND
Indeno(1k,2,3-c,d)pyrene	ND
Isophorone	ND
2-Methylaziridine**	---
Methylbenz(c)phenanthrene	ND
3-Methylcholanthrene	ND
Methylchrysene***	ND
1-Methylnaphthalene	620
Naphthalene	260
Naphthylamine	ND
5-Nitroacenaphthene***	ND
p-Nitroaniline	ND
Nitrobenzene	ND
N-nitrosodiethylamine	ND
Phenanthrene	300
Pyrene	85
Pyridine	ND
Quinoline	ND
Trichlorobenzenes	ND
Trimethylbenz(a)anthracene***	ND

** Not recovered using Method 8270
*** Standard not available, concentration estimated, not confirmed
**** Measured as azobenzene

ND: NOT DETECTED AT METHOD DETECTION LIMITS

TABLE 13-2 CONTINUED

TOTAL PETROLEUM ARKANSAS CITY, KANSAS REFINERY
WASTE ANALYSES APRIL, 1984

SLOP OIL EMULSION SOLIDS - BASE/NEUTRAL ORGANICS

Parameter, mg/kg-dry wt.	
Aniline	ND
Anthracene	49
Benz(c)acridine***	ND
Benz(a)anthracene	ND
Benzidine	ND
Benzo(b)fluoranthene	ND
Benzo(j)fluoranthene***	ND
Benzo(k)fluoranthene	ND
Benzo(a)pyrene	ND
Benzylchloride	ND
Bis(2-chloroethyl)ether	ND
Bis(2-chloroisopropyl)ether	ND
Bis(2-ethylhexyl)phthalate	ND
Butylbenzylphthalate	ND
2-Chloronaphthalene	ND
Chrysene	21
Dibenz(a,h)acridine***	ND
Dibenz(a,j)acridine***	ND
Dibenz(a,h)anthracene	ND
7H-Dibenzo(c,g)carbazole	ND
7,12-Dimethylbenz(a)anthracene	ND
Dibenzo(a,e)pyrene***	ND
Dibenzo(a,h)pyrene***	ND
Dibenzo(a,i)pyrene***	ND
Di-n-butylphthalate	ND
Dichlorobenzenes	ND
Diethylphthalate	ND

***Standard not available, concentration estimated, not confirmed

ND: NOT DETECTED AT METHOD DETECTION LIMITS

TABLE 13-2 CONTINUED

TOTAL PETROLEUM ARKANSAS CITY, KANSAS REFINERY
WASTE ANALYSES APRIL, 1984

SLOP OIL EMULSION SOLIDS - VOLATILE ORGANICS

Parameter, mg/kg-dry wt.	
Acetonitrile	ND
Acrolein	ND
Acrylonitrile	ND
Benzene	ND
Bis(chloromethyl)ether	ND
Chlorobenzene	ND
Chloroform	ND
Chloromethane	ND
Crotonaldehyde	ND
1,1-Dichloroethane	ND
1,2-Dichloroethane	ND
1,1-Dichloroethylene	ND
1,2-Dichloroethylene	ND
Dichloromethane	ND
Dichloropropane	ND
1,4-Dioxane	ND
Ethyleneimine**	---
Ethylene dibromide	ND
Ethylene oxide**	---
Methyl ethyl ketone	ND
Styrene	ND
Tetrachloroethanes	ND
Tetrachloroethylene	ND
Toluene	240
Trichloroethanes	ND
Trichloroethylene	ND

SLOP OIL EMULSION SOLIDS - VOLATILE SULFUR COMPOUNDS

Hydrogren sulfide	0.19
Methyl mercaptan	ND
Carbon disulfide	0.96

**Not recovered using Method 8240

ND: NOT DETECTED AT METHOD DETECTION LIMITS

TABLE 13-2 CONTINUED

TOTAL PETROLEUM ARKANSAS CITY, KANSAS REFINERY
WASTE ANALYSES APRIL, 1984

SLOP OIL EMULSION SOLIDS - ACID ORGANICS

Parameter, mg/kg-dry wt.	
Benzenethiol	ND
p-Chloro-m-cresol	ND
2-Chlorophenol	ND
Cresols	ND
Dichloropropanol	ND
2,4-Dimethylphenol	ND
4,6-Dinitro-o-cresol	ND
2,4-Dinitrophenol	ND
Nitrophenols	ND
Pentachlorophenol	ND
Phenol	ND
Trichlorophenols	ND

ND: NOT DETECTED AT METHOD DETECTION LIMITS

APPENDIX E

Waste Analysis for #3A

Accute, Inc.
Environmental
& Laboratory
Services

February 17, 1994

Client: Total Petroleum Inc.
1400 South "M" Street
Arkansas City, KS 67005

Requested By: Richard Thomas

Project Name: Total Petroleum Inc., Ark City
Sample I.D.: **3 A Pond**
Date Sample Collected: February 8, 1994 (Time:1430)
Date Sample Received: February 9, 1994 (Time: 0922)
Date Sample Completed: February 17, 1994
Sample Type: Grab
Sample Matrix: Sludge
Lab Log Number: **B3111**
Oklahoma Certification: OWRB-8316
Kansas Certification; E-1192
Method Ref.: US EPA 40 CFR Part 136, March 1990, Test Method 1311 and EPA SW 846; GC/MS Methods 8260-modified, 8270, and 8080; Metals Method 200's.

General Indicators

Parameter	Result, mg/Kg	PQL*, mg/Kg	Date/Time of Analysis	Analyst	Method
pH, s.u.	7.79	0-14	02/15/94 / 1010	Mindi	9045
Flashpoint	> 100°C	-----	02/15/94 / 1630	B. S.	1010
Cyanide Reactivity	0.90	.25	02/15/94 / 0900	M.C.	335.2
Sulfide Reactivity	BPQL	1.0	02/15/94 / 1350	K.H.	9030

TCLP Extraction for Metals

Parameter	Results, ppm	PQL*, ppm	Regulatory Level, ppm	Date/Time of Analysis	Analyst
Arsenic (As)	BPQL	1.0	5.0	02/15/94 / 0930	S. W.
Barium (Ba)	BPQL	10.0	100.0	02/15/94 / 1115	S. W.
Cadmium (Cd)	BPQL	1.0	1.0	02/15/94 / 1000	S. W.
Chromium (Cr)	BPQL	1.0	5.0	02/15/94 / 1000	S. W.
Lead (Pb)	BPQL	1.0	5.0	02/15/94 / 1000	S. W.
Mercury (Hg)	BPQL	0.0002	0.2	02/16/94 / 1221	S. W.
Selenium (Se)	BPQL	1.0	1.0	02/15/94 / 0930	S. W.
Silver (Ag)	BPQL	1.0	5.0	02/15/94 / 1100	S. W.

ppm: mg/L of TCLP extract
Sample Preparation by S. Willard on 02/10/94 at 0900 (Method 3010).
* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.
BPQL: Below Practical Quantitation Limit (if applicable).

(cont.)

TCLP EXTRACTION FOR VOLATILE ORGANICS, ZHE
Method 8260-modified

Volatiles	Results, ppm	Det. Limits, ppm	PQL*, ppm	Reg. Level, ppm
Vinyl Chloride	BPQL	0.005	0.05	0.2
1,1-Dichloroethylene	BPQL	0.005	0.05	0.7
2-Butanone (MEK)	BPQL	0.025	0.25	200.0
Chloroform	BPQL	0.005	0.05	6.0
1,2-Dichloroethane	BPQL	0.005	0.05	0.5
Carbon Tetrachloride	BPQL	0.005	0.05	0.5
Benzene	BPQL	0.005	0.05	0.5
Trichlorethylene	BPQL	0.005	0.05	0.5
Tetrachloroethylene	BPQL	0.005	0.05	0.7
Chlorobenzene	BPQL	0.005	0.05	100.0

Analysis performed by L. Irvin on 02/10/94 at 2205.

TCLP EXTRACTION FOR SEMI-VOLATILE ORGANICS
Method 8270

Semi-Volatiles	Results, ppm	Det. Limits, ppm	PQL*, ppm	Reg. Level, ppm
Pyridine	BPQL	0.01	0.10	5.0
Cresols (Total)	BPQL	0.01	0.10	200.0
1,4-Dichlorobenzene	BPQL	0.01	0.10	7.5
Hexachloroethane	BPQL	0.01	0.10	3.0
Nitrobenzene	BPQL	0.01	0.10	2.0
Hexachlorobutadiene	BPQL	0.01	0.10	0.5
2,4,6-Trichlorophenol	BPQL	0.01	0.10	2.0
2,4,5-Trichlorophenol	BPQL	0.01	0.10	400.0
Pentachlorophenol	BPQL	0.025	0.25	100.0
Hexachlorobenzene	BPQL	0.01	0.10	0.5
2,4-Dinitrotoluene	BPQL	0.01	0.10	0.13

Sample preparation by M. Baligh on 02/14/94 at 1730 (Method 3510).
Analysis performed by B. Nordberg on 02/17/94 at 1017.
ppm: mg/L of TCLP extract

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.
BPQL: Below Practical Quantitation Limit (if applicable)

Ali Fazel, Ph. D.
Director of Environmental Services
AF:jm

Accutec, Inc.
Environmental
& Laboratory
Services

February 17, 1994
QA/QC

Parameter	% Duplicate Recovery	% Spike Recovery
Flashpoint	100	100
Cyanide Reactivity	95	90
Sulfide Reactivity	N/A	106

METALS

Parameter	% Duplicate Recovery	% Spike Recovery
Arsenic	100	76
Barium	100	101
Cadmium	100	84
Chromium	100	92
Lead	100	74
Mercury	100	93
Selenium	110	78
Silver	100	N/A

Blank was run with each batch.

VOLATILES-METHOD 8260-modified (MS/MSD RECOVERIES)

COMPOUND	SAMPLE CONC	SPIKE ADDED	SPIKE RESULT	DUPL RESULT	SPIKE % RECOV	DUP % RECOV	RPD	QC LIMITS RPD	QC LIMITS % REC
1,1-DICHLOROETHENE	0.0	500	515	523	103	105	2	14	61-145
BENZENE	0.0	500	516	499	103	100	3	13	76-130
TRICHLOROETHENE	0.0	500	490	486	98	97	1	14	71-120
TOLUENE	0.0	500	537	512	107	102	5	13	76-125
CHLOROBENZENE	0.0	500	509	485	102	97	5	11	76-127

505 S. Lowry Street ■ Stillwater, OK 74074 ■ 405-372-5300 ■ Fax: 405-372-5396
Oklahoma City: 405-236-5333 ■ Tulsa: 918-587-5300 ■ Wichita: 316-683-1123

Client: Total Petroleum, Inc.
Attn: Russ Seybert
1400 South M Street
Arkansas City, KS 67005

Date Sample Rptd: 09/25/92
Date Sample Recd: 09/09/92
CAS File No: 92-5126
CAS Order No: 13162
Client P.O.: 02-38116

Lab Number: 92090496
Sample Description: AC-201-92 #3A Aer. lag. Sludge

Date Sampled: 09/04/92
Time Sampled:

Analysis	Concentration	Units	Date Analyzed	Book/Page
Fluoride	109.	mg/kg	09/15/92	169 /55
TCLP Volatiles			09/19/92	/
1,1,1,2-Tetrachloroethane	ND(10.)	µg/L		512 /110
1,1,1-Trichloroethane	ND(10.)	µg/L		512 /110
1,1,2,2-Tetrachloroethane	ND(10.)	µg/L		512 /110
1,1,2-Trichloroethane	ND(10.)	µg/L		512 /110
1,1-Dichloroethylene	ND(10.)	µg/L		512 /110
1,2-Dichloroethane	ND(10.)	µg/L		512 /110
Acrylonitrile	ND(50.)	µg/L		512 /110
Benzene	74.	µg/L		512 /110
Carbon Disulfide	ND(100)	µg/L		512 /110
Carbon Tetrachloride	ND(10.)	µg/L		512 /110
Chlorobenzene	ND(10.)	µg/L		512 /110
Chloroform	ND(10.)	µg/L		512 /110
Isobutanol	ND(100)	µg/L		512 /110
Methyl Ethyl Ketone	ND(50.)	µg/L		512 /110
Methylene Chloride	ND(10.)	µg/L		512 /110
Tetrachloroethylene	ND(10.)	µg/L		512 /110
Toluene	120.	µg/L		512 /110
Trichloroethylene	ND(10.)	µg/L		512 /110
Vinyl Chloride/Chloroethene	ND(10.)	µg/L		512 /110
TCLP Extractables	*		09/24/92	/
2,3,4,6-Tetrachlorophenol	ND(25)	µg/L		787 /73
2,4,5-Trichlorophenol	ND(25)	µg/L		787 /73
2,4,6-Trichlorophenol	ND(25)	µg/L		787 /73
2,4-Dinitrotoluene	ND(25)	µg/L		787 /73
bis(2-Chloroethyl) Ether	ND(25)	µg/L		787 /73
Hexachlorobenzene	ND(25)	µg/L		787 /73
Hexachlorobutadiene	ND(25)	µg/L		787 /73
Hexachloroethane	ND(25)	µg/L		787 /73
m-Cresol	ND(25)	µg/L		787 /73
Nitrobenzene	ND(25)	µg/L		787 /73
o-Cresol	ND(25)	µg/L		787 /73
o-Dichlorobenzene	ND(25)	µg/L		787 /73
p-Cresol	ND(25)	µg/L		787 /73
p-Dichlorobenzene	ND(25)	µg/L		787 /73
Pentachlorophenol	ND(25)	µg/L		787 /73
Phenol	ND(25)	µg/L		787 /73
Pyridine	ND(250)	µg/L		787 /73
Arsenic, TCLP	ND(1)	mg/L	09/15/92	1205/29
Barium, TCLP	6.	mg/L	09/15/92	1249/16

-Continued-

CONTINENTAL ANALYTICAL SERVICES, INC.

LABORATORY REPORT

Client: Total Petroleum, Inc.
Lab Number: 92090496

Analysis	Concentration	Units	Date Analyzed	Book/Page
Cadmium, TCLP	ND(0.5)	mg/L	09/15/92	1260/2
Chromium, TCLP	ND(0.4)	mg/L	09/15/92	1251/27
Lead, TCLP	ND(2)	mg/L	09/15/92	1240/28
Mercury, TCLP	ND(0.02)	mg/L	09/16/92	1242/18
Selenium, TCLP	ND(0.5)	mg/L	09/15/92	1201/34
Silver, TCLP	ND(0.5)	mg/L	09/15/92	1220/89

Analysis	Date Prepared	QC Batch	Analyst
Fluoride	NA	2	TLG
TCLP Volatiles	09/10/92	1	GDE
TCLP Extractables	09/14/92	1	BBE
Arsenic, TCLP	09/14/92	1	MLH
Barium, TCLP	09/14/92	1	MAG
Cadmium, TCLP	09/14/92	1	MAG
Chromium, TCLP	09/14/92	1	MAG
Lead, TCLP	09/14/92	1	MAG
Mercury, TCLP	09/14/92	1	MDB
Selenium, TCLP	09/14/92	1	MLH
Silver, TCLP	09/14/92	1	MAG

*Acid compounds are estimated values; acid surrogate values were below control limits. Samples being reprepped for confirmation of surrogate values.

Quality Control analyses were performed on samples at time of analysis in accordance with procedures published in Title 40 of the Code of Federal Regulations part 136, July 1, 1986 or in EPA Publication, SW-846, 3rd edition, Nov. 1986. ND(), where noted, indicates none detected with the detection limit in parentheses.

Samples will be retained for thirty days unless otherwise notified.

CONTINENTAL ANALYTICAL SERVICES, INC.

Clifford J. Baker

Clifford J. Baker
Laboratory Director

CAS

CONTINENTAL ANALYTICAL SERVICES, INC.

1804 GLENDALE - SALINA, KANSAS 67401 - (913)827-1273

LABORATORY REPORT

CLIENT: TOTAL PETROLEUM, INC.
ATTN:PHILLIP E. HOLMES
1400 SOUTH M STREET
ARKANSAS CITY, KS 67005

DATE SAMPLE RPTD: 08/10/90
DATE SAMPLE RECD: 08/08/90
CAS FILE NO: 90-5126
CAS ORDER NO: 4379
CLIENT P.O.:

LAB NUMBER: 90080321
SAMPLE DESCRIPTION: AC-350-90 #3 aerated lagoon sludge

DATE SAMPLED: 08/07/90
TIME SAMPLED:

ANALYSIS	CONCENTRATION	UNITS	BOOK/PAGE
TCLP VOLATILES			/
VINYL CHLORIDE	ND(10.)	UG/L	266/1
TRICHLOROETHYLENE	ND(10.)	UG/L	266/1
TOLUENE	ND(10.)	UG/L	266/1
TETRACHLOROETHYLENE	ND(10.)	UG/L	266/1
METHYLETHYL KETONE	ND(50.)	UG/L	266/1
METHYLENE CHLORIDE	ND(10.)	UG/L	266/1
ISOBUTANOL	ND(100)	UG/L	266/1
CHLOROFORM	ND(10.)	UG/L	266/1
CHLOROBENZENE	ND(10.)	UG/L	266/1
CARBON TETRACHLORIDE	ND(10.)	UG/L	266/1
CARBON DISULFIDE	ND(100)	UG/L	266/1
BENZENE	65	UG/L	266/1
ACRYLONITRILE	ND(50.)	UG/L	266/1
1,2-DICHLOROETHANE	ND(10.)	UG/L	266/1
1,1-DICHLOROETHYLENE	ND(10.)	UG/L	266/1
1,1,2-TRICHLOROETHANE	ND(10.)	UG/L	266/1
1,1,2,2-TETRACHLORO ETHANE	ND(10.)	UG/L	266/1
1,1,1-TRICHLOROETHANE	ND(10.)	UG/L	266/1
1,1,1,2-TETRACHLORO ETHANE	ND(10.)	UG/L	266/1
TCLP EXTRACTABLES			/
PYRIDINE	ND(50.)	UG/L	267/1
PHENOL	ND(5.0)	UG/L	267/1
PENTACHLOROPHENOL	ND(5.0)	UG/L	267/1
P-DICHLOROBENZENE	ND(5.0)	UG/L	267/1
P-CRESOL	ND(5.0)	UG/L	267/1
O-DICHLOROBENZENE	ND(5.0)	UG/L	267/1
O-CRESOL	ND(5.0)	UG/L	267/1
NITROBENZENE	ND(5.0)	UG/L	267/1
M-CRESOL	ND(5.0)	UG/L	267/1
HEXACHLOROETHANE	ND(5.0)	UG/L	267/1
HEXACHLOROBUTADIENE	ND(5.0)	UG/L	267/1
HEXACHLOROBENZENE	ND(5.0)	UG/L	267/1
BIS(2-CHLOROETHYL) ETHER	ND(5.0)	UG/L	267/1

-CONTINUED-

CONTINENTAL ANALYTICAL SERVICES, INC.

LABORATORY REPORT

CLIENT: TOTAL PETROLEUM, INC.
LAB NUMBER: 90080321

ANALYSIS	CONCENTRATION	UNITS	BOOK/PAGE
2,4-DINITROTOLUENE	ND(5.0)	UG/L	267/1
2,4,6-TRICHLOROPHENOL	ND(5.0)	UG/L	267/1
2,4,5-TRICHLOROPHENOL	ND(5.0)	UG/L	267/1
2,3,4,6-TETRACHLOROPHENOL	ND(5.0)	UG/L	267/1
BARIUM, TCLP	4.1	MG/L	232/44
CADMIUM, TCLP	ND(0.05)	MG/L	260/14
CHROMIUM, TCLP	1.19	MG/L	233/54
LEAD, TCLP	ND(0.2)	MG/L	251/26
MERCURY, TCLP	ND(0.002)	MG/L	235/60
SELENIUM, TCLP	ND(0.5)	MG/L	208/80
SILVER, TCLP	ND(0.05)	MG/L	236/34

CONCLUSION OF LAB NUMBER: 90080321

ND(), WHERE NOTED, INDICATES NONE DETECTED WITH THE DETECTION LIMIT IN PARENTHESES.

QUALITY CONTROL ANALYSES WERE PERFORMED ON SAMPLES AT TIME OF ANALYSIS IN ACCORDANCE WITH PROCEDURES PUBLISHED IN TITLE 40 OF THE CODE OF FEDERAL REGULATIONS PART 136, JULY 1, 1986 OR IN EPA PUBLICATION, SW-846, 3RD EDITION, NOV. 1986.

SAMPLES WILL BE RETAINED FOR 30 DAYS UNLESS OTHERWISE NOTIFIED.

CONTINENTAL ANALYTICAL SERVICES, INC.

Kathleen A. Mitchell for

CLIFFORD J. BAKER
LABORATORY DIRECTOR

APPENDIX F

Waste Stream Characterization for LTU

Table 4-1: Analysis Data for Wastes Manages at the LTU, Total Petroleum, Inc., Arkansas City, Kansas

Analysis[1]	Oily Dirt[2]	Pipeline Cleanout Dirt[3]	Pipeline Cleanout Dirt[4]	Contaminated Soil [5]	Contaminated Soil [6]	Cooling Tower Sludge [7]	Tank Bottoms [8]	Alky Neutralization pit sludge [9]
Fluoride	NA[10]	NA	NA	NA	48 mg/kg	NA	NA	NA
TCLP Volatiles								
1,1,1,2-tetrachloroethane	ND[11] (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (200 µg/L)	ND (10 µg/L)
1,1,1-trichloroethane	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (200 µg/L)	150 µg/L
1,1,2,2-tetrachloroethane	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (200 µg/L)	ND (10 µg/L)
1,1,2-trichloroethane	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (200 µg/L)	ND (10 µg/L)
1,1-dichloroethane	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (200 µg/L)	20 µg/L
1,2-dichloroethane	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (200 µg/L)	ND (10 µg/L)
acrylonitrile	ND (50 µg/L)	ND (50 µg/L)	ND (50 µg/L)	ND (50 µg/L)	ND (50 µg/L)	ND (50 µg/L)	ND (1000 µg/L)	ND (50 µg/L)
benzene	44 µg/L[12]	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	370 µg/L	ND (10 µg/L)
carbon disulfide	ND (100 µg/L)	ND (100 µg/L)	ND (100 µg/L)	ND (100 µg/L)	ND (100 µg/L)	ND (100 µg/L)	ND (2000 µg/L)	ND (100 µg/L)
carbon tetrachloride	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (200 µg/L)	ND (10 µg/L)
chlorobenzene	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (200 µg/L)	ND (10 µg/L)
chloroform	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (200 µg/L)	ND (10 µg/L)
isobutanol	ND (100 µg/L)	ND (100 µg/L)	ND (100 µg/L)	ND (100 µg/L)	ND (100 µg/L)	ND (100 µg/L)	ND (2000 µg/L)	ND (100 µg/L)
methylene chloride	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (200 µg/L)	ND (10 µg/L)
metyl ethyl ketone	ND (50 µg/L)	ND (50 µg/L)	ND (50 µg/L)	ND (50 µg/L)	ND (50 µg/L)	ND (50 µg/L)	ND (1000 µg/L)	ND (50 µg/L)
tetrachloroethylene	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (200 µg/L)	ND (10 µg/L)
toluene	110 µg/L	ND (10 µg/L)	ND (10 µg/L)	20 µg/L	ND (10 µg/L)	ND (10 µg/L)	3900 µg/L	16 µg/L
trichloroethylene	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (200 µg/L)	ND (10 µg/L)
vinyl chloride / chloroethane	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (10 µg/L)	ND (200 µg/L)	ND (10 µg/L)

Table 4-1 (continued)

Analysis[1]	Oily Dirt[2]	Pipeline Cleanout Dirt[3]	Pipeline Cleanout Dirt[4]	Contaminated Soil [5]	Contaminated Soil [6]	Cooling Tower Sludge [7]	Tank Bottoms [8]	Alky Neutralization pit sludge [9]
TCLP Extractables								
2,3,4,6-tetrachlorophenol	ND (25 µg/L)	ND (25 µg/L)	ND (5 µg/L)	ND (5 µg/L)	ND (17 µg/L)	ND (50 µg/L)	ND (2.5 mg/L)	ND (25 µg/L)
2,4,5-trichlorophenol	ND (25 µg/L)	ND (25 µg/L)	ND (5 µg/L)	ND (5 µg/L)	ND (17 µg/L)	ND (50 µg/L)	ND (2.5 mg/L)	ND (25 µg/L)
2,4,6-trichlorophenol	ND (25 µg/L)	ND (25 µg/L)	ND (5 µg/L)	ND (5 µg/L)	ND (17 µg/L)	ND (50 µg/L)	ND (2.5 mg/L)	ND (25 µg/L)
2,4-dinitrotoluene	ND (25 µg/L)	ND (25 µg/L)	ND (5 µg/L)	ND (5 µg/L)	ND (17 µg/L)	ND (50 µg/L)	ND (2.5 mg/L)	ND (25 µg/L)
bis (2-chloroethyl) ether	ND (25 µg/L)	ND (25 µg/L)	ND (5 µg/L)	ND (5 µg/L)	ND (17 µg/L)	ND (50 µg/L)	ND (2.5 mg/L)	ND (25 µg/L)
hexachlorobenzene	ND (25 µg/L)	ND (25 µg/L)	ND (5 µg/L)	ND (5 µg/L)	ND (17 µg/L)	ND (50 µg/L)	ND (2.5 mg/L)	ND (25 µg/L)
hexachloro butadiene	ND (25 µg/L)	ND (25 µg/L)	ND (5 µg/L)	ND (5 µg/L)	ND (17 µg/L)	ND (50 µg/L)	ND (2.5 mg/L)	ND (25 µg/L)
hexachloroethane	ND (25 µg/L)	ND (25 µg/L)	ND (5 µg/L)	ND (5 µg/L)	ND (17 µg/L)	ND (50 µg/L)	ND (2.5 mg/L)	ND (25 µg/L)
m-cresol	ND (25 µg/L)	ND (25 µg/L)	ND (5 µg/L)	ND (5 µg/L)	ND (17 µg/L)	ND (50 µg/L)	ND (2.5 mg/L)	ND (25 µg/L)
o-dichlorobenzene	ND (25 µg/L)	ND (25 µg/L)	ND (5 µg/L)	ND (5 µg/L)	ND (17 µg/L)	ND (50 µg/L)	ND (2.5 mg/L)	ND (25 µg/L)
p-cresol	ND (25 µg/L)	ND (25 µg/L)	ND (5 µg/L)	ND (5 µg/L)	ND (17 µg/L)	ND (50 µg/L)	ND (2.5 mg/L)	ND (25 µg/L)
p-dichlorobenzene	ND (25 µg/L)	ND (25 µg/L)	ND (5 µg/L)	ND (5 µg/L)	ND (17 µg/L)	ND (50 µg/L)	ND (2.5 mg/L)	ND (25 µg/L)
pentachlorophenol	ND (25 µg/L)	ND (25 µg/L)	ND (5 µg/L)	ND (5 µg/L)	ND (17 µg/L)	ND (50 µg/L)	ND (2.5 mg/L)	ND (25 µg/L)
phenol	ND (25 µg/L)	ND (25 µg/L)	ND (5 µg/L)	ND (5 µg/L)	ND (17 µg/L)	ND (50 µg/L)	50 mg/L	ND (25 µg/L)
pyridine	ND (250 µg/L)	ND (250 µg/L)	ND (50 µg/L)	ND (50 µg/L)	ND (170 µg/L)	ND (500 µg/L)	ND (20 mg/L)	ND (250 µg/L)

Table 4-1 (Continued)

Analysis[1]	Oily Dirt[2]	Pipeline Cleanout Dirt[3]	Pipeline Cleanout Dirt[4]	Contaminated Soil [5]	Contaminated Soil [6]	Cooling Tower Sludge [7]	Tank Bottoms [8]	Alky Neutralization pit sludge [9]
TCLP Metals								
arsenic	ND (1.0 mg/L)	ND (1.0 mg/L)	ND (1.0 mg/L)	ND (1.0 mg/L)	ND (1.0 mg/L)	ND (1.0 mg/L)	ND (1.0 mg/L)	ND (1.0 mg/L)
barium	ND (0.5 mg/L)	ND (2 mg/L)	2 mg/L	ND (2 mg/L)	ND (2 mg/L)	ND (2 mg/L)	ND (2 mg/L)	ND (2 mg/L)
cadmium	ND (0.05 mg/L)	ND (0.5 mg/L)	ND (0.5 mg/L)	ND (0.5 mg/L)	ND (0.5 mg/L)	ND (0.5 mg/L)	ND (0.5 mg/L)	ND (0.5 mg/L)
chromium	ND (0.04 mg/L)	ND (0.4 mg/L)	ND (0.4 mg/L)	ND (0.4 mg/L)	ND (0.4 mg/L)	ND (0.4 mg/L)	ND (0.4 mg/L)	1.4 mg/L
lead	ND (2.0 mg/L)	ND (2 mg/L)	ND (2 mg/L)	ND (2 mg/L)	ND (2 mg/L)	ND (2 mg/L)	ND (2 mg/L)	ND (2 mg/L)
mercury	ND (0.02 mg/L)	ND (0.02 mg/L)	ND (0.02 mg/L)	ND (0.02 mg/L)	ND (0.02 mg/L)	ND (0.02 mg/L)	ND (0.02 mg/L)	ND (0.02 mg/L)
selenium	ND (0.5 mg/L)	ND (0.5 mg/L)	ND (0.5 mg/L)	ND (0.5 mg/L)	ND (0.5 mg/L)	ND (0.5 mg/L)	ND (0.5 mg/L)	ND (0.5 mg/L)
silver	ND (0.5 mg/L)	ND (0.5 mg/L)	ND (0.5 mg/L)	ND (0.5 mg/L)	ND (0.5 mg/L)	ND (0.5 mg/L)	ND (0.5 mg/L)	ND (0.5 mg/L)

1 All analyses performed by Continental Analytical Services, Inc. of Salina, Kansas
2 Oily Sewer Cleanout Dirt sample collected 6/26/92
3 Pipeline Cleanout Dirt sample collected 9/4/92 from the pipeline barrel racks
4 Pipeline Cleanout Dirt sample collected 9/18/91 from a hydrocarbon spill
5 Contaminated Soil sample collected 3/19/91 from drill cuttings
6 Contaminated Soil sample collected 9/4/92 from stormwater pond sludges
7 Cooling Tower Sludge sample collected 3/10/92
8 Tank bottoms sample collected 2/26/92
9 Alkyd neutralization pit sludge sample collected 4/1/92 from the HF Alkylation CBM pit
10 Not Analyzed
11 Not detected at the detection limit shown in parenthesis
12 Sample for benzene analysis of oily sewer dirt collected 7/23/92

Activated Alumina

Accu... Inc
Environmental
& Laboratory
Services

April 1, 1994

Client: Total Petroleum Inc.
1400 South "M" Street
Arkansas City, KS 67005

Requested By: Richard Thomas

Project Name: Amine Socks
Sample I.D.: Alky Alumina
Sample Location: **Alky Deflorinator**
Date Sample Collected: March 24, 1994 (Time: 1600)
Date Sample Received: March 25, 1994 (Time: 1715)
Date Sample Completed: March 31, 1994
Sample Type: Grab/Composite
Sample Matrix: Solid
Lab Log Number: **B3903**
Oklahoma Certification: OWRB-8316
Kansas Certification; E-1192
Method Ref.: US EPA 40 CFR Part 136, March 1990, Test Method 1311 and EPA SW 846; GC/MS Methods 8260, 8270, 8080 and 8150; Metals Method 6010 (7470 for Hg).

TCLP Extraction for Metals

Parameter	Results, ppm	PQL*, ppm	Regulatory Level, ppm	Date/Time of Analysis	Analyst
Arsenic (As)	2.30	1.0	5.0	03/29/94 / 0900	R. F.
Barium (Ba)	BPQL	10.0	100.0	03/29/94 / 0900	S. W.
Cadmium (Cd)	BPQL	1.0	1.0	03/29/94 / 0900	R. F.
Chromium (Cr)	BPQL	1.0	5.0	03/29/94 / 0900	R. F.
Lead (Pb)	BPQL	1.0	5.0	03/29/94 / 0900	R. F.
Mercury (Hg)	BPQL	0.0002	0.2	03/28/94 / 1830	R. F.
Selenium (Se)	BPQL	1.0	1.0	03/29/94 / 0900	R. F.
Silver (Ag)	BPQL	1.0	5.0	03/29/94 / 0930	S. W.

Sample Preparation by S. Willard & R. F. on 03/28/94 at 0800 (Method 3010).

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.

BPQL: Below Practical Quantitation Limit (if applicable).

ppm: mg/L of TCLP extract

(cont.)

505 S. Lowry Street ■ Stillwater, OK 74074 ■ 405-372-5300 ■ Fax: 405-372-5396

Oklahoma City: 405-236-5333 ■ Tulsa: 918-587-5300 ■ Wichita: 316-683-1123

TCLP EXTRACTION FOR VOLATILE ORGANICS, ZHE - Method 8260

Volatiles	Results, ppm	Det. Limits, ppm	PQL*, ppm	Reg. Level, ppm
Vinyl Chloride	BPQL	0.005	0.05	0.2
1,1-Dichloroethylene	BPQL	0.005	0.05	0.7
2-Butanone (MEK)	BPQL	0.050	0.50	200.0
Chloroform	BPQL	0.005	0.05	6.0
1,2-Dichloroethane	BPQL	0.005	0.05	0.5
Carbon Tetrachloride	BPQL	0.005	0.05	0.5
Benzene	BPQL	0.005	0.05	0.5
Trichlorethylene	BPQL	0.005	0.05	0.5
Tetrachloroethylene	BPQL	0.005	0.05	0.7
Chlorobenzene	BPQL	0.005	0.05	100.0

Analysis performed by L. Irvin on 03/28/94 at 1720.

TCLP EXTRACTION FOR SEMI-VOLATILE ORGANICS - Method 8270

Semi-Volatiles	Results, ppm	Det. Limits, ppm	PQL*, ppm	Reg. Level, ppm
Pyridine	BPQL	0.01	0.10	5.0
Cresols (Total)	BPQL	0.01	0.10	200.0
1,4-Dichlorobenzene	BPQL	0.01	0.10	7.5
Hexachloroethane	BPQL	0.01	0.10	3.0
Nitrobenzene	BPQL	0.01	0.10	2.0
Hexachlorobutadiene	BPQL	0.01	0.10	0.5
2,4,6-Trichlorophenol	BPQL	0.01	0.10	2.0
2,4,5-Trichlorophenol	BPQL	0.01	0.10	400.0
Pentachlorophenol	BPQL	0.025	0.25	100.0
Hexachlorobenzene	BPQL	0.01	0.10	0.5
2,4-Dinitrotoluene	BPQL	0.01	0.10	0.13

Sample preparation by M. Baligh on 03/27/94 at 1700 (Method 3510).
Analysis performed by B. Nordberg on 03/31/94 at 0037.

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.

BPQL: Below Practical Quantitation Limit (if applicable).
ppm: mg/L of TCLP extract

(cont.)

General Indicators

1. *Ignitability* Method 1010 - Analyzed by B. S. on 04/01/94 at 1000.
   Flash Point = > 100 °C

2. *Corrosivity* Method 9040 - Analyzed by B. S. on 03/28/94 at 1630.
   pH = 3.00

3. *Reactivity* Method 9010 - Cyanide Reactivity - PQL* = 0.1 mg/Kg - Analyzed by M. C. on 03/28/94 at 1130.
   Method 9030 - Sulfide Reactivity - PQL* = 10.0 mg/Kg- Analyzed by K. H. on 03/28/94 at 1645.

   1-Stable under pressure
   2-No violent reaction with water
   3-No explosive reaction with water
   4-No toxic gases, vapors or fumes when mixed with water
   5-No explosive reaction under heat or pressure
   6-No toxic gases when exposed to pH conditions between 2 and 12.5
   7-Cyanide Reactivity = BPQL
   8-Sulfide Reactivity = BPQL

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.
BPQL: Below Practical Quantitation Limits (if applicable).

Ali Fazel, Ph.D.
Director of Environmental Services
AF:jm

Activated Charcoal

ACCURATE, Inc.
Environmental & Laboratory Services

October 3, 1996

Client: Total Petroleum, Inc.
P.O. Box 500
Denver, CO 80201

Requested by: Jim Charles

Sample Locations: FCCU Charcoal
Date Samples Collected: September 16, 1996 (Time: 1315)
Date Samples Received: September 25, 1996 (Time: 1710)
Sample Type: *Grab*
Sample Matrix: *Soil*
Lab Log Number: D9548
Kansas Certification: E319 / E1192
Oklahoma Certification: DEQ 8316 / Drinking Water, DEQ D9602
Method References: 40 CFR 136, 261 Method for Chemical Analysis of Water and Waste EPA-600/4-79-020, March, 1983. Test Method for Evaluating Solid Waste, SW-846, 1986. Latest EPA approved Standard Methods for the Examination of Water and Wastewater.

TCLP Extraction for Metals - Method 6010 (7470 for Hg)

Parameter	Results, ppm	PQL*, ppm	Regulatory Level, ppm	Date/Time of Analysis	Analyst
Arsenic (As)	0.52	0.10	5.00	10/02/96 / 1000	SM
Barium (Ba)	0.75	0.05	100.00	10/02/96 / 1030	SM
Cadmium (Cd)	BPQL	0.05	1.00	10/02/96 / 1100	SM
Chromium (Cr)	BPQL	0.05	5.00	10/02/96 / 1100	SM
Lead (Pb)	BPQL	0.05	5.00	10/02/96 / 1100	SM
Mercury (Hg)	BPQL	0.0002	0.20	10/01/96 / 1330	SM
Selenium (Se)	BPQL	0.10	1.00	10/02/96 / 1000	SM
Silver (Ag)	BPQL	0.05	5.00	10/02/96 / 1300	SM

ppm: mg/L of TCLP extract
Sample prepared by CF on 09/30/96 @ 1300 (Method 3010) & by SM/SF on 09/30/96 @ 1400 (Method 7470 for Hg).

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.

BPQL: Below Practical Quantitation Limits (if applicable).

TCLP Extraction by MM/YD *(Start* -09/27/96 @ 1635 – Finish - 09/28/96 @ 0940 *(Method* 1311*)*.

(cont.)

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Oklahoma City: 405-236-5333 ■ Tulsa: 918-587-5300 ■ Wichita: 316-683-1123

General Indicators

1. ***Reactivity*** Method 9010A - Cyanide Reactivity - PQL* = 10 mg/Kg - Analyzed by MC on 09/30/96 at 1100.
Method 9030 - Sulfide Reactivity - PQL* = 10 mg/Kg - Analyzed by MC on 09/30/96 / 1100.

1-Stable under pressure
2-No violent reaction with water
3-No explosive reaction with water
4-No toxic gases, vapors or fumes when mixed with water
5-No explosive reaction under heat or pressure
6-No toxic gases when exposed to pH conditions between 2 and 12.5
7-Cyanide Reactivity, mg/Kg • = BPQL (*Regulatory Level* = 250 mg/Kg)
8-Sulfide Reactivity, mg/Kg • = BPQL (*Regulatory Level* = 500 mg/Kg)

2. ***Corrosivity*** Method 9045 - Analyzed by KAL on 09/30/96 at 1040.
pH = 6.47 s.u.

3. ***Ignitability*** Method 1010 - Analyzed by KAL on 10/01/96 at 1400.
Flash Point = > 64.9 °C (> 149°F) (*Regulatory Level* = 140°F)

• *mg/Kg on a dry weight basis*

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.
BPQL: Below Practical Quantitation Limits (if applicable).

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects. BPQL: Below Practical Quantitation Limits (if applicable).

George Daye

George Daye,
Laboratory Manager
GD: sr / fcccchr1.doc

cc: Fax only, Dan Dowler 1-316-442-1544

Accurate, Inc.
Environmental & Laboratory Services

QA/QC

October 3, 1996

METALS

Parameter	% Duplicate Recovery	% Spike Recovery
Arsenic (As)	98	124
Barium (Ba)	95	86
Cadmium (Cd)	100	80
Chromium (Cr)	100	91
Lead (Pb)	100	90
Mercury (Hg)	100	85
Selenium (Se)	100	101
Silver (Ag)	100	97

Parameter	% Duplicate Recovery	% Spike Recovery
Cyanide Reactivity	N/A	N/A
Sulfide Reactivity	N/A	98
pH, s.u.	100	N/A

A blank analysis was run with each batch (~10-15 samples per batch)

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SRU Alumina

Accurate, Inc.
Environmental & Laboratory Services

October 4, 1996

Client: Total Tower
900 19th St.
Denver, CO 80202-2523

Requested by: Jim Charles

Sample Location:	SRU Activate Alumina
Date Sample Collected:	September 18, 1996 (Time: 1430)
Date Sample Received:	September 18, 1996 (Time: 1035)
Sample Type:	*Grab*
Sample Matrix:	*Solid*
Lab Log Number:	D9364
Kansas Certification:	E-219 / E1192
Oklahoma Certification:	DEQ #316 / Drinking Water, DEQ D9602
Method References:	40 CFR 136, 261 Method for Chemical Analysis of Water and Waste EPA-600/4-79-020, March, 1983. Test Method for Evaluating Solid Waste, SW-846, 1986. Latest EPA approved Standard Methods for the Examination of Water and Wastewater.

TCLP Extraction for Metals - Method 6010 (7470 for Hg)

Parameter	Results, ppm	PQL*, ppm	Regulatory Level, ppm	Date/Time of Analysis	Analyst
Arsenic (As)	BPQL	0.10	5.00	09/24/96 / 1030	RF
Barium (Ba)	BPQL	0.05	100.00	09/24/96 / 1100	RF
Cadmium (Cd)	BPQL	0.05	1.00	09/24/96 / 1000	RF
Chromium (Cr)	BPQL	0.05	5.00	09/24/96 / 0945	RF
Lead (Pb)	BPQL	0.05	5.00	09/24/96 / 0830	RF
Mercury (Hg)	BPQL	0.0002	0.20	09/20/96 / 1500	SM
Selenium (Se)	BPQL	0.10	1.00	09/24/96 / 1030	RF
Silver (Ag)	BPQL	0.05	5.00	09/24/96 / 1200	RF

Sample prepared by CP on 09/20/96 at 1400 (Method 3010) & by BM/KF on 09/20/96 at 1200 (Method 7470 for Hg).

ppm: mg/L of TCLP extract

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.

BPQL: Below Practical Quantitation Limits (if applicable).

(cont.)

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Oklahoma City: 405-236-5333 ■ Tulsa: 918-587-5300 ■ Wichita: 316-683-1123

TCLP EXTRACTION *for* **VOLATILE ORGANICS, ZHE** - *Method 8260*

Compound	Results, ppm	Det. Limits, ppm	PQL*, ppm	Reg. Level, ppm
Benzene	BPQL	0.005	0.05	0.5
2-Butanone (MEK)	BPQL	0.025	0.25	200.0
Carbon Tetrachloride	BPQL	0.005	0.05	0.5
Chlorobenzene	BPQL	0.005	0.05	100.0
Chloroform	BPQL	0.005	0.05	6.0
1,2-Dichloroethane	BPQL	0.005	0.05	0.5
1,1-Dichloroethylene	BPQL	0.005	0.05	0.7
Tetrachloroethylene	BPQL	0.005	0.05	0.7
Trichlorethylene	BPQL	0.005	0.05	0.5
Vinyl Chloride	BPQL	0.005	0.05	0.2

Analysis performed by OC/DK on 09/25/96 at 0014.

TCLP EXTRACTION FOR SEMI-VOLATILE ORGANICS - Method 8270

Semi-Volatiles	Results, ppm	Det. Limits, ppm	PQL*, ppm	Reg. Level, ppm
Pyridine	BPQL	0.01	0.10	5.0
Cresols (Total)	BPQL	0.01	0.10	200.0
1,4-Dichlorobenzene	BPQL	0.01	0.10	7.5
Hexachloroethane	BPQL	0.01	0.10	3.0
Nitrobenzene	BPQL	0.01	0.10	2.0
Hexachlorobutadiene	BPQL	0.01	0.10	0.5
2,4,6-Trichlorophenol	BPQL	0.01	0.10	2.0
2,4,5-Trichlorophenol	BPQL	0.01	0.10	400.0
Pentachlorophenol	BPQL	0.025	0.25	100.0
Hexachlorobenzene	BPQL	0.01	0.10	0.5
2,4-Dinitrotoluene	BPQL	0.01	0.10	0.13

Sample prepared by GC on 09/23/96 at 1400 (Method 3510).
Analysis performed by YZ/DK on 09/24/96 at 1232.

ppm: mg/L of TCLP extract

TCLP Extraction by YD (Start - 09/19/96 @ 1850 -- Finish - 09/20/96 @ 1200 (Method 1311).

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.

BPQL: Below Practical Quantitation Limits (if applicable).

(cont.)

General Indicators

1. ***Reactivity*** Method 9010 - Cyanide Reactivity - PQL* = 10 mg/Kg - Analyzed by KL on 09/23/96 at 1600.
Method 9030 - Sulfide Reactivity - PQL* = 10 mg/Kg - Analyzed by KL on 09/23/96 at 1430.

1-Stable under pressure
2-No violent reaction with water
3-No explosive reaction with water
4-No toxic gases, vapors or fumes when mixed with water
5-No explosive reaction under heat or pressure
6-No toxic gases when exposed to pH conditions between 2 and 12.5
7-Cyanide Reactivity, mg/Kg* = BPQL *(Regulatory Level = 250 mg/Kg)*
8-Sulfide Reactivity, mg/Kg* = 10 *(Regulatory Level = 500 mg/Kg)*

2. ***Corrosivity*** Method 9045 - Analyzed by KL on 09/19/96 at 1445.
pH = 3.32 s.u.

3. ***Ignitability*** Method 1010 - Analyzed by KL on 09/19/96 at 1300.
Flash Point = > 65 °C (>149°F) *(Regulatory Level = 140°F)*

* *mg/Kg on a dry weight basis*

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.
BPQL: Below Practical Quantitation Limits (if applicable).

MC:jm / [illegible]

Cooling tower

Accute, Inc. Environmental & Laboratory Services

October 11, 1996

Client: Total Petroleum, Inc.
P.O. Box 500
Denver, CO 80201

Requested by: Jim Charles

Project Name:	*none*
Sample Location:	**West Cooling Tower Sludge**
Date Samples Collected:	October 2, 1996 (Time: 1300)
Date Samples Received:	October 3, 1996 (Time: 1810)
Sample Type:	*Grab*
Sample Matrix:	***Sludge***
Lab Log Number:	**E1507**
Kansas Certification:	E-219 / E1192
Oklahoma Certification:	DEQ 8316 / **Drinking Water, DEQ D9602**
Method Reference:	40 CFR 136, 261 Method for Chemical Analysis of Water and Waste EPA-600/4-79-020, March, 1983. Test Method for Evaluating Solid Waste, SW-846, 1986. Latest EPA approved Standard Methods for the Examination of Water and Wastewater.

TCLP Extraction for Metals - Method 6010 (7470 for Hg)

Parameter	Results, ppm	PQL*, ppm	Regulatory Level, ppm	Date/Time of Analysis	Analyst
Arsenic (As)	BPQL	0.10	5.00	10/09/96 / 1430	RF
Barium (Ba)	**1.4**	0.05	100.00	10/08/96 / 1530	SM
Cadmium (Cd)	BPQL	0.05	1.00	10/08/96 / 1600	SM
Chromium (Cr)	**0.21**	0.05	5.00	10/08/96 / 1600	SM
Lead (Pb)	BPQL	0.05	5.00	10/08/96 / 1600	SM
Mercury (Hg)	BPQL	0.0002	0.20	10/10/96 / 1400	SM
Selenium (Se)	BPQL	0.10	1.00	10/09/96 / 1430	RF/SM
Silver (Ag)	BPQL	0.05	5.00	10/09/96 / 1500	RF/SM

Sample prepared by CP on 10/08/96 at 1400 (Method 3010) & on 10/10/96 at 0900 (Method 7470 *for* Hg).

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.

BPQL: Below Practical Quantitation Limits (if applicable).

TCLP Extraction by PF/LI/YD *(*Start - 10/04/96 @ 1705 – Finish - 10/05/96 @ 1105 *(Method* 1311 *).*

ppm: mg/L of TCLP extract

George Drye

George Drye,
Laboratory Manager
GD:jm / TCrsle01.doc
cc: Fax only, Dan Dowler 1-316-442-1544

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Oklahoma City: 405-236-5333 ■ Tulsa: 918-587-5300 ■ Wichita: 316-683-1123

Accutec, Inc.
Environmental & Laboratory Services

QA/QC

October 11, 1996

METALS

Parameter	% Duplicate Recovery	% Spike Recovery
Arsenic (As)	100	113
Barium (Ba)	100	114
Cadmium (Cd)	100	111
Chromium (Cr)	100	100
Lead (Pb)	100	106
Mercury (Hg)	100	103
Selenium (Se)	100	100
Silver (Ag)	100	109

A blank analysis was run with each batch (~10-15 samples per batch)

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Cooling Tower

Accu-Tech, Inc.
Environmental & Laboratory Services

October 4, 1996

Client: Total Tower
900 19th St.
Denver, CO 80202-2523

Requested by: Jim Charles

Sample Location:	**Hudson Cooling Tower Sludge**
Date Sample Collected:	September 13, 1996 (Time: 1130)
Date Sample Received:	September 18, 1996 (Time: 1835)
Sample Type:	*Grab*
Sample Matrix:	***Sludge***
Lab Log Number:	**D9365**
Kansas Certification:	E-219 / E1192
Oklahoma Certification:	DEQ 8316 / **Drinking Water, DEQ D9602**
Method Reference:	40 CFR 136, 261 Method for Chemical Analysis of Water and Waste EPA-600/4-79-020, March, 1983. Test Method for Evaluating Solid Waste, SW-846, 1986. Latest EPA approved Standard Methods for the Examination of Water and Wastewater.

TCLP Extraction for Metals - Method 6010 (7470 for Hg)

Parameter	Results, ppm	PQL*, ppm	Regulatory Level, ppm	Date/Time of Analysis	Analyst
Arsenic (As)	BPQL	0.10	5.00	09/24/96 / 1030	RF
Barium (Ba)	**0.80**	0.05	100.00	09/24/96 / 1100	RF
Cadmium (Cd)	BPQL	0.05	1.00	09/24/96 / 1000	RF
Chromium (Cr)	BPQL	0.05	5.00	09/24/96 / 0945	RF
Lead (Pb)	BPQL	0.05	5.00	09/24/96 / 0830	RF
Mercury (Hg)	BPQL	0.0002	0.20	09/20/96 / 1500	SM
Selenium (Se)	BPQL	0.10	1.00	09/24/96 / 1030	RF
Silver (Ag)	BPQL	0.05	5.00	09/24/96 / 1200	RF

Sample prepared by CP on 09/20/96 at 1400 (Method 3010) & by SM/RF on 09/20/96 at 1200 (Method 7470 *for* Hg).

ppm: mg/L of TCLP extract

TCLP Extraction by YD *(*Start - 09/19/96 @ 1850 – Finish - 09/20/96 @ 1200 *(Method* 1311*)*.

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.

BPQL: Below Practical Quantitation Limits (if applicable).

MC:jm / D9614R3H

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Oklahoma City: 405-236-5333 ■ Tulsa: 918-587-5300 ■ Wichita: 316-683-1123

Cooling Tower

Accutite, Inc.
Environmental & Laboratory Services

September 23, 1996

Client: Total Petroleum
P.O. Box 500
Denver, CO 80201

Requested by: Jim Charles

Project Name:	*Total Petroleum*
Sample I.D.:	**Crude Marley Cooling Twr Sl**
Date Sample Collected:	September 12, 1996 (Time: 1030)
Date Sample Received:	September 13, 1996 (Time: 1145)
Sample Type:	*Grab*
Sample Matrix:	*Sludge*
Lab Log Number:	**D9222**
Kansas Certification:	E-1192 / E-219
Oklahoma Certification:	OWRB-8316 *and* OCC-0218
Method Reference:	40 CFR 136, 261 Method for Chemical Analysis of Water and Waste EPA-600/4-79-020, March, 1983. Test Method 1311 and EPA SW-846, 1986. Standard Methods for the Examination of Water and Wastewater, 18th Edition.

TCLP Extraction for Metals - Method 6010 (7470 for Hg)

Parameter	Results, ppm	PQL*, ppm	Regulatory Level, ppm	Date/Time of Analysis	Analyst
Arsenic (As)	BPQL	0.10	5.00	09/17/96 / 1630	RF
Barium (Ba)	**2.3**	0.05	100.00	09/17/96 / 1600	RF
Cadmium (Cd)	BPQL	0.05	1.00	09/17/96 / 1515	RF
Chromium (Cr)	**0.10**	0.05	5.00	09/17/96 / 1300	RF
Lead (Pb)	BPQL	0.05	5.00	09/17/96 / 1430	RF
Mercury (Hg)	BPQL	0.0002	0.20	09/20/96 / 1500	SM
Selenium (Se)	BPQL	0.10	1.00	09/17/96 / 1630	RF
Silver (Ag)	BPQL	0.05	5.00	09/17/96 / 1730	RF

Samples prepared by CP on 09/16/96 at 1400 (Method 3010) and by SM/RF on 09/19/96 at 1200 (Method 7470).
ppm: mg/L of TCLP extract

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.
BPQL: Below Practical Quantitation Limits (if applicable).

TCLP Extraction by PF *(*Start -09/13/96 @ 1700 -- Finish - 09/14/96 @ 1100 *(Method* 1311*)*.

(*cont.*)

505 S. Lowry Street ■ Stillwater, OK 74074 ■ 405-372-5300 ■ Fax: 405-372-5396
Oklahoma City: 405-236-5333 ■ Tulsa: 918-587-5300 ■ Wichita: 316-683-1123

Cooling Tower

Accute, Inc. Environmental & Laboratory Services

September 23, 1996

Client: Total Petroleum
P.O. Box 500
Denver, CO 80201

Requested by: Jim Charles

Project Name:	***Total Petroleum***
Sample I.D.:	**Ecodyke Cooling Tower SI**
Date Sample Collected:	September 12, 1996 (Time: 1045)
Date Sample Received:	September 13, 1996 (Time: 1145)
Sample Type:	*Grab*
Sample Matrix:	***Sludge***
Lab Log Number:	**D9223**
Kansas Certification:	E-1192 / E-219
Oklahoma Certification:	OWRB-8316 *and* OCC-0218
Method Reference:	40 CFR 136, 261 Method for Chemical Analysis of Water and Waste EPA-600/4-79-020, March, 1983. Test Method 1311 and EPA SW-846, 1986. Standard Methods for the Examination of Water and Wastewater, 18th Edition.

TCLP Extraction for Metals - Method 6010 (7470 for Hg)

Parameter	Results, ppm	PQL*, ppm	Regulatory Level, ppm	Date/Time of Analysis	Analyst
Arsenic (As)	BPQL	0.10	5.00	09/17/96 / 1630	RF
Barium (Ba)	**1.6**	0.05	100.00	09/17/96 / 1600	RF
Cadmium (Cd)	BPQL	0.05	1.00	09/17/96 / 1515	RF
Chromium (Cr)	**0.40**	0.05	5.00	09/17/96 / 1300	RF
Lead (Pb)	BPQL	0.05	5.00	09/17/96 / 1430	RF
Mercury (Hg)	BPQL	0.0002	0.20	09/20/96 / 1500	SM
Selenium (Se)	BPQL	0.10	1.00	09/17/96 / 1630	RF
Silver (Ag)	BPQL	0.05	5.00	09/17/96 / 1730	RF

Samples prepared by CP on 09/16/96 at 1400 (Method 3010) and by SM/RF on 09/19/96 at 1200 (Method 7470).
ppm: mg/L of TCLP extract

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.

BPQL: Below Practical Quantitation Limits (if applicable).

TCLP Extraction by PF *(*Start -09/13/96 @ 1700 -- Finish - 09/14/96 @ 1100 *(Method* 1311*)*.

(cont.)

505 S. Lowry Street ■ Stillwater, OK 74074 ■ 405-372-5300 ■ Fax: 405-372-5396

Oklahoma City: 405-236-5333 ■ Tulsa: 918-587-5300 ■ Wichita: 316-683-1123

Cooling Tower

ACCUTE, INC.
Environmental
& Laboratory
Services

September 23, 1996

Client: Total Petroleum
P.O. Box 500
Denver, CO 80201

Requested by: Jim Charles

Project Name:	*Total Petroleum*
Sample I.D.:	**Uksat Cooling Tower Sl**
Date Sample Collected:	September 12, 1996 (Time: 1315)
Date Sample Received:	September 13, 1996 (Time: 1145)
Sample Type:	*Grab*
Sample Matrix:	*Sludge*
Lab Log Number:	**D9224**
Kansas Certification:	E-1192 / E-219
Oklahoma Certification:	OWRB-8316 *and* OCC-0218
Method Reference:	40 CFR 136, 261 Method for Chemical Analysis of Water and Waste EPA-600/4-79-020, March, 1983. Test Method 1311 and EPA SW-846, 1986. Standard Methods for the Examination of Water and Wastewater, 18th Edition.

TCLP Extraction for Metals - Method 6010 (7470 for Hg)

Parameter	Results, ppm	PQL*, ppm	Regulatory Level, ppm	Date/Time of Analysis	Analyst
Arsenic (As)	BPQL	0.10	5.00	09/17/96 / 1630	RF
Barium (Ba)	**1.0**	0.05	100.00	09/17/96 / 1600	RF
Cadmium (Cd)	BPQL	0.05	1.00	09/17/96 / 1515	RF
Chromium (Cr)	BPQL	0.05	5.00	09/17/96 / 1300	RF
Lead (Pb)	BPQL	0.05	5.00	09/17/96 / 1430	RF
Mercury (Hg)	BPQL	0.0002	0.20	09/20/96 / 1500	SM
Selenium (Se)	BPQL	0.10	1.00	09/17/96 / 1630	RF
Silver (Ag)	BPQL	0.05	5.00	09/17/96 / 1730	RF

Samples prepared by CP on 09/16/96 at 1400 (Method 3010) and by SM/RF on 09/19/96 at 1200 (Method 7470).
ppm: mg/L of TCLP extract

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.
BPQL: Below Practical Quantitation Limits (if applicable).

TCLP Extraction by PF *(*Start -09/13/96 @ 1700 -- Finish - 09/14/96 @ 1100 *(Method* 1311*).*

(cont.)

505 S. Lowry Street ■ Stillwater, OK 74074 ■ 405-372-5300 ■ Fax: 405-372-5396
Oklahoma City: 405-236-5333 ■ Tulsa: 918-587-5300 ■ Wichita: 316-683-1123

Tank Bottom

August 26, 1993

Client: Total Petroleum
1400 South M Street
P.O. Box 857
Arkansas City, Ks 67005

Requested by: Greg Brown

Project Name: TK 27 Bottoms
Client I.D.: 02-41955
Date Sample Collected: August 17, 1993
Time Sample Collected: 1300
Date Sample Received: August 17, 1993
Time Sample Received: 2015
Date Sample Completed: August 25, 1993
Sample Matrix: Solid
Sample Type: Grab
Lab Log Number: A9144
Oklahoma Certification : OWRB-8316
Kansas Certification: E-1192
Method Ref.: US EPA 40 CFR Part 261, March 1990, Test Method 1311 and EPA SW 846; GC/MS Methods 8240, 8270, and 8080; Metals Method 200's.

% Moisture: 12.1

TCLP EXTRACTION FOR METALS

Metals	Results, ppm	Detection Limits, ppm	Regulatory Level, ppm
Arsenic (As)	BDL	1.0	5.00
Barium (Ba)	BDL	10.0	100.00
Cadmium (Cd)	BDL	1.0	1.00
Chromium (Cr)	BDL	1.0	5.00
Lead (Pb)	BDL	1.0	5.00
Selenium (Se)	BDL	1.0	1.00
Silver (Ag)	BDL	1.0	5.00
Mercury (Hg)	BDL	0.0002	0.20

BDL: Below Detection Limits
Sample Preparation by S. Venable on 8/20/93 at 0830.
Analysis by S. Venable and R. Fazel on 8/23/93 at 1000.

TCLP EXTRACTION FOR VOLATILE ORGANICS, ZHE

Volatiles	Results, ppm	Det. Limits, ppm	PQL, ppm	Reg. Level, ppm
Vinyl Chloride	BDL	0.005	0.05	0.2
1,1-Dichloroethylene	BDL	0.005	0.05	0.7
2-Butanone (MEK)	BDL	0.02	0.2	200.0
Chloroform	BDL	0.005	0.05	6.0
1,2-Dichloroethane	BDL	0.005	0.05	0.5
Carbon Tetrachloride	BDL	0.005	0.05	0.5
Benzene	BDL	0.005	0.05	0.5
Trichlorethylene	BDL	0.005	0.05	0.5
Tetrachloroethylene	BDL	0.005	0.05	0.7
Chlorobenzene	BDL	0.005	0.05	100.0

TCLP EXTRACTION FOR SEMI-VOLATILE ORGANICS

Semi-Volatiles	Results, ppm	Det. Limits, ppm	PQL, ppm	Reg. Level, ppm
Pyridine	BDL	0.01	0.01	5.0
Cresols (Total)	0.041	0.01	0.01	200.0
1,4-Dichlorobenzene	BDL	0.01	0.01	7.5
Hexachloroethane	BDL	0.01	0.01	3.0
Nitrobenzene	BDL	0.01	0.01	2.0
Hexachlorobutadiene	BDL	0.01	0.01	0.5
2,4,6-Trichlorophenol	BDL	0.01	0.01	2.0
2,4,5-Trichlorophenol	BDL	0.01	0.01	400.0
Pentachlorophenol	BDL	0.01	0.01	100.0
Hexachlorobenzene	BDL	0.01	0.01	0.5
2,4-Dinitrotoluene	BDL	0.01	0.01	0.13

Sample Preparation by M. Baligh on 8/21/93 at 1600 (Method 3510).
Analysts: W. Ishmael (Semi-Volatiles 8/24/93 at 1709) and B. Nordberg (Volatiles 8/20/93 at 2013).
PQL: Practical Quantitation Limits
BDL: Below Detection Limits
ppm: mg/L of TCLP extract

Ali Fazel, Ph. D.
Director of Environmental Services
AF:jm

August 26, 1993

QA/QC

METALS

Parameter	% Duplicate Recovery	% Spike Recovery
Arsenic	100.0	91.0
Barium	100.0	N/A
Cadmium	100.0	101.0
Chromium	100.0	N/A
Lead	100.0	112.0
Mercury	100.0	94.0
Selenium	100.0	95.0
Silver	100.0	69.0

Blank was run with each batch.

VOLATILES-METHOD 8240 (MS/MSD RECOVERIES)
SAMPLE PREPARATION METHOD: 5030

COMPOUND	SAMPLE CONC	SPIKE ADDED	SPIKE RESULT	DUPL RESULT	SPIKE % RECOV	DUP % RECOV	RPD	QC LIMITS RPD	QC LIMITS % REC
1,1-DICHLOROETHENE	0.0	50	49	56	96	111	14	14	61-145
BENZENE	0.0	50	48	54	96	108	11	13	76-130
TRICHLOROETHENE	0.0	50	51	48	102	96	6	14	71-120
TOLUENE	0.0	50	50	51	101	103	2	13	76-125
CHLOROBENZENE	0.0	50	50	50	99	100	1	11	76-127

BASE NEUTRAL/ ACIDS-METHOD 8270 (MS/MSD RECOVERIES)
SAMPLE PREPARATION METHOD: 3510

COMPOUND	SAMPLE CONC	SPIKE ADDED	SPIKE RESULT	DUPL RESULT	SPIKE % RECOV	DUP % RECOV	RPD	QC LIMITS RPD	QC LIMITS % REC
PHENOL	0.0	75	35	27	46	37	23	42	12-110
2-CHLOROPHENOL	0.6	75	23	31	30	40	29	40	27-123
1,4-DICHLOROBENZENE	0.1	50	37	34	75	67	11	28	36-97
N-NITROSO-DI-N-PROPY	1.0	50	55	52	108	103	5	38	41-116
1,2,4-TRICHLOROBENZ	0.0	50	43	42	85	84	1	28	39-98
4-CHLORO-3-METHYL P	1.0	75	37	44	48	57	16	42	23-97
ACENAPTHENE	0.8	50	56	50	110	99	11	31	46-118
4-NITROPHENOL	0.1	75	39	29	52	38	32	50	10-80
2,4-DINITROTOLUENE	0.5	50	47	42	94	84	11	38	24-96
PENTACHLOROPHENOL	0.0	75	35	31	46	42	11	50	9-103
PYRENE	0.0	50	52	56	103	112	9	31	29-127

PESTICIDES-METHOD 8080 (MS/MSD RECOVERIES)
SAMPLE PREPARATION METHOD: 3510

COMPOUND	SAMPLE CONC	SPIKE ADDED	SPIKE RESULT	DUPL RESULT	SPIKE % RECOV	DUP % RECOV	RPD	QC LIMITS RPD	QC LIMITS % REC
GAMMA-BHC LINDANE	0.0	0.25	0.22	0.24	88	96	15	15	56-123
HEPTACHLOR	0.0	0.25	0.26	0.24	104	96	8	20	40-131
ALDRIN	0.0	0.25	0.28	0.25	112	100	11	22	40-120
DIELDRIN	0.0	0.25	0.19	0.22	76	88	15	18	52-126
ENDRIN	0.0	0.25	0.25	0.21	100	84	15	21	56-121
4,4-DDT	0.0	0.25	0.27	0.23	117	92	24	27	38-127

Contaminated Soil

ACCUTEC, Inc.
Environmental
& Laboratory
Services

December 21, 1993

Client: Total Petroleum Inc.
1400 South "M" Street
Arkansas City, KS 67005

Requested by: Richard Thomas

Site Name:	Total Petroleum Inc.
Site Location:	Arkansas City, KS
Sample Location:	TK 130 Soil
Date Sample Collected:	December 6, 1993
Time Sample Collected:	1000
Date Sample Received:	December 6, 1993
Time Sample Received:	1300
Sample Matrix:	Solid
Lab Log Number:	B1909
Oklahoma Certification:	OWRB-8316
Kansas Certification:	E-1192
Method Ref.:	US EPA 40 CFR Part 261, March 1990, Test Method 1311 and EPA SW 846; GC/MS Methods 8260-mod., 8270, and 8080; Metals Method 200's.

TCLP EXTRACTION FOR METALS

Metals	Results, ppm	Detection Limits, ppm	Regulatory Level, ppm
Arsenic (As)	BDL	1.0	5.00
Barium (Ba)	BDL	10.0	100.00
Cadmium (Cd)	BDL	1.0	1.00
Chromium (Cr)	BDL	1.0	5.00
Lead (Pb)	BDL	1.0	5.00
Mercury (Hg)	BDL	0.0002	0.20
Selenium (Se)	BDL	1.0	1.00
Silver (Ag)	BDL	1.0	5.00

BDL: Below Detection Limits
Sample Preparation by S. Fair on 12/09/93 at 1400 (Method 3010).
Analysis by R. Fazel on 12/12/93 at 1045-1312 (Method 200.7).
Mercury (Hg) analysis performed by R. Fazel on 12/13/93 at 1500 (Method 245.1).

(cont.)

TCLP EXTRACTION FOR VOLATILE ORGANICS, ZHE
Method 8260-modified

Volatiles	Results, ppm	Det. Limits, ppm	PQL, ppm	Reg. Level, ppm
Vinyl Chloride	BPQL	0.005	0.05	0.2
1,1-Dichloroethylene	BPQL	0.005	0.05	0.7
2-Butanone (MEK)	BPQL	0.025	0.25	200.0
Chloroform	BPQL	0.005	0.05	6.0
1,2-Dichloroethane	BPQL	0.005	0.05	0.5
Carbon Tetrachloride	BPQL	0.005	0.05	0.5
Benzene	0.0609	0.005	0.05	0.5
Trichlorethylene	BPQL	0.005	0.05	0.5
Tetrachloroethylene	BPQL	0.005	0.05	0.7
Chlorobenzene	BPQL	0.005	0.05	100.0

Analysis performed by L. Irvin on 12/10/93 at 1449.

TCLP EXTRACTION FOR SEMI-VOLATILE ORGANICS
Method 8270

Semi-Volatiles	Results, ppm	Det. Limits, ppm	PQL, ppm	Reg. Level, ppm
Pyridine	BPQL	0.01	0.10	5.0
Cresols (Total)	BPQL	0.01	0.10	200.0
1,4-Dichlorobenzene	BPQL	0.01	0.10	7.5
Hexachloroethane	BPQL	0.01	0.10	3.0
Nitrobenzene	BPQL	0.01	0.10	2.0
Hexachlorobutadiene	BPQL	0.01	0.10	0.5
2,4,6-Trichlorophenol	BPQL	0.01	0.10	2.0
2,4,5-Trichlorophenol	BPQL	0.01	0.10	400.0
Pentachlorophenol	BPQL	0.025	0.25	100.0
Hexachlorobenzene	BPQL	0.01	0.10	0.5
2,4-Dinitrotoluene	BPQL	0.01	0.10	0.13

PQL: Practical Quantitation Limits
BPQL: Below Practical Quantitation Limits
ppm: mg/L of TCLP extract
Sample Preparation by M. Baligh on 12/11/93 at 1500 (Method 3510).
Analysis performed by B. Nordberg on 12/13/93 at 1818.

(cont.)

GENERAL INDICATORS

1. **Ignitability** Method 1010 / Pensky-Martens Closed-Cup Method
   Flash Point = 95 °C

2. **Corrosivity**
   pH= 7.3

3. **Reactivity**
   1-Stable under pressure
   2-No violent reaction with water
   3-No explosive reaction with water
   4-No toxic gases vapors or fumes when mixed with water
   5-No explosive reaction under heat or pressure
   6-No toxic gases when exposed to pH conditions between 2 and 12.5
   7-Cyanide Reactivity = < 0.1 ppm
   8-Sulfide Reactivity = < 0.1 ppm

Date/Time of Analyses: Flash Point by B. Stewart on 12/21/93 at 1300 (Method 7.1)
pH by Y. Dallenbach on 12/15/93 at 1745 (Method 150.1)
Cyanide Reactivity by M. Crosswhite on 12/16/93 at 0900 (Method 335.2)
Sulfide Reactivity by K. Howald on 12/17/93 at 1545 (Method 9030)

Ali Fazel, Ph. D.
Director of Environmental Services

AF:jm

Continental Analytical
S E R V I C E S , I N C .

Client: Total Petroleum, Inc.
Attn: Russ Seybert
1400 South M Street
Arkansas City, KS 67005

C-16 | C-21 slop oil tanks; soil samples from tank dike are prior to demo.

Date Sample Rptd: 10/12/92
Date Sample Recd: 10/06/92
CAS File No: 92-5126
CAS Order No: 13571
Client P.O.: 02-38116

Lab Number: 92100485
Sample Description: C-16 SWMU Composite

Date Sampled: 10/05/92
Time Sampled:

Analysis	Concentration	Units	Date Analyzed	Book/Page
TCLP Volatiles			10/10/92	/
1,1,1,2-Tetrachloroethane	ND(100)	µg/L		998 /88
1,1,1-Trichloroethane	ND(100)	µg/L		998 /88
1,1,2,2-Tetrachloroethane	ND(100)	µg/L		998 /88
1,1,2-Trichloroethane	ND(100)	µg/L		998 /88
1,1-Dichloroethylene	ND(100)	µg/L		998 /88
1,2-Dichloroethane	ND(100)	µg/L		998 /88
Acrylonitrile	ND(500)	µg/L		998 /88
Benzene	ND(100)	µg/L		998 /88
Carbon Disulfide	ND(1000)	µg/L		998 /88
Carbon Tetrachloride	ND(100)	µg/L		998 /88
Chlorobenzene	ND(100)	µg/L		998 /88
Chloroform	ND(100)	µg/L		998 /88
Isobutanol	ND(1000)	µg/L		998 /88
Methyl Ethyl Ketone	ND(500)	µg/L		998 /88
Methylene Chloride	ND(100)	µg/L		998 /88
Tetrachloroethylene	ND(100)	µg/L		998 /88
Toluene	ND(100)	µg/L		998 /88
Trichloroethylene	ND(100)	µg/L		998 /88
Vinyl Chloride/Chloroethene	ND(100)	µg/L		998 /88
TCLP Extractables			10/12/92	/
2,3,4,6-Tetrachlorophenol	ND(15)	µg/L		513 /52
2,4,5-Trichlorophenol	ND(15)	µg/L		513 /52
2,4,6-Trichlorophenol	ND(15)	µg/L		513 /52
2,4-Dinitrotoluene	ND(15)	µg/L		513 /52
bis(2-Chloroethyl) Ether	ND(15)	µg/L		513 /52
Hexachlorobenzene	ND(15)	µg/L		513 /52
Hexachlorobutadiene	ND(15)	µg/L		513 /52
Hexachloroethane	ND(15)	µg/L		513 /52
m-Cresol	ND(15)	µg/L		513 /52
Nitrobenzene	ND(15)	µg/L		513 /52
o-Cresol	ND(15)	µg/L		513 /52
o-Dichlorobenzene	ND(15)	µg/L		513 /52
p-Cresol	ND(15)	µg/L		513 /52
p-Dichlorobenzene	ND(15)	µg/L		513 /52
Pentachlorophenol	ND(15)	µg/L		513 /52
Phenol	ND(15)	µg/L		513 /52
Pyridine	ND(150)	µg/L		513 /52
Arsenic, TCLP	ND(1)	mg/L	10/09/92	1205/46
Barium, TCLP	3.	mg/L	10/09/92	1248/86
Cadmium, TCLP	ND(0.5)	mg/L	10/09/92	1260/85

-Continued-

1804 Glendale Road • Salina, Kansas 67401
913-827-1273 • 800-535-3076 • FAX 913-823-7830

CONTINENTAL ANALYTICAL SERVICES, INC.

LABORATORY REPORT

Client: Total Petroleum, Inc.
Lab Number: 92100485

Analysis	Concentration	Units	Date Analyzed	Book/Page
Chromium, TCLP	ND(0.4)	mg/L	10/08/92	1288/22
Lead, TCLP	ND(2)	mg/L	10/09/92	1240/68
Mercury, TCLP	ND(0.02)	mg/L	10/12/92	1242/57
Selenium, TCLP	ND(0.5)	mg/L	10/12/92	1201/45
Silver, TCLP	ND(0.5)	mg/L	10/09/92	1277/54

Analysis	Date Prepared	QC Batch	Analyst
TCLP Volatiles	10/09/92	1	BBE
TCLP Extractables	10/07/92	1	DRW
Arsenic, TCLP	10/07/92	4	PLH
Barium, TCLP	10/07/92	1	MDB
Cadmium, TCLP	10/07/92	1	MDB
Chromium, TCLP	10/07/92	1	MDB
Lead, TCLP	10/07/92	1	MDB
Mercury, TCLP	10/07/92	1	PLH
Selenium, TCLP	10/07/92	4	MLH
Silver, TCLP	10/07/92	1	MDB

Laboratory analyses were performed on samples utilizing procedures published in Title 40 of the Code of Federal Regulations part 136, July 1, 1986 or in EPA Publication, SW-846, 3rd edition, Nov. 1986. ND(), where noted, indicates none detected with the detection limit in parentheses.

Samples will be retained for thirty days unless otherwise notified.

CONTINENTAL ANALYTICAL SERVICES, INC.

Clifford J. Baker

Clifford J. Baker
Laboratory Director

CAS

Actuated Charcoal

ACCUTE, Inc. Environmental & Laboratory Services

September 23, 1996

Client: Total Petroleum
P.O. Box 500
Denver, CO 80201

Requested by: Jim Charles

Project Name:	***Total Petroleum***
Sample I.D.:	**Merox 10**
Date Sample Collected:	September 12, 1996 (Time: 1330)
Date Sample Received:	September 13, 1996 (Time: 1145)
Sample Type:	*Grab*
Sample Matrix:	***Soil***
Lab Log Number:	**D9225**
Kansas Certification:	E-1192 / E-219
Oklahoma Certification:	OWRB-8316 *and* OCC-0218
Method Reference:	40 CFR 136, 261 Method for Chemical Analysis of Water and Waste EPA-600/4-79-020, March, 1983. Test Method 1311 and EPA SW-846, 1986. Standard Methods for the Examination of Water and Wastewater, 18th Edition.

TCLP Extraction for Metals - Method 6010 (7470 for Hg)

Parameter	Results, ppm	PQL*, ppm	Regulatory Level, ppm	Date/Time of Analysis	Analyst
Arsenic (As)	BPQL	0.10	5.00	09/17/96 / 1630	RF
Barium (Ba)	**0.30**	0.05	100.00	09/17/96 / 1600	RF
Cadmium (Cd)	BPQL	0.05	1.00	09/17/96 / 1515	RF
Chromium (Cr)	BPQL	0.05	5.00	09/17/96 / 1300	RF
Lead (Pb)	BPQL	0.05	5.00	09/17/96 / 1430	RF
Mercury (Hg)	BPQL	0.0002	0.20	09/20/96 / 1500	SM
Selenium (Se)	BPQL	0.10	1.00	09/17/96 / 1630	RF
Silver (Ag)	BPQL	0.05	5.00	09/17/96 / 1730	RF

Samples prepared by CP on 09/16/96 at 1400 (Method 3010) and by SM/RF on 09/19/96 at 1200 (Method 7470).
ppm: mg/L of TCLP extract

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.
BPQL: Below Practical Quantitation Limits (if applicable).

TCLP Extraction by PF ***(*** Start -09/13/96 @ 1700 – Finish - 09/14/96 @ 1100 ***(Method*** 1311 ***).***

(cont.)

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TCLP EXTRACTION *for* **VOLATILE ORGANICS, ZHE** - ***Method 8260***

Compound	Results, ppm	Det. Limits, ppm	PQL*, ppm	Reg. Level, ppm
Benzene	BPQL	0.005	0.05	0.5
2-Butanone (MEK)	BPQL	0.025	0.25	200.0
Carbon tetrachloride	BPQL	0.005	0.05	0.5
Chlorobenzene	BPQL	0.005	0.05	100.0
Chloroform	BPQL	0.005	0.05	6.0
1,2-Dichloroethane	BPQL	0.005	0.05	0.5
1,1-Dichloroethylene	BPQL	0.005	0.05	0.7
Tetrachloroethylene	BPQL	0.005	0.05	0.7
Trichlorethylene	BPQL	0.005	0.05	0.5
Vinyl chloride	BPQL	0.005	0.05	0.2

Analysis performed by GC/DRK on 09/16/96 @ 1911.

TCLP EXTRACTION *for* **SEMI-VOLATILE ORGANICS** - ***Method 8270***

Compound	Results, ppm	Det. Limits, ppm	PQL*, ppm	Reg. Level, ppm
Pyridine	BPQL	0.01	0.10	5.0
Cresols (*Total*)	BPQL	0.01	0.10	200.0
1,4-Dichlorobenzene	BPQL	0.01	0.10	7.5
Hexachloroethane	BPQL	0.01	0.10	3.0
Nitrobenzene	BPQL	0.01	0.10	2.0
Hexachlorobutadiene	BPQL	0.01	0.10	0.5
2,4,6-Trichlorophenol	BPQL	0.01	0.10	2.0
2,4,5-Trichlorophenol	BPQL	0.01	0.10	400.0
Pentachlorophenol	BPQL	0.025	0.25	100.0
Hexachlorobenzene	BPQL	0.01	0.10	0.5
2,4-Dinitrotoluene	BPQL	0.01	0.10	0.13

Sample prepared by YZ/GC on 09/17/96 at 1345 (Method 3510).
Analysis performed by YZ/DRK on 09/17/96 at 1437.

1. ***Reactivity*** Method 9010A - Cyanide Reactivity - PQL* = 10 mg/Kg - Analyzed by MC on 09/19/96 at 1100.
Method 9030 - Sulfide Reactivity - PQL* = 10 mg/Kg - Analyzed by MC on 09/19/96 / 1100.

1-Stable under pressure
2-No violent reaction with water
3-No explosive reaction with water
4-No toxic gases, vapors or fumes when mixed with water
5-No explosive reaction under heat or pressure
6-No toxic gases when exposed to pH conditions between 2 and 12.5
7-Cyanide Reactivity, mg/Kg* = BPQL (***Regulatory Level* = 250 mg/Kg**)
8-Sulfide Reactivity, mg/Kg* = 40 (***Regulatory Level* = 500 mg/Kg**)

2. ***Corrosivity*** Method 9045 - Analyzed by KAL on 09/19/96 at 1445.
pH = **9.49** *s.u.*

3. ***Ignitability*** Method 1010 - Analyzed by KAL on 09/19/96 at 1100.
Flash Point = **≥ 65 °C** (> 149°F) (***Regulatory Level* = 140°F**)

* *mg/Kg on a dry weight basis*

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.
BPQL: Below Practical Quantitation Limits (if applicable).

George Drye
Laboratory Manager
GD:sr / tcl9i01.doc
cc: Dan Dowler (Fax only 316-442-1544)

Accutec, Inc.
Environmental
& Laboratory
Services

QA/QC

September 23, 1996

TCLP Metals

Parameter	% Duplicate Recovery	% Spike Recovery
Arsenic (As)	100	90
Barium (Ba)	100	82
Cadmium (Cd)	100	83
Chromium (Cr)	100	82
Lead (Pb)	100	99
Mercury (Hg)	100	120
Selenium (Se)	100	96
Silver (Ag)	100	94

Parameter	% Duplicate Recovery	% Spike Recovery
Cyanide Reactivity	N/A	N/A
Sulfide Reactivity	96	76
pH	98	N/A

VOLATILES - Method 8260 (MS/MSD RECOVERIES)

COMPOUND	SAMPLE CONC	SPIKE ADDED	SPIKE RESULT	DUP RESULT	SPIKE % REC	DUP % REC	RPD	RPD LIMIT	% REC LIMIT
1,1-DICHLOROETHENE	0.0	50	57	56	113	113	0	14	61-145
BENZENE	0.3	50	58	56	115	112	2	13	76-130
TRICHLOROETHENE	0.2	50	56	52	111	103	7	14	71-120
TOLUENE	0.4	50	56	49	110	97	12	13	76-125
CHLOROBENZENE	0.3	50	53	48	105	96	9	11	76-127

BASE NEUTRAL/ ACIDS - Method 8270 (MS/MSD RECOVERIES)

COMPOUND	SAMPLE CONC	SPIKE ADDED	SPIKE RESULT	DUP RESULT	SPIKE % REC	DUP % REC	RPD	RPD LIMIT	% REC LIMIT
1,4-DICHLOROBENZENE	0.0	50	35	36	70	72	3	28	36-94
2,4-DINITROTOLUENE	0.0	50	35	38	71	77	9	38	25-95
PENTACHLOROPHENOL	0.0	75	48	55	64	73	13	50	9-103

A blank analysis was run with each batch (~10-15 samples per batch)

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Refracory

Accutate, Inc.
Environmental & Laboratory Services

January 18, 1995

Client: Total Petroleum Inc.
1400 South "M" Street
Arkansas City, KS 67005

Requested by: Greg Brown / Rich Thomas

Site Name/Location:	Total Petroleum Inc./Arkansas City, KS
Sample Location:	**Refractory**
Date Sample Collected:	January 11, 1995 (Time: 1000)
Date Sample Received:	January 11, 1995 (Time: 1830)
Sample Type:	*Composite*
Sample Matrix:	***Soil***
Lab Log Number:	**C1507**
Kansas Certification:	E-1192
Oklahoma Certification:	OWRB-8316 *and* OCC-0218
Method Reference:	40 CFR 136, 261, Method for Chemical Analysis of Water and Waste EPA-600/4-79-020, March, 1983. Test Method for Evaluating Solid Waste, SW-846, 1986. Standard Methods for the Examination of Water and Wastewater, 18th Edition. TCLP Metals Method 6010 (7470 for Hg).

TCLP Extraction *for* Metals

Parameter	Results, ppm	PQL*, ppm	Regulatory Level, ppm	Date/Time of Analysis	Analyst
Arsenic (As)	BPQL	1.0	5.0	01/16/95 / 1100	S. W.
Barium (Ba)	BPQL	10.0	100.0	01/16/95 / 1400	S. W.
Cadmium (Cd)	BPQL	1.0	1.0	01/16/95 / 1500	S. W.
Chromium (Cr)	BPQL	1.0	5.0	01/16/95 / 1500	S. W.
Lead (Pb)	BPQL	1.0	5.0	01/16/95 / 1500	S. W.
Mercury (Hg)	BPQL	0.0002	0.2	01/17/95 / 0900	S. W.
Selenium (Se)	BPQL	1.0	1.0	01/16/95 / 1100	S. W.
Silver (Ag)	BPQL	1.0	5.0	01/16/95 / 1600	R. F.

ppm: mg/L of TCLP extract

Sample prepared by R. Fazel & M. Crosswhite on 01/16/95 at 0800 (Method 3010) & at 1300 (Method 7470 *for* Hg).

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.
BPQL: Below Practical Quantitation Limits (if applicable).

George Dryc

George Dryc,
Laboratory Manager
GD:jm / TCLPMet1.doc

(page 3 of 3)

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Accutite, Inc.
Environmental
& Laboratory
Services

QA/QC

January 18, 1995

METALS (TCLP)

Parameter	% Duplicate Recovery	% Spike Recovery
Arsenic (As)	100	85
Barium (Ba)	100	90
Cadmium (Cd)	100	80
Chromium (Cr)	100	80
Lead (Pb)	100	85
Mercury (Hg)	100	107
Selenium (Se)	100	95
Silver (Ag)	100	N/A

A blank analysis was run with each batch (~10-15 samples per batch)

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Retracoey

ACCuDATE, INC.

Environmental
& Laboratory
Services

November 25, 1994

Client: Total Petroleum Inc.
1400 South "M" Street
Arkansas City, KS 67005

Requested by: Greg Brown / Rich Thomas

Site Name/Location:	Total Petroleum Inc./Arkansas City, KS
Sample Location:	**Refinery Refracory**
Date Sample Collected:	November 16, 1994 (Time: 1000)
Date Sample Received:	November 17, 1994 (Time: 1700)
Sample Type:	*Composite*
Sample Matrix:	***Solid***
Lab Log Number:	**B9480**
Kansas Certification:	E-219
Oklahoma Certification:	OWRB-8316
Method Reference:	40 CFR 136, 261 Method for Chemical Analysis of Water and Waste EPA-600/4-79-020, March, 1983. Test Method for Evaluating Solid Waste, SW-846, 1986. Standard Methods for the Examination of Water and Wastewater, 18th Edition. TCLP Metals Method 6010 (7470 for Hg).

TCLP Extraction *for* Metals

Parameter	Results, ppm	PQL*, ppm	Regulatory Level, ppm	Date/Time of Analysis	Analyst
Arsenic (As)	BPQL	1.0	5.0	11/21/94 / 1100	S. W.
Barium (Ba)	BPQL	10.0	100.0	11/21/94 / 1130	S. W.
Cadmium (Cd)	BPQL	1.0	1.0	11/21/94 / 1400	S. W.
Chromium (Cr)	BPQL	1.0	5.0	11/21/94 / 1400	S. W.
Lead (Pb)	BPQL	1.0	5.0	11/21/94 / 1400	S. W.
Mercury (Hg)	BPQL	0.0002	0.2	11/23/94 / 0800	S. W.
Selenium (Se)	BPQL	1.0	1.0	11/21/94 / 1100	S. W.
Silver (Ag)	BPQL	1.0	5.0	11/21/94 / 1430	S. W.

ppm: mg/L of TCLP extract

Sample prepared by S. Willard on 11/21/94 at 0900 (Method 3010) & on 11/22/94 at 1000 (Method 7470 *for* Hg).

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.
BPQL: Below Practical Quantitation Limits (if applicable).

(cont.)

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Reactivity Method 9010 - Cyanide Reactivity - PQL* = 0.10 mg/Kg - Analyzed by M.C./K.H. on 11/21/94 at 1300.
Method 9030 - Sulfide Reactivity - PQL* = 10.0 mg/Kg - Analyzed by K. H. on 11/21/94 / 1030.

1-Stable under pressure
2-No violent reaction with water
3-No explosive reaction with water
4-No toxic gases, vapors or fumes when mixed with water
5-No explosive reaction under heat or pressure
6-No toxic gases when exposed to pH conditions between 2 and 12.5
7-**Cyanide Reactivity = BPQL mg/Kg** •
8-**Sulfide Reactivity = BPQL mg/Kg** •

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects.
BPQL: Below Practical Quantitation Limits (if applicable).

• *Results are reported as mg/Kg on a dry weight basis.*

Ali Fazel, Ph.D.
Director of Environmental Services
AF:jm

tclyRe03.doc

Accutite, Inc.
Environmental
& Laboratory
Services

QA/QC

November 25, 1994

METALS (TCLP)

Parameter	% Duplicate Recovery	% Spike Recovery
Arsenic (As)	100	111
Barium (Ba)	100	106
Cadmium (Cd)	100	89
Chromium (Cr)	100	91
Lead (Pb)	100	89
Mercury (Hg)	100	100
Selenium (Se)	100	79
Silver (Ag)	100	N/A

Parameter	% Duplicate Recovery	% Spike Recovery
Cyanide Reactivity	N/A	N/A
Sulfide Reactivity	N/A	96

A blank analysis was run with each batch (~10-15 samples per batch)

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Contaminated Soil

KDPS

Analytical Laboratory Report

Customer Reference Number: Tank 131 Total
Sample Identifier: WS34034.D
Customer Identifier: Kaneb Pipeline Co.

Project Number
Project Location: Kaneb Pipeline

Date Sampled: 05/18/94
Date Received: 05/23/94
Date Analyzed: 06/09/94

Matrix: Soil
Method: EPA 8240 / 1311

Analyte	Concentration in TCLP Extract	units	Detection limit	units	Flag
Benzene	16.7	µg/l	4.0	µg/l	-
Carbon tetrachloride	Not detected	µg/l	7.0	µg/l	-
Chlorobenzene	Not detected	µg/l	4.0	µg/l	-
Chloroform	Not detected	µg/l	5.0	µg/l	-
1,2-Dichloroethane	Not detected	µg/l	6.0	µg/l	-
1,1-Dichloroethene	Not detected	µg/l	6.0	µg/l	-
Methyl ethyl ketone	Not detected	µg/l	20.0	µg/l	-
Tetrachloroethene	Not detected	µg/l	11.0	µg/l	-
Trichloroethene	Not detected	µg/l	6.0	µg/l	-
Vinyl chloride	Not detected	µg/l	8.0	µg/l	-

Units Conversion:
ppm (parts per million) = µg/ml, mg/l (water based or aqueous liquids),
ng/mg, µg/g, mg/kg (soilds)

ppb (parts per billion) = ng/ml, µg/l (water based or aqueous liquids),
pg/mg, ~~ng/g~~, µg/kg (solids)

Signed Tod
Todd J. Loken
Analytical Chemist

KDPS, Inc. 205 W. Eighth St. Lawrence, KS 66044 *OFFICE:* (913) 842-9856 or 842-3066 *FAX:* (913) 842-0966

KDPS

Analytical Laboratory Report

Customer Reference Number: Tank 131 Total
Sample Identifier: 5081-02fp
Customer Identifier: Kaneb Pipeline / Leroy Anderson

Date Sampled: 05/18/94
Date Received: 05/20/94
Date Analyzed: 06/02/94

Project Location: Kaneb Pipeline Co.

Sample 1 of 01

Method: SW-846-1010 / Open Cup
Matrix: Soil

Analyte	Concentration / Value	Flag
Flash Point	176 °F	-

Signed R. Bhaskar
Ravi K. Bhaskar, Ph.D
President.

KDPS

Analytical Laboratory Report

Customer Reference Number: Tank 131 Total
Sample Identifier: y94-5081og
Customer Identifier: Kaneb Pipeline / Leroy Anderson

Date Sampled: 05/18/94
Date Received: 05/20/94
Date Analyzed: 05/25/94

Project Location: Kaneb Pipeline Co.

Method: EPA 413.2
Matrix: Soil

Analyte	Concentration	Detection limit	Flag
Oil & Grease	2,369 mg/Kg (0.24 %)	0.5 mg/Kg	-

Key to Flags

1. Average of multiple extractions

2. Insufficient sample for multiple extractions

Units Conversion:

1. **ppm** (parts per million) = µg/ml, mg/l (water based or aqueous liquids), ng/mg, µg/g, mg/kg (solids).

2. **ppb** (parts per billion) = ng/ml, µg/l (water based or aqueous liquids), pg/mg, ng/g, µg/kg (solids).

Signed
Ravi K. Bhaskar, Ph.D
President.

KDPS, Inc. 1411 E. 1850 Road Lawrence, KS. 66046 *OFFICE:* (913)842-9856 *LAB:* (913)842-3066

KDPS

Analytical Laboratory Report

Customer Reference Number: Tank 131 Total
Sample Identifier: y94-5081pH
Customer Identifier: Kaneb Pipeline Co.

Date Sampled: 05/18/94
Date Received: 05/23/94
Date Analyzed: 06/10/94

Project Location: Kaneb Pipeline
Sample 1 of 01

Method: Electrometric pH EPA Method 9045
Matrix: Water

Analyte	Concentration / Value	Detection limit	Flag
pH	7.4	± 0.1 unit	-

Key to Flags

1. Possible interference from suspended solids

2. Possible interference from multiple liquid phases

Signed
Ravi K. Bhaskar, Ph.D
President.

KDPS, Inc. 205 W. Eighth St. Lawrence, KS 66044 *OFFICE:* (913) 842-9856 or 842-3066 *FAX:* (913) 842-0966

KDPS

Analytical Laboratory Report

Customer Reference Number: Tank 131 Total
Sample Identifier: y94-5081solids
Customer Identifier: Kaneb Pipeline / Leroy Anderson

Date Sampled: 05/18/94
Date Received: 05/20/94
Date Analyzed: 05/25/94

Project Location: Kaneb Pipeline Co.

Method: EPA 160.3
Matrix: Soil

Analyte	Concentration	Detection limit	Flag
% Solids	83.3%	0.005%	-
% moisture	17.7%	0.005%	-

Key to Flags

1. Average of multiple extractions

2. Insufficient sample for multiple extractions

Units Conversion:

1. **ppm** (parts per million) = µg/ml, mg/l (water based or aqueous liquids), ng/mg, µg/g, mg/kg (solids).

2. **ppb** (parts per billion) = ng/ml, µg/l (water based or aqueous liquids), pg/mg, ng/g, µg/kg (solids).

Signed _____
Ravi K. Bhaskar, Ph.D
President.

KDPS, Inc. 205 W. Eighth St. Lawrence, KS 66044 *OFFICE:* (913) 842-9856 or 842-3066 *FAX:* (913) 842-0966

KDPS

Analytical Laboratory Report

Customer Reference Number: Tank 131 Total
Sample Identifier: y94-5081solids
Customer Identifier: Kaneb Pipeline / Leroy Anderson

Date Sampled: 05/18/94
Date Received: 05/20/94
Date Analyzed: 05/25/94

Project Location: Kaneb Pipeline Co.

Method: EPA 160.3
Matrix: Soil

Analyte	Concentration	Detection limit	Flag
% Solids	96.1 mg/Kg (92.5 %m/m)	0.5 mg/Kg	-
% Water	7.8 mg/Kg (7.5 %m/m)	0.5 mg/Kg	-

Key to Flags

1. Average of multiple extractions

2. Insufficient sample for multiple extractions

Units Conversion:

1. **ppm** (parts per million) = µg/ml, mg/l (water based or aqueous liquids), ng/mg, µg/g, mg/kg (solids).

2. **ppb** (parts per billion) = ng/ml, µg/l (water based or aqueous liquids), pg/mg, ng/g, µg/kg (solids).

Signed _____
Ravi K. Bhaskar, Ph.D
President.

KDPS, Inc. 205 W. Eighth St. Lawrence, KS 66044 *OFFICE:* (913) 842-9856 or 842-3066 *FAX:* (913) 842-0966

APPENDIX G

Contingency Plan

APPENDIX G

CONTINGENCY PLAN

MRP PROPERTIES COMPANY, LLC

ARKANSAS CITY, KANSAS

[40 CFR §265 Subpart D]

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Attachment 2 Transmittal of Contingency Plan to Emergency Providers

APPENDIX G

CONTINGENCY PLAN (40 CFR §265 Subpart D)

1.0 CONTINGENCY PLAN

1.1 Purpose and Implementation of The Contingency Plan [40 CFR §264.51 and §265.51]

This contingency plan has been prepared to describe the procedures that will be implemented if a fire or release of hazardous waste were to occur at the MRP Arkansas City Site. This plan addresses two types of units: 1) the permitted units; and 2) the non-permitted 90-day storage areas. Since the permitted units are regulated under 40 CFR Part §264 and the non-permitted storage units are subject to the requirements of 40 CFR Parts §262 and §265, both §264 and §265 are referenced in this section.

The permitted units consist of the:

- Land Treatment Unit (LTU)
- Closed 3A aerated lagoon
- Closed Surface Impoundments #I and #2

None of the regulated units accept waste. The Contingency Plan addresses issues associated with the post-closure care of the regulated units. No potential for a release is possible from these units.

Currently the facility has not generated any hazardous waste since May 2006 when some remaining laboratory chemicals were disposed. However, if a hazardous waste is generated the following areas will be used to store hazardous waste:

- Drum storage at the Wastewater Treatment Plant
- Heat Exchanger Bundle Area

The units listed above would be subject to the relevant sections of 40 CFR Parts §262 and §265.

1.2 Coordinated Emergency Services [40 CFR §264.52(C) and §265.52(C)]

Arkansas City Fire/EMS and Police Department as well as the Arkansas City Memorial Hospital have been notified of the current operations at the Site. Copies of the written agreements are included as Attachment I to this Plan.

The Arkansas City Fire/EMS and Police Departments are well staffed and trained to respond to an emergency situation at the Arkansas City Site. The Fire/EMS Department has personnel that can respond twenty-four hours-a-day to an emergency situation at this Site. The Arkansas City Fire/EMS Department also can use firefighting equipment that is currently available at the Site. This list of equipment is provided in Table 1.

1.3 Emergency Equipment [40 CFR §264.52(e) and §265.52(e)]

The potential of a significant release from any of the permitted units are low. Table 1 contains a list of the emergency equipment associated with the RCRA units and corrective actions at the Site.

1.4 Evacuation Plan [40 CFR §264.52(f) and §265.52(f)]

An evacuation of the Site will be ordered when there is a serious threat to the health and safety of the Site employees. This threat may be due to a major fire or uncontrolled release of hazardous waste or hazardous materials.

The senior management official, upon ordering an evacuation, will immediately notify the local police and fire department that the Site is evacuating its personnel. The Arkansas City Police and Fire Department resources will be utilized if evacuation of surrounding residential areas is necessary.

Evacuation routes and the safe assembly area for the Site are included on Figure 1. In the event an evacuation is ordered, the safety routes, based on current weather conditions, will be utilized. Evacuated personnel are to report to the front gate.

Once everyone has reached the front gate, each employee should be identified and a head count should be determined. The local emergency response team should be notified of any missing employees.

Employees are to remain at the front gate until they are given the all clear signal from their supervisor or the senior personnel at the site.

1.5 Emergency Coordinator [40 CFR §264.55 and §265.55]

The Senior Environmental Specialist has been selected as the primary Emergency Coordinator for this facility. The Alternate Emergency Coordinator is the Environmental Coordinator. The names, addresses, daytime, evening phone numbers for these individuals are provided in Table 2.

Both the Emergency Coordinator and the alternate have the authority to coordinate and commit all necessary resources to implement the contingency plan. In addition, both individuals are thoroughly familiar with:

- the contents of this contingency plan,
- the characteristics, quantity, and location of all hazardous wastes stored at the facility,
- the location of all records within the facility, and
- the physical layout of the facility.

Every employee has the responsibility to report imminent or actual emergency situations to the Emergency Coordinator (or his designated alternate when he is not available).

1.6 Emergency Procedures [40 CFR §264.56 and §265.56]

This section of the contingency plan outlines the procedures that will be implemented in the event of a fire or release of hazardous waste.

1.6.1 Emergency Procedures in the Event of a Fire or Explosion

Emergency procedures to be followed in the event of a fire involving hazardous waste at the Site are listed below:

1. Stop work.
2. Turn off any equipment, if in use.
3. Immediately leave the affected area.
4. Notify the Site office at 442-5100. Give your name, location, and extent of fire.
5. Move upwind of the fire and prevent others from entering the area.

The Emergency Coordinator or alternate will notify the Arkansas City Fire/EMS and Police Departments. All individuals responding to the emergency situation will be under the direction of the Emergency Coordinator.

The Emergency Coordinator, with assistance from the Fire Chief, will be responsible for completing the following actions:

1. Direct the Police Department to deny entry to the Site to all non-emergency personnel.
2. Identify the waste and/or material causing the fire.
3. Evaluate the hazards and risks associated with the burning material.
4. Determine whether evacuation of personnel from off-site business and residences is necessary.
5. If required, notify the police to begin evacuation of off-site locations.
6. Direct the Fire Department to contain and extinguish the fire.
7. Monitor the cleanup operation to ensure that the cause of the fire is eliminated and all waste residue is properly cleaned-up, contained, and stored on-site.
8. Ensure that the affected area is properly decontaminated.
9. Ensure all equipment that is used in the emergency response is decontaminated, repaired or replaced, if required, and ready for reuse.

1.6.3 Emergency Procedures in the Event of a Small Spill of Hazardous Waste

The following procedures will be implemented in the event of a spill of 55-gallons or less of hazardous waste at the Site.

1. Stop work.
2. Turn off any equipment, if in use.
3. Place absorbent materials around the spilled material to prevent it from reaching soils, surface waters, or storm drain.
4. Notify the Site office at 442-5100. Give your name, location, and nature and extent of the spill.
5. Move upwind of the spill and prevent others from entering the area.

The Emergency Coordinator or alternate will determine if additional support is needed from the local emergency response organizations. All individuals responding to the emergency situation will be under the direction of the Emergency Coordinator.

The Emergency Coordinator will be responsible for completing the following actions:

1. Direct the Terminal Operations personnel to deny entry to the Site to all non-emergency personnel.
2. Identify the waste and/or material that was spilled.
3. Evaluate the hazards and risks associated with the spill, including potential impacts if the spill reached soils, surface waters, or storm drains.
4. Determine whether evacuation of personnel from nearby residences and offices is necessary.
5. If required, notify the police to begin evacuation of residences and offices.
6. If they have had the required training, direct Site personnel to clean-up the spilled waste materials. The spilled waste will be cleaned- up using shovels if the material is a sludge or solid. If the spilled waste is a liquid absorbent will be placed to collect any liquid. All visible stained soils will also be removed during this clean-up activity.
7. Monitor the cleanup operation to ensure that the cause of the spill is eliminated and all waste residue is properly cleaned-up, contained, and stored on-site.
8. Ensure that the affected area is properly decontaminated.
9. Ensure all equipment that is used in the emergency response is decontaminated, repaired or replaced, if required and ready for reuse.

1.6.4 Emergency Procedures in the Event of a Large Spill of Hazardous Waste

While it is not foreseeable that a large spill could occur at the Site, the following procedures will be implemented in the event of a spill of more than 55 gallons of hazardous waste at the Site.

1. Stop work.
2. Turn off any equipment, if in use.
3. If you can do so without harming yourself or others, place absorbent materials around the spilled material to prevent it from reaching soils, surface waters, or storm drain.
4. Notify the Emergency Coordinator or alternate office at 620-442-5100 or by communicating with the two-way radio. Give your name, location, and nature and extent of the spill.
5. Move upwind of the spill and prevent others from entering the area.

The Emergency Coordinator or alternate will determine if additional support is need from the local emergency response organizations. All individuals responding to the emergency situation will be under the direction of the Emergency Coordinator.

The Emergency Coordinator will be responsible for completing the following actions:

1. Direct the Terminal operations personnel to deny entry to the Site to all non-emergency personnel.
2. Identify the waste and/or material that was spilled.
3. Evaluate the hazards and risks associated with the spill, including potential impacts if the spill reached soils, surface waters, or storm drains.
4. Determine whether evacuation of personnel from nearby residences and offices is necessary.
5. If required, notify the police to begin evacuation of residences and offices.'
6. Direct emergency response personnel in the containment and clean-up of the spill.

7. Monitor the cleanup operation to ensure that the cause of the spill is eliminated and all waste residue is properly cleaned-up, contained, and stored on-site.
8. Ensure that the affected area is properly decontaminated.
9. Ensure all equipment that is used in the emergency response is decontaminated, repaired or replaced, if required and ready for reuse.

1.7 Care of Equipment

Emergency equipment that is used in an emergency situation will be examined, cleaned and/or replaced or repaired, as necessary. Operations will not resume until all emergency equipment is in-place and ready for use.

1.8 Copies of the Contingency Plan [40 CFR §264.53 and §265.53]

A Copy of this plan and all revisions will be maintained in the main office.

A copy of the contingency plan will also be provided to the Arkansas City Fire/EMS and Police Departments as well as the Arkansas City Memorial Hospital. Emergency response contractors that could be called upon to respond to an emergency situation at the site will be provided a copy of this plan.

1.9 Amendments to the Contingency Plan [40 CFR §264.54 and §265.541]

It will be the responsibility of the Senior Environmental Specialist to review and immediately amend this Contingency plan if one or more of the following conditions occur:

- the facility permit is revised;
- the plan fails in an emergency;
- the facility makes a change that materially increases the potential for fires, explosions, or release of hazardous waste or constituents: design, construction, operation, maintenance, or other circumstances.
- the facility changes the response necessary in an emergency; or
- the list of emergency equipment changes.

The Senior Environmental Specialist is responsible for ensuring (by return of signed receipt) that amendments to this plan are distributed. The amendments must be sent to all individuals, local emergency response departments, and response contractors that have copies of the contingency plan.

1.10 Reporting and Notification [40 CFR §264.566 and §265.560]

Following the response to an emergency situation, certain reporting and notification procedures will be completed. The Senior Environmental Project Specialist will notify the KDHE that the cleanup effort is completed and that regular operations will resume at the Site. In addition to this verbal notification, a written incident report will be prepared by the Site and submitted to KDHE within 15 days of the incident.

The incident reports will include the following elements:

1. facility name, address, and telephone number,
2. owner's name, address, and telephone number;
3. date, time, and type of incident;

4. quantity and name of the waste involved;
5. extent of injuries, if any;
6. assessment of actual or potential hazards to the outside population and/or environment, if applicable;
7. quantity of waste recovered during response and clean-up operations; and
8. disposition of waste recovered during response and clean-up operations.

When cleanup procedures are complete and all emergency equipment is cleaned, repaired, and/or replaced, the Emergency Coordinator will notify KDHE that operations will be resumed. .

The Site operating record will be updated by the Senior Environmental Project Specialist to indicate that an incident involving the implementation of the contingency plan has occurred at the site. The operating record will reflect the date, time and details of the incident, including a discussion of the cleanup activities.

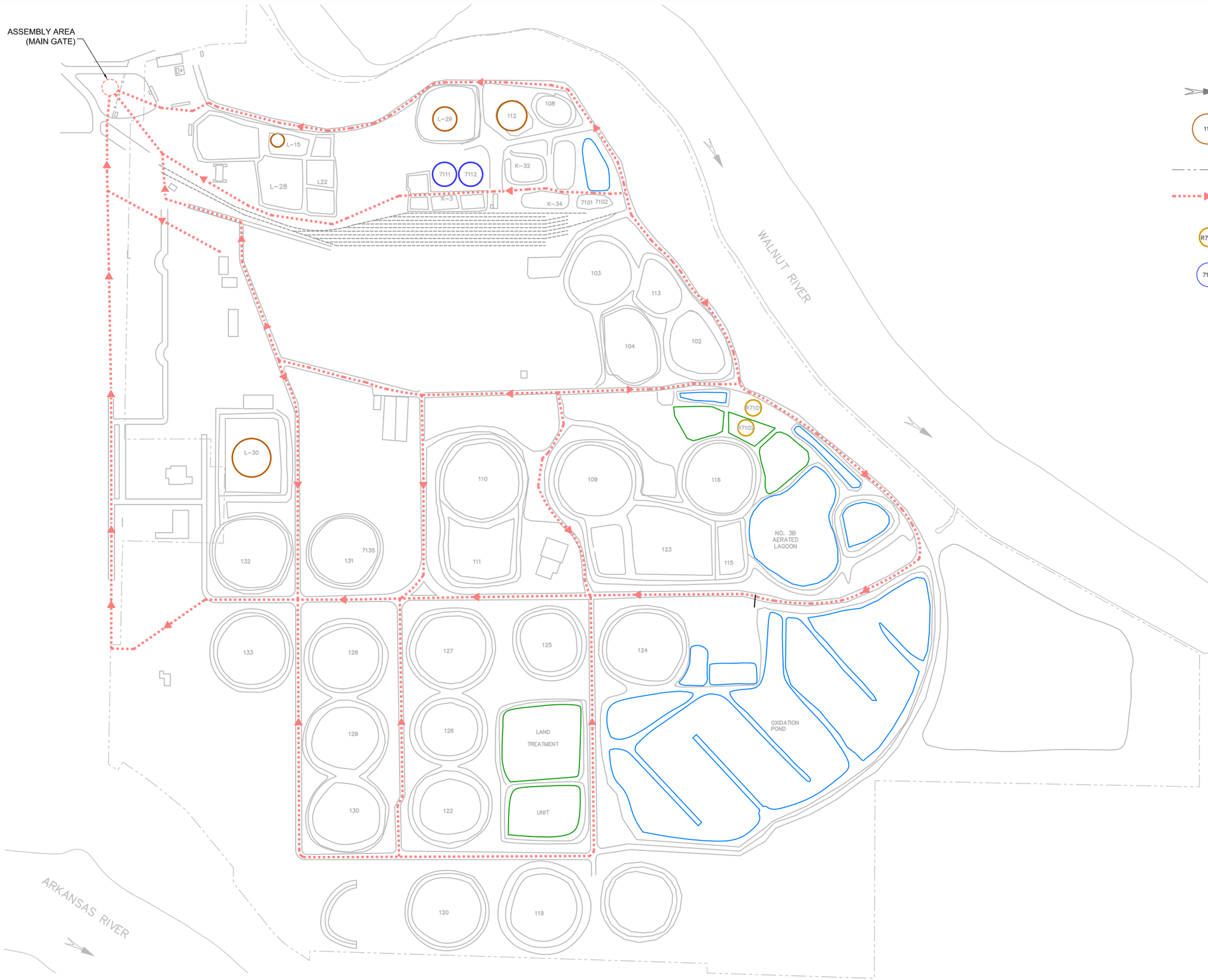
Table 1 – List of Emergency Response Equipment Maintained at the Site.

Emergency Equipment	Physical Description	Capabilities	Location
First Aid Kit	Hand held	Supplies for minor first aid	Environmental Office
Fire Extinguisher	2 - 30 lb Ansul	Type ABC	Environmental Office
Fire Extinguisher	1 - 30 lb Ansul	Type ABC	CSI – System
Fire Extinguisher	1 - 30 lb Ansul	Type CO_2	Motor Control Center
Fire Extinguisher	1 - 30 lb Ansul	Type ABC	LTU -System
Fire Extinguisher	3 - 30 lb Ansul	Type ABC	Guard Office
Fire Extinguisher	1 - 30 lb Ansul	Type ABC	Vacuum Truck
Absorbent booms	4 - 8” x 10 ft	Oil absorbent, spill containment	Environmental Office
Absorbent mats	50 – 15” x 20”	Oil absorbent, spill containment	Environmental Office

Table 2 – List of Primary and Alternate Emergency Response Coordinators

Primary Emergency Coordinator	
Kent Biggerstaff	Senior Environmental Specialist
Office	620-442-5100
Cell Phone (home & evening)	620-446-1741
Home Address	5301 302 RD, Arkansas City, KS 67005

Alternative Emergency Coordinator	
Dale Dobbs	Environmental Coordinator
Office	620-442-5100
Cell Phone (home & evening)	620-222-2584
Home Address	7165 172nd RD, WINFIELD, KS 67156



EXPLANATION

DIRECTION OF SURFACE WATER FLOW

112 — ABOVE GROUND PRODUCT STORAGE TANK

PROPERTY BOUNDARY

EVACUATION ROUTES

R7101 — BIOREACTOR TANK - GROUNDWATER TREATMENT

7112 — WATER STORAGE TANK

N
W E
S

SCALE IN FEET

0 400 800

TITLE

EVACUATION ROUTES

PROJECT

MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

FIGURE

1

U:\Christopher Lee\Arkcity\APPENDIX G_FIG_1.dwg May 18, 2011 - 1:20pm

ATTACHMENT 1

WRITTEN AGREEMENTS WITH LOCAL EMERGENCY RESPONSE AGENCIES

TOTAL

TOTAL PETROLEUM, INC.

Mr. Oren Skiles
Police Chief
City of Arkansas City
Police Department
Central and 1st Streets
Arkansas City, Kansas 67005-2622

Subject: Mutual Aid Agreement Between Total Petroleum, Inc and the Police Department

Dear Mr. Skiles:

Pursuant to Section 264.37 of Title 40 of the Code of Federal Regulations, this letter shall constitute a letter of mutual aid agreement between Total Petroleum, Inc. and the Arkansas City Police Department.

Total Petroleum, Inc. agrees to provide the Arkansas City Police Department with a copy of the facility's RCRA Contingency Plan. Total Petroleum will also conduct annual site tours for Police Department personnel. As a result of these activities, the following information will be provided to the Department:

- The layout of the Terminal, including the locations of emergency response equipment maintained by Total Petroleum,
- Properties of hazardous waste handled at the facility and associated hazards,
- Locations where Terminal personnel will typically be working,
- Locations of entrances to and roads inside the Terminal, and
- Locations of evacuation routes within the Terminal.

The Arkansas City Police Department agrees to provide Total Petroleum with the following services upon notification by a Total representative:

TOTAL

- Assistance limiting site access, if required, during an emergency situation at the site, and
- Assistance evacuating local residence and business, if such evauaction is deemed necessary.

Over the years, Total Petroleum and the Arkansas City Police Department have developed an effective working relationship. We look forward to maintaining this relationship into the future. Total Petroleum appreciates the support and assistance it has received from the Police Department.

Agreed to:

Harold Green
Operations Manager
Arkansas City Terminal

Oren Skiles
Police Chief - Arkansas City, KS

TOTAL

TOTAL PETROLEUM, INC.

Mr. Eddie W. Moore
Fire Chief
City of Arkansas City
Fire/EMS Department
115 South D Street
Arkansas City, Kansas 67005-2622

Subject: Mutual Aid Agreement Between Total Petroleum, Inc and the Fire/EMS Department

Dear Mr. Moore:

Pursuant to Section 264.37 of Title 40 of the Code of Federal Regulations, this letter shall constitute a letter of mutual aid agreement between Total Petroleum, Inc. and the Arkansas City Fire/EMS Department.

Total Petroleum, Inc. agrees to provide the Arkansas City Fire/EMS Department with a copy of the facility's RCRA Contingency Plan. Total Petroleum will also conduct annual site tours for Fire/EMS Department personnel. As a result of these activities, the following information will be provided to the Department:

- The layout of the Terminal, including the locations of emergency response equipment maintained by Total Petroleum,
- Properties of hazardous waste handled at the facility and associated hazards,
- Locations where Terminal personnel will typically be working,
- Locations of entrances to and roads inside the Terminal, and
- Locations of evacuation routes within the Terminal.

The Arkansas City Fire/EMS Department agrees to provide Total Petroleum with the following services upon notification by a Total representative:

TOTAL

TOTAL TOWER 900 19TH STREET DENVER, COLORADO 80202-2523 TELEPHONE 303 291-2220
P.O. BOX 500 DENVER, COLORADO 80201-0500 FAX 303 291-2104
H:\WP\TOTAL\FIRELTR.DOC\21-Apr-97\DEN

- Response to fires, explosions or release/spills of hazardous wastes or other materials within the refinery, and

- Ambulance service in the event of a serious injury or illness requiring immediate medical attention.

Over the years, Total Petroleum and the Arkansas City Fire/EMS Department have developed an effective working relationship. We look forward to maintaining this relationship into the future. Total Petroleum appreciates the support and assistance it has received from the Fire/EMS Department.

Agreed to:

Harold Green
Operations Manager
Arkansas City Terminal

Eddie W. Moore
Fire Chief - Arkansas City, KS

LAM:cmg

TOTAL

TOTAL PETROLEUM, INC.

Mr. Webster Russell
Administrator
South Central Kansas Regional Medical Center
216 W. Birch Street
Arkansas City, Kansas 67005

Subject: Mutual Aid Agreement Between Total Petroleum, Inc and the Medical Center

Dear Mr. Russell:

Pursuant to Section 264.37 of Title 40 of the Code of Federal Regulations, this letter shall constitute a letter of mutual aid agreement between Total Petroleum, Inc. and the South Central Kansas Regional Medical Center (Medical Center).

Total Petroleum, Inc. agrees to provide the Medical Center with a copy of the facility's RCRA Contingency Plan. Total Petroleum will also provide copies of relevant material safety data sheets. As a result of these activities, the following information will be provided to the Medical Center:

- Properties of hazardous waste handled at the facility and associated hazards, and
- Types of injuries or illnesses that could result from fires, explosions, or releases at the facility.

The Medical Center agrees to provide medical attention to personnel from the Total Petroleum site.

Over the years, Total Petroleum and the Medical Center have developed an effective working relationship. We look forward to maintaining this relationship into the future. Total Petroleum appreciates the support and assistance it has received from the Medical Center.

Agreed to:

Harold Green
Operations Manager
Arkansas City Terminal

Webster Russell
S.C. KS Regional Medical Center

TOTAL

TOTAL TOWER 900 19TH STREET DENVER, COLORADO 80202-2523 TELEPHONE 303 291-2220
P.O. BOX 500 DENVER, COLORADO 80201-0500 FAX 303 291-2104

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ATTACHMENT 2

TRANSMITTAL OF CONTINGENCY PLAN TO EMERGENCY PROVIDERS

MRP Properties Company, LLC

1400 South M Street • Arkansas City, Kansas 67005 • Telephone (620) 442-5100

Kent Biggerstaff
Senior Environmental Specialist

June 7, 2011

Mr. Sean Wallace
Police Chief
City of Arkansas City Police Department
Central and 1st Streets
Arkansas City, Kansas 67005-2622

Subject: **Update to MRP Properties Company, LLC RCRA Contingency Plan**

Dear Mr. Wallace:

MRP Properties Company, LLC (MRP) is updating the RCRA Contingency Plan for our closed refinery site in Arkansas City. The plan was modified to focus on the contingencies that could arise from onsite hazardous waste operations. Hazardous waste operations currently include the management and maintenance of closed waste management units. In the event that waste is generated during remediation activities, waste would be managed in container storage and/or roll-off bin storage areas.

In accordance with Section 264.37 of Title 40 of the Code of Federal Regulations, we are required to send a copy of our plan to the emergency providers in our area. Please find enclosed one copy of the updated plan for your records. This RCRA Contingency Plan should replace the one you received in 2002.

Attachment 1 of the plan provides an agreement that was signed previously by your office. The agreement is to provide services to our facility in a time of an emergency. If you would like to visit the closed refinery to familiarize yourself with the layout and remaining structures, please contact me at (620) 442-5100.

Sincerely,

Kent Biggerstaff

Enclosure: Contingency Plan

Cc: Mr. Everett Spellman
Chief, Corrective Action Unit
KDHE-Bureau of Waste Management
1000 SW Jackson, Suite 320
Topeka, Kansas 66620-0001

MRP Properties Company, LLC

1400 South M Street • Arkansas City, Kansas • Telephone (620) 442-5100

Kent Biggerstaff
Senior Environmental Specialist

June 7, 2011

Mr. Les Parks
Interim Fire-EMS Chief
115 South D Street
Arkansas City, Kansas 67005-2622

Subject: **Update to MRP Properties Company, LLC RCRA Contingency Plan**

Dear Mr. Parks:

MRP Properties Company, LLC (MRP) is updating the RCRA Contingency Plan for our closed refinery site in Arkansas City. The plan was modified to focus on the contingencies that could arise from onsite hazardous waste operations. Hazardous waste operations currently include the management and maintenance of closed waste management units. In the event that waste is generated during remediation activities, waste would be managed in container storage and/or roll-off bin storage areas.

In accordance with Section 264.37 of Title 40 of the Code of Federal Regulations, we are required to send a copy of our plan to the emergency providers in our area. Please find enclosed one copy of the updated plan for your records. This RCRA Contingency Plan should replace the one you received in 2002.

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Sincerely,

Kent Biggerstaff

Enclosure: Contingency Plan

Cc: Mr. Everett Spellman
Chief, Corrective Action Unit
KDHE-Bureau of Waste Management
1000 SW Jackson, Suite 320
Topeka, Kansas 66620-0001

MRP Properties Company, LLC

1400 South M Street • Arkansas City, Kansas • Telephone (620) 442-5100

Kent Biggerstaff
Senior Environmental Specialist

June 7, 2011

Mr. Steven J. Perkins, CEO
South Central Kansas Regional Medical Center
6401 Patterson Parkway
Arkansas City, Kansas 67005

Subject: **Update to MRP Properties Company, LLC RCRA Contingency Plan**

Dear Mr. Perkins:

MRP Properties Company, LLC (MRP) is updating the RCRA Contingency Plan for our closed refinery site in Arkansas City. The plan was modified to focus on the contingencies that could arise from onsite hazardous waste operations. Hazardous waste operations currently include the management and maintenance of closed waste management units. In the event that waste is generated during remediation activities, waste would be managed in container storage and/or roll-off bin storage areas.

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Sincerely,

Kent Biggerstaff

Enclosure: Contingency Plan

Cc: Mr. Everett Spellman
Chief, Corrective Action Unit
KDHE-Bureau of Waste Management
1000 SW Jackson, Suite 320
Topeka, Kansas 66620-0001

APPENDIX H

100 Year Flood Map

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table shown on this map. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) Zone 14. **Horizontal datum** was NAD 83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov/.

Base Map information shown on this FIRM was derived from U.S. Geological Survey Digital Orthophoto Quadrangles (DOQs) produced at a scale of 1:12,000 from photography dated 1995 or later.

The "profile base lines" represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the "profile base line", in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

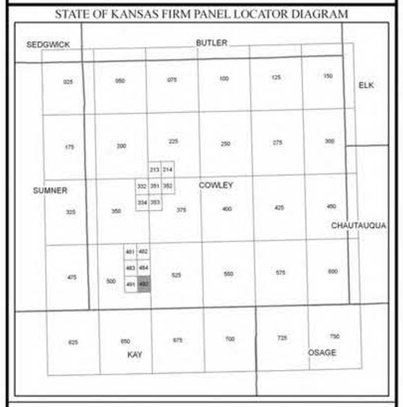
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

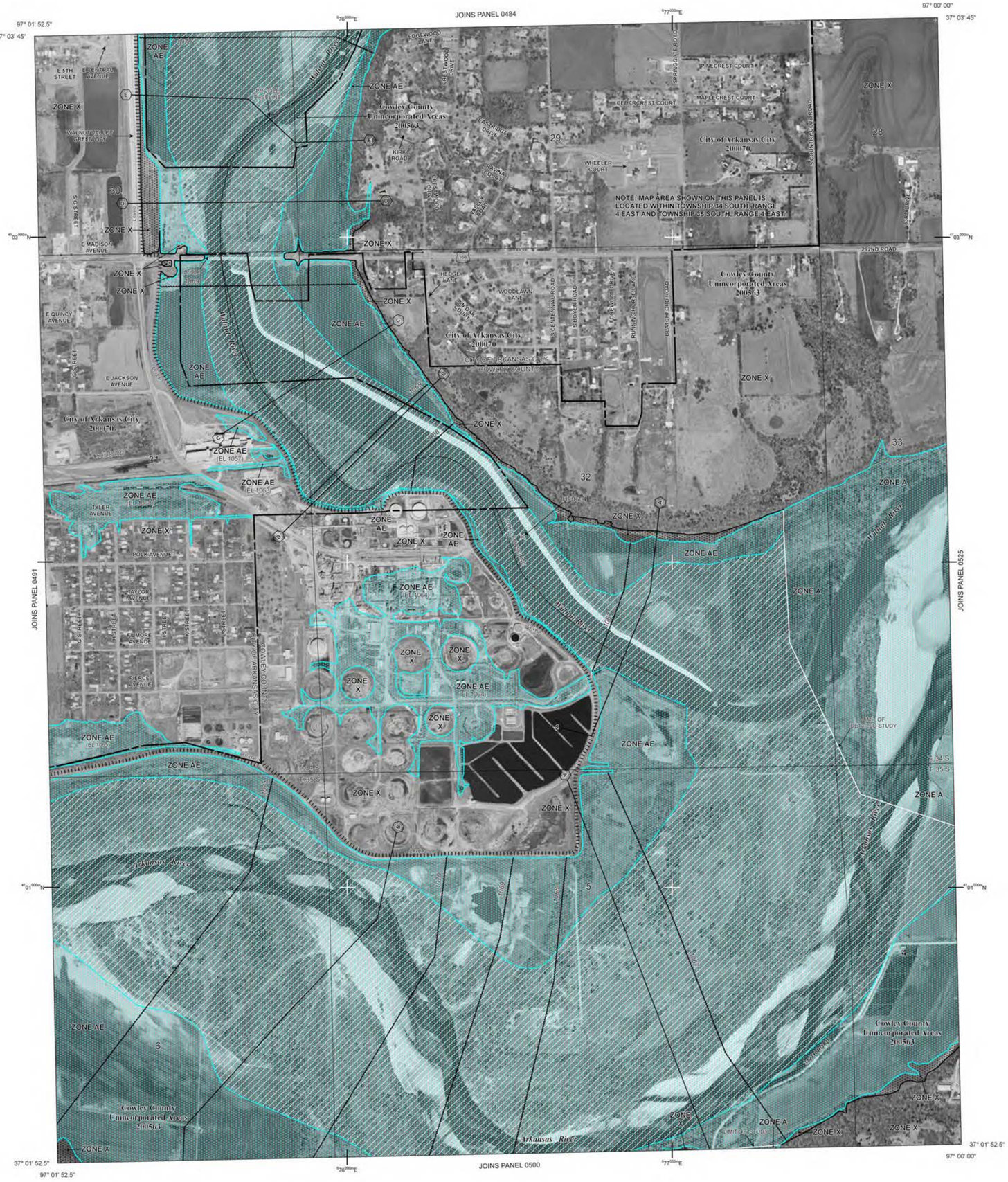
Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and /or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip/.

STATE OF KANSAS FIRM PANEL LOCATOR DIAGRAM



In cooperation with the Federal Emergency Management Agency (FEMA) and local communities in Kansas, this Flood Insurance Rate Map (FIRM) was developed by the Kansas Department of Agriculture Division of Water Resources in a digital statewide format to assist communities in their efforts to minimize the loss of property and life through effectively managing development in flood-prone areas. The State of Kansas has implemented a long term approach to floodplain management to reduce the impacts of flooding. This is demonstrated by the State's commitment to map floodplain areas at the local level. As part of this effort, the Kansas Department of Agriculture Division of Water Resources is working closely with FEMA as a Cooperating Technical Partner to produce and maintain this digital FIRM.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAS)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

A — A	Cross section line
23 - - - 23	Transect line
87°07'45", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4276000mE	1000-meter Universal Transverse Mercator grid values, zone 14
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
October 19, 2010

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0492D

FIRM
FLOOD INSURANCE RATE MAP

COWLEY COUNTY, KANSAS
AND INCORPORATED AREAS

PANEL 492 OF 750

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ARKANSAS CITY, CITY OF	200070	0492	D
COWLEY COUNTY	200563	0492	D

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
20035C0492D

EFFECTIVE DATE
OCTOBER 19, 2010

Federal Emergency Management Agency

APPENDIX I

LTU Closure Plan

LAND TREATMENT UNIT CLOSURE PLAN
TPI PETROLEUM, INC.
ARKANSAS CITY, KANSAS REFINERY

[40 CFR 264.111-264.116, 264.280]

ORIGINAL APPROVAL: JANUARY 25, 2000

MODIFICATION 01: AUGUST 2002
MODIFICTION 02: DECEMBER 2005

Submitted to:

Kansas Department of Health and Environment
Topeka, Kansas

Submitted by:

TPI Petroleum, Inc.
San Antonio, Texas

Prepared by:

Earth Tech, Inc.
5555 Glenwood Hills Parkway SE
Grand Rapids, MI 49588-0874

EARTH TECH PROJECT NO. 27002.01

Modification 01 and 02 Completed by:

R&B Associates, Inc.
201 W. Beltline Rd., Suite C-800
Cedar Hill, Texas 75104

RBA PROJECT No. 003 019 003 018

LAND TREATMENT UNIT CLOSURE PLAN

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LAND TREATMENT UNIT CLOSURE PLAN
(40 CFR 264.111 – 264.116, 264.280)

1.0 INTRODUCTION

This plan addresses requirements for closure of a Land Treatment Unit (LTU) at TPI Petroleum, Inc.'s (TPI) Arkansas City Refinery. This closure plan has been prepared to meet the RCRA closure requirements of Chapter 1, Title 40, "Protection of Environment" contained in the Code of Federal Regulations (CFR) and the requirements presented in the RCRA Corrective Action Plan guidance (RCAP), EPA 520-R-94-004 (OSWER Directive 9902.3-2A) as approved by EPA in the Corrective Measures Study (CMS) dated February 2002. Specifically addressed by this plan is Part 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities" as they relate to closure of land treatment units. The applicable rules are 40 CFR 264, Subpart G "Closure and Post-Closure of Hazardous Waste Facilities," Sections 264.111 – 264.116; and Subpart M, "Land Treatment," Section 264.280.

This written closure plan will be implemented beginning November 1998. TPI notified the Kansas Department of Health and Environment (KDHE) of their intent to close the LTU in a letter dated November 6, 1997 and clarified key issues to reach agreement on elements of this plan at a September 15, 1998 meeting in Topeka, Kansas. The plan has been updated as of April 2002 and will be updated and amended as may be required. Modification 02 to this plan was completed December 2005.

Based on 40 CFR 264.111 (c), this plan has been modified to provide for closure of the LTU consistent with corrective action for other Solid Waste Management Units (SWMUs) listed in Part II of the RCRA Permit and to change the frequency of sampling and analysis under Section 3.4. While Modification 01 provides for a consistent approach to closure and corrective action for the LTU and other SWMUs, the KDHE retails sole authority for closure of the LTU as a RCRA regulated unit. Similarly, the EPA retains authority regarding RCRA corrective action as a solid waste management unit (SWMU). Consequently, the KDHE will be actively involved in discussions and documents regarding final cleanup standards and technologies under the corrective action program as these items related to closure of the LTU.

1.1 GENERAL SITE DESCRIPTION

The refinery is located near the southeast corner of Arkansas City in the southwest 1/4 of Section 32, Township 34 South, Range 4 East and the NW 1/4 of Section 5, Township 35 South, Range 4 East in southwestern Cowley County, Kansas. The refinery is located at the confluence of the Arkansas and Walnut

Rivers. It is located on flat lying alluvium soils and sediments. Most of the land around the refinery is cultivated for growing wheat and grain sorghum. Several oil wells are also active in the immediate vicinity.

The LTU is located in the southeastern corner of the refinery property. A figure describing the configuration of the LTU has been provided in the permit that was issued in 1987. The LTU consists of a 3.85-acre soil plot. The LTU is divided into two (2) subplots separated by a roadway. Plot A (the northern portion) is 2.22 acres in area while Plot B (the southern portion) consists of 1.63 acres.

The LTU can be divided vertically into a zone of waste incorporation, a treatment zone (TZ) and below the treatment zone. Unsaturated zone monitoring beneath the TZ is conducted to demonstrate that no releases have occurred. Unsaturated zone monitoring consists of soil core sampling and soil pore water sampling using lysimeters.

The dimensions (depth) relative to the initial soil surface, of the TZ and the unsaturated monitoring zone are as follows:

1. The zone of waste incorporation is a maximum of 10 inches from initial soil surface.
2. The treatment zone is a maximum of 4.5 feet from the initial soil surface.
3. The unsaturated soil core samples representing BTZ conditions have historically been collected from a depth of 4.5 to 5 feet below initial land surface as specified in the RCRA Operating Permit.

A description of the prior operation of the LTU is presented in Section 3.3.3 of the permit application. Analysis of wastes managed at the LTU is provided in Section 4 of the Permit Application, “Waste Analysis.” A summary of the annual reports of the unsaturated zone submitted over the last four years of monitoring is provided in Attachment A of this plan. Additional reports are on file with KDHE for both soils and groundwater monitoring conducted since the LTU was permitted.

1.2 CLOSURE PERFORMANCE STANDARD (40 CFR 264.111)

TPI will close the LTU in a manner that will (a) minimize the need for further maintenance; and (b) control, minimize, or eliminate to the extent necessary for the protection of human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the groundwater, surface water, or the atmosphere and (c) meet the goals and objectives of the Corrective Measure Study Work Plan.

In designing the LTU Closure Plan, the following factors were taken into consideration:

1. type and amount of wastes previously applied to the LTU;
2. mobility and rate of migration of hazardous waste constituents likely to be present;
3. site location, topography, and surrounding land use;
4. climate, including precipitation;
5. characteristics of the vegetative cover;
6. geological and soil profiles, and surface and subsurface hydrology;
7. unsaturated zone monitoring information;
8. type, concentration, and depth of hazardous constituent migration as compared to background concentrations or risk-based levels; and
9. consistency with provisions established in the EPA approved Corrective Measure Study Work Plan dated February 2002.

1.3 GENERAL CLOSURE PLAN (40 CFR 264.112)

The closure plan approach was written with the recognition that land treatment closure is a continuing process, particularly as it relates to the necessity for, or advent of, post-closure care. The Closure Timetable commenced on August 1, 1998. The unsaturated zone monitoring beneath the land treatment zone, utilizing soil core and lysimeter samples, has not detected a statistically significant presence of the permit specified Principal Hazardous Constituents (PHC's) listed in Section 3.3 of this Closure Plan above background levels. This has been reported in the annual monitoring reports submitted to the KDHE.

Closure (and determination of post-closure needs) will include the following steps, which will be expanded upon in the following Sections of this Plan:

1. Continue maintenance and operations of the LTU beginning on July 31, 1998, following procedures as used in the past to maximize degradation, transformation, and immobilization of hazardous constituents within the treatment zone (Section 2 of this Closure Plan). Operation of the LTU will be continued during completion of the CMS and implementation of corrective measures.
2. Implement an ongoing Closure Determination Sampling and Analysis Program. This program is described in Section 3 of this Closure Plan and includes the following:
    a. continued soil core sampling and analysis immediately beneath the treatment zone to verify control of the constituent source and that no release has occurred;

b. sampling within the treatment zone to determine if the levels of PHC's statistically differ from background levels and/or verify continued degradation/immobilization of the PHC's;

c. sampling within the treatment zone for physical/chemical parameters (pH, cation exchange capacity (CEC)) to determine necessary adjustments to the treatment process; and

d. sampling within the treatment zone and enhanced sampling beneath the treatment zone to evaluate constituent levels versus cleanup goals that will be established under the CMS.

The above Closure Determination Sampling regimen will, in turn, determine whether closure of the LTU can be accomplished at either background or acceptable risk levels without removal, as well as establishing the extent (or time frame) of post-closure care required. Closure of the LTU under corrective measures may include alternative requirements, but must be protective of human health and the environment and satisfy the closure performance standards.

3. Clean closure with no post-closure care as authorized by 40 CFR 264.280 (d) and (e) is unlikely as groundwater beneath the LTU is impacted. This condition is being addressed in the context of the renewal permit application submitted to the KDHE. Thus, based on the results of the Closure Determination Sampling and Analysis Program and the CMS Report, this plan will be used to determine which of the following closure (and thereby post-closure) scenarios apply:

a. enhanced or more aggressive operation of the LTU, or removal/decontamination of the TZ to achieve background levels or acceptable human and ecological health levels to allow closure; or

b. implementation of the post-closure care program.

Establishment of a final vegetative cover pursuant to 40 CFR 264.280 (a) (8) will occur following the above determinations and prior to Certification of Closure.

4. Time Allowed for Closure (40 CFR 264.113)

The closure of the LTU, as established in this Closure Plan is likely to take more than 180 days. This is necessary to allow for continued treatment of the waste residuals incorporated in the Unit prior to Closure. Accordingly, an extension to the closure time frames established in 40 CFR 264.113 (b) is requested to coincide with the implementation of corrective action activities under Part II of the RCRA Permit. TPI will continue to take all steps to prevent threats to human health and the environment during the extended closure period, including compliance with the requirements of the Closure Permit. The Closure Activity Schedule appears as Table 1.

5. Disposal or Decontamination (40 CFR 264.114)

Any contaminated soil or equipment generated or removed during closure will be properly disposed or decontaminated. If contaminated soils are excavated they will be disposed at an approved treatment or disposal facility. Equipment used in operation or closure activities will be decontaminated prior to removal from the unit.

6. Submit Certification of Closure (40 CFR 264.115)

As required by 40 CFR 264.115, TPI will submit the Certification of Closure within 60 days of the completion of closure of the LTU. Because the other formerly permitted RCRA regulated units (#1 and #2 surface impoundments and #3A aerated lagoon) have already undergone closure and the Closure Certifications have been submitted to the KDHE, the completion of closure of the LTU will constitute final closure of the TPI refinery pursuant to the Part I of the RCRA facility operating permit.

7. Survey Plat (40 CFR 264.116)

If significant levels of hazardous constituents remain at the LTU at the time of Closure Certification, a survey plat prepared in accordance with 40 CFR 264.116 will be submitted to the local zoning authority. The plat filed will contain a notification to restrict disturbance of the hazardous waste disposal unit indicated, in accordance with the applicable 40 CFR 264, Subpart G regulations.

2.0 CLOSURE OPERATION AND MAINTENANCE OF THE LTU

Operation and maintenance of the LTU will continue and be concurrent with the closure determination sampling. The LTU will continue to be operated to allow further degradation, transformation or immobilization of waste constituents during the closure period. The termination of operation will be determined by one of the following:

1. when continued treatment operation is no longer beneficial;
2. when closure objectives are achieved and verified through the Closure Determination Sampling; or
3. at such time that numerical or risk-based goals for soil or groundwater are deemed unattainable, and post-closure begins. A determination that the goals are unattainable will be made if three (3) successive sampling and analyses rounds indicate no reduction of PHCs in pertinent environmental media.

TPI recently used the LTU only for non-hazardous wastes. TPI has managed these wastes according to the waste application procedures, loading rates, and other operating procedures described in the 1987 permit. A summary of the previous operational criteria for the LTU is presented below:

1. Waste was applied, during the term of the LTU operating permit, to the LTU so that no more than 120 barrels of oil were applied per acre per month. No more than 3,000 barrels of oil were applied to the entire LTU per year.
2. Based upon the specified oil application rates and the Land Treatment Demonstration predictions, the LTU would have reached capacity in the year 2029.
3. Waste was only applied to the LTU during the period from April to October of each year.
4. Waste was not applied to the LTU during periods of heavy precipitation.
5. Wastes were transported and applied to the LTU by one of the following methods:
    a. vacuuming waste from holding tanks and spreading the waste on the LTU using hoses from the vacuum truck; or
    b. transporting solid wastes in a dumpster or dump truck and spreading the waste on the LTU.
6. Wastes were uniformly distributed upon application to the LTU. The LTU was tilled using a tractor-drawn disk apparatus as soon as practicable after a waste application. The LTU was tilled as necessary (monthly at a minimum) between April and October to properly aerate the soil.

2.1 LAND TREATMENT DEMONSTRATION

TPI performed a land treatment demonstration (LTD) pursuant to Section III of the 1987 permit. A LTD report was submitted to the KDHE as specified in the permit. The non-hazardous waste residuals for which treatment will continue during closure implementation were considered during that treatment demonstration.

2.2 TREATMENT ZONE DESCRIPTION

The LTU is located on the Dale-Canadian-Lincoln Soil Association. This association is characteristically located in stream terraces and flood plains and is typically deep, level, and well to somewhat excessively drained. The soil types were confirmed by an on-site soil exploration program. Detailed results of the on-site soil exploration program are contained in Attachment VIII of the 1987 permit. A summary of the soil exploration program results is provided below.

The native soil at the LTU is Canadian fine sandy loam. The native soil is level and well drained. Typically, the upper layer of the native soil is grayish-brown fine sandy loam approximately 16 inches thick. The subsoil is brown, very friable fine sandy loam approximately 12 inches thick. The substratum is yellowish-brown and light yellowish-brown fine sandy loam and extends to approximately 60 inches.

The native surface soil layer is very friable and easily tilled. Runoff is slow, organic matter content is moderate, and fertility is medium. Soil pH ranges between slightly acidic and neutral at the surface and between slightly acidic and moderately alkaline in the subsoil. Shrink-swell potential is low. Available water holding capacity ranges between 0.8 and 2.4 inches per foot of soil. Permeability ranges between 2.0 and 20 inches per hour.

The native soil is overlain by 18 inches of sandy clay, which is in turn overlain, by approximately 18 inches of fine silty sand. The fill soil was placed by TPI in an effort to enhance the treatment characteristics of the LTU. The fill soil is finer than the native soil and is 10% to 20% clay and 20% to 45% silt. The cation exchange capacity (CEC) of the fill soil is higher than that of the native soil. This is reflective of the higher clay content. This higher CEC improves the capacity of the LTU to immobilize metallic waste constituents.

Double ring infiltrometer test results for the fill soil indicated a moderately slow steady state infiltration rate of 0.5 inches per hour. This is significantly less than the rate of 2.0 to 20 inches per hour reported for the

native soils. Therefore, the addition of the fill soil has slowed fluid movement through the treatment zone, allowing greater retention time for waste degradation, transformation, and immobilization.

The soil pH of the fill soil and the native topsoil are mildly to moderately alkaline and ranges between 7.6 and 8.2 standard units. A soil pH greater than 6.5 is indicative of good capacity for oily waste treatment.

Based upon the characteristics of the soil, the treatment zone incorporates the fill soil and 4 feet of the uppermost native soil unit. The LTU permit specifies that the treatment zone shall be considered to extend to four and one-half (4½) feet below the initial soil surface.

2.3 CLOSURE IMPLEMENTATION (40 CFR 264.112)

Closure of the land treatment facility will be accomplished as follows:

1. No additional wastes will be applied.

2. Migration of wastes into groundwater will be minimized by maintaining an active biological community to degrade the waste oil and adequate cation exchange capacity (CEC) to fix the metals contained in the waste. Storm-water control structures will be maintained during closure and any collected rainwater pumped to the wastewater treatment system per 264.280(a)(2), (3) and (4). Monitoring of groundwater sampling wells and the unsaturated zone monitoring (soil cores) will continue, through the closure implementation period as described in Section 3.

3. The area used for land treatment is in the refinery tank farm. Food-chain crops will not be raised on the site per 264.280(a)(6). However, the property will be retained for possible use consistent with land-use applicable, risk-based goals. Otherwise, a vegetative cover or an impermeable cap will be established and maintained during the post-closure care period.

4. Encouraging the immobilization of the applied metals and continued degradation of the organic oils in the LTU will result in hazardous constituents, if present, at concentrations below applicable risk-based standards for the protection of human health and the environment. Removal of the soil to a disposal or treatment facility is not considered desirable, but, if necessary to meet corrective action standards including risk-based standards or the closure performance standard, may be conducted.

2.4 CLOSURE MAINTENANCE AND TREATMENT

During the closure operating period for the land treatment facility, TPI will:

1. Continue to monitor and till the fields as determined by the Closure Determination Sampling, to enhance continued degradation of the oil. Once the oil content of the soil has stabilized or has decreased to approximately 1 to 2 percent, tilling may be discontinued. The fields will be tilled on a monthly basis from April to October until this time or as otherwise approved by the

KDHE as part of the corrective measures implementation. The tilling will be done using a tractor-drawn disk apparatus.

2. Continue to maintain the LTU so that the soil pH is between 6.5 and 8.0 standard units. The need for pH adjustment will be determined by review of soil core pH results and the routine use of field soil pH test kits.

3. Continue to fertilize the LTU as necessary to supply adequate nitrogen (N) and phosphorus (P). The soil nitrogen, phosphorus, potassium (N-P-K) levels will be monitored on an annual basis using field soil fertility kits.

4. Continue to maintain the proper moisture content by tilling the soil and by maintaining the LTU run-on and run-off management systems. The LTU soil will be maintained with approximate soil moisture content between 40 and 70 percent field capacity. Portable or field soil moisture meters will be utilized.

5. Apply lime, water, or fertilizer at rates determined by soil testing and consultation with the county agricultural agent, U.S. Department of Agriculture. The soil conditions that enhance bioremediation are the same as those for agricultural productivity. Continued waste loading will not occur, and it is anticipated that nutrient or soil supplements will not be required to foster continued degradation of the residual wastes. Should such be necessary, the material would be applied at the necessary rate using broadcast spreader attachments to the tractor.

6. Continue to decontaminate the tillage equipment using a steam cleaner or high-pressure water washer. The decontamination rinse water will be collected and managed in the Refinery wastewater treatment system.

7. Continue all operations necessary to maximize degradation, transformation, and immobilization of hazardous constituents within the treatment zone as required under Section 264.273 (a).

8. Control the migration of hazardous waste constituents from the treated area into the groundwater by maintaining the run-on/runoff control system as required by Section 264.273 (b)-(e). This minimizes the amount of water available for transport of hazardous constituents through the soil.

9. Control the release of contaminated runoff from the facility into surface water by maintaining the runoff control system as required by Section 264.273 (b)-(e).

10. Continue unsaturated zone (soil core) monitoring as described in Section 3 of this Closure Plan, and continue groundwater monitoring as described in Section 15 of the Permit Application. In accordance with Section 264.280 (a)(7), soil pore liquid monitoring will be terminated. As noted later, the lysimeters will remain in place, and the sampling plan for these devices remains in this Plan, for use in the event that TPI decides to resume soil pore liquid monitoring. Soil core samples will be analyzed for moisture content, oil & grease, pH, cation exchange capacity, and total organic carbon (TOC), and PHCs.

2.5 ESTABLISHMENT OF VEGETATIVE COVER

Final cover contours and drainage for the LTU will be established at the conclusion of the closure period in accordance with the preliminary design provided in Figure 12-1 of the permit application or as defined in the corrective measures implementation plan. The following steps will be taken to establish final contours, drainage, and vegetative cover for the LTU:

1. Conduct a 50-foot grid topographic survey to establish base elevations, prior to re-grading the surface of the land treatment unit.
2. Remove lysimeters.
3. Implement a final closure grading and seeding plan during the months of April through October. The grading and seeding activities would preferably be performed in the spring or before frost, in late fall.
4. Provide any necessary surface water diversions.
5. Submit final closure certification, including as-built drawings to KDHE, within 60-days of project completion. Closure certification shall include construction methods, quality control, and final grading plans for the closure project.

Once final cover surface elevations including a minimum six (6) inches of topsoil are established, seeding mixtures consistent with Table 2 of this closure plan will be applied to minimize wind dispersion, infiltration, erosion, and mobilization of soils due to heavy precipitation. Soils and/or seed mixtures may be amended, depending upon local moisture pH and fertilization requirements at the time of application.

Construction plans and specifications shall provide details for vegetative cover and other surface water runoff controls, including specifications for construction materials and related activities. The construction design basis shall be a 24-hour, 25-year rainfall event.

3.0 CLOSURE DETERMINATION SAMPLING AND UNSATURATED ZONE MONITORING (40 CFR 264.280(A)(7))

This section describes the sampling and analysis plans for the continued unsaturated zone monitoring required by 40 CFR 264.280(a)(7) which references 40 CFR 264.278. It also establishes the sampling procedures for what is termed the "Closure Determination Sampling." Sampling of the TZ within the LTU will be conducted in accordance with corrective measures implemented under Part II of the Permit, and the requirements outlined in Section 2.6 Data Quality Objectives of the CMS. The results will be used to evaluate cleanup standards applicable to the LTU. While the lysimeters will remain, these will not be utilized during closure pursuant to 40 CFR 264.280(a)(7). The lysimeters are maintained only in the event that TPI determines such sampling may be beneficial.

3.1 CLOSURE DETERMINATION SAMPLING

The RCRA permit issued to TPI in October 1987 defined specific environmental and groundwater monitoring efforts to be undertaken, and maintained, by TPI. These requirements were specified in permit Sections IV. G. and IV. H. During the life of the permit, this monitoring has been conducted in accordance with these sections and all applicable references.

Several options exist for satisfactory closure of the hazardous waste land treatment unit pursuant to 40 CFR 264.280 and applicable Land Treatment Closure/Post Closure Guidance. Closure of the LTU will be completed in accordance with the corrective measures of Part II of the Permit. The closure approach selected will depend on data collected during implementation of this closure plan and the CMS Report and will also determine the scope of post-closure care.

The target practical quantitation limits (PQLs) for PHCs are listed in Table 3. The presence of biomass and other oily waste materials typically result in matrix interferences that increase the quantitation limits above the target PQLs shown in Table 3.

Groundwater sampling will continue as required in Part I of the RCRA Permit.

The soil core sampling required by 40 CFR 264.278 will continue to be conducted as part of the "Closure Determination Sampling" described in this Section.

After the final application of waste, the soil-pore liquid monitoring (lysimeter sampling) of the LTU will be terminated within ninety (90) days as authorized by 40 CFR 264.280(1)(7). The lysimeters and the Soil Pore Liquid Monitoring Plan will remain in place in the event that TPI determines that such sampling may provide pertinent data for closure or treatment efficacy.

The Closure Determination Sampling is designed to:

1. Meet the requirements for establishing Data Quality Objectives as described in the corrective measures of Part II of the Permit and the development of cleanup standards

2. Fulfill or continue the required soil monitoring immediately beneath the treatment zone using soil cores.

3. Determine the presence of significant levels of PHC's in the treatment zone relative to background concentrations and/or risk-based levels.

4. Determine whether the organic waste constituents, if present, are capable of further degradation or transformation and if continued land treatment operation remains beneficial.

5. Determine whether any significant levels of inorganic waste constituents in the treatment zone would be further immobilized and if continued land treatment operation would be beneficial.

6. Determine whether the establishment of a vegetative cover on the closed LTU would be beneficial or interfere with the continued land treatment.

7. Determine whether any PHC's have migrated below the treatment zone, or the prior monitoring zone (4 to 5 feet below the initial surface), to the deeper unsaturated soils.

8. Allow quantification or risk assessment of any PHC's detected above background in the LTU treatment and unsaturated zones to determine if any threat exists to health or the environment.

9. Indicate whether the LTU is impacting groundwater and, if so, minimize future impacts to groundwater at the facility.

The above information will be obtained through implementation of the Closure Determination Sampling. TPI will prepare and submit to KDHE, on an annual basis, reports that present sampling and analytical methods, results and recommendations. Based on results from the Closure Determination Sampling, one (or a combination) of the following closure approaches can be selected and implemented:

1. Continued operation of LTU, with or without interim vegetative cover establishment.

2. The removal of all or a portion of the treatment zone to eliminate or minimize any concerns for migration of waste constituents to the unsaturated or saturated soil zones.

3. The installation of a final cover on the LTU to limit access to the TZ or installation of a cap on the LTU to limit permeability, initiation of post-closure care including all elements of 40 CFR 264.280(a), and continued groundwater monitoring (40 CFR, Subpart F).

3.2 UNSATURATED ZONE MONITORING PROGRAM (40 CFR 264.278)

The RCRA Operating Permit issued to Total in 1987 required the installation and operation of an unsaturated zone monitoring program complicit with the requirements of 40 CFR 264.278, as defined in the Permit in Section IV.G. The purpose of this system is for the determination of whether or not hazardous constituents have migrated out of the TZ. This program consisted of the collection and analysis of composite soil core samples and soil-pore liquid samples.

Accordingly, TPI installed and operated such a monitoring system for the aforementioned purpose. During the implementation of the monitoring program, subsequent to the required collection and analysis of samples, the sample results were subjected to statistical comparison to previously established background constituent concentration values. The results of this statistical comparison, conducted in strict adherence to the permit, did not indicate a statistically significant increase in PHC concentrations at the base of the treatment zone.

In compliance with the current operating permit and the provisions of 40 CFR 264.280 (a) (7), TPI intends to continue the collection of soil core samples and terminate the soil-pore liquid monitoring 90 days after the last application of waste to the treatment unit.

3.3 DETERMINATION AND IDENTIFICATION OF PRINCIPAL HAZARDOUS CONSTITUENTS (40 CFR 264.278(A))

TPI will continue to collect and analyze soil core samples during the closure period and during closure determination. TPI has expanded the list of PHC's included in the original permit to include all the parameters listed in Table 3. Also included on Table 3 are general parameters which evaluate the ability of the TZ to treat constituents. The initial set of soil core samples collected from the TZ and BTZ will be analyzed for these PHC's. Additionally, the soils from the TZ will be analyzed for the general parameters. The PHC list will be modified based upon the results of these analyses. The modified PHC's will only include parameters, which are detected above the method detection limits (or PQLs).

These analytes will also be included in the analysis of the treatment zone samples and the deeper unsaturated zone samples under the Closure Determination Sampling Program which is inclusive of the

unsaturated zone monitoring required by 40 CFR 264.280 (a) (7). Further, these parameter meet the other criteria for PHC's pursuant to 40 CFR 264.278(a)(2).

3.4 SOIL CORE MONITORING PROCEDURES (40 CFR 264.278(B))

The following describes the procedures for the selection, collection and analysis of samples under the "Closure Determination Sampling" as well as the Unsaturated Zone Monitoring (40 CFR 264.280(a)(7)) programs.

Soil boring locations shall be selected utilizing random sampling methodology. Soil boring locations for the collection of analytical samples will be located utilizing a random grid approach. The approved permit identified a grid interval of 20 feet between grid nodes as sufficient for sampling and analyses of the LTU. This grid system will also be used for implementation of the closure plan. The area to be gridded, will be constructed so as to generally fit the interior perimeter of the unit. All grid nodes will then be sequentially numbered. The cube root of the number of sample points will then be calculated to determine the number of boreholes to be placed. A random number table, or calculator with a random number generating feature, will then be used to determine the grid points to be sampled. Grid nodes to be sampled will be randomly selected for each sampling event.

At each location, the soil borings will be advanced using a bucket auger or equivalent sampling techniques after initial decontamination of the equipment. Within the LTU TZ, two samples will be collected, one in the upper 1-foot interval and one in the lower portion (3 to 3.5 feet) of the treatment zone. Upon reaching BTZ (a depth of 4.5 feet from initial soil grade), two samples will be collected. The equipment will again be decontaminated to prevent contamination of the sample to be collected immediately below the treatment zone from the 4.5 to 5-foot interval. The auger will then again be decontaminated and further advanced for the collection of another 6-inch interval sample from 8.5 to 9 feet. The samples will be analyzed as follows:

Depth	Analysis
0-1	General Parameters
3-3.5	PHCs/General Parameters
4.5-5	PHCs
8.5-9	PHCs

The analytical methods and parameters are summarized in Table 3.

The borehole should then be backfilled carefully to prevent hazardous constituents from channeling down the hole. Bentonite chips will be used to fill the borehole in the unsaturated zone and the spoil from the borehole will be utilized for fill to grade.

The samples will then be placed on ice for transport back to the refinery laboratory/sample control point for shipment preparations. The samples will be transported under chain-of-custody procedures to a KDHE-certified laboratory for analysis.

3.4.1 SAMPLING EQUIPMENT

The equipment needed to collect soil-core samples for Closure Determination Sampling is as follows:

- Bucket auger
- Laboratory supplied containers
- Five gallon buckets, 4 each
- Trowel
- Field Log Book
- Sampling and Analysis Plan
- Transport containers with ice
- Chain-of-custody forms
- Steam Cleaner
- Bentonite chips

3.4.2 DECONTAMINATION AND FIELD QUALITY ASSURANCE AND QUALITY CONTROL

3.4.2.1 Decontamination

To minimize the potential for cross contamination between samples, all tools, sampling devices, and measuring instruments will be thoroughly decontaminated between sampling locations and depths. The general decontamination procedures that will be observed are as follows:

- Wash equipment with a laboratory grade non-phosphate solution (Alconox or equivalent) and a stiff brush in a 10-gallon (approximate) wash basin about half filled, to remove all visible particles,

- Rinse with tap water (potable supply) in a second 10-gallon wash basin about half filled.

- Rinse with 95 percent reagent grade methanol (hexane can be substituted for methanol, as necessary) over a third wash basin to contain the methanol rinse. The methanol will be dispensed from a one quart plastic squeeze bottle or garden sprayer, clearly labeled “Methanol.”

- Rinse with deionized water over a fourth empty 10-gallon basin to contain the deionized water rinse. The deionized water will be dispensed from a one-quart plastic squeeze bottle or garden sprayer, clearly labeled "Deionized Water."
- Allow sampling equipment to air dry.
- Wrap air-dried sampling equipment in aluminum foil (shiny side facing out) if necessary, to prevent contamination prior to use. Equipment wrapped in aluminum foil may be placed in a plastic bag for additional protection.

The sampling equipment decontamination solutions generated will be transferred to the wastewater treatment system.

3.4.2.2 Quality Assurance/Quality Control

Quality Assurance/Quality Control shall be performed to assure collection of representative, and valid data and the accuracy and precision of the field collection and analytical procedures. The soil samples will be collected with non-dedicated sampling equipment. The field quality assurance/quality control program will consist of the collection of equipment rinseate blanks, trip blanks, and field duplicate samples.

3.4.2.3 Soil Sampling Field Quality Assurance/Quality Control

The following field quality control checks will be employed to document the collection of representative soil samples and make comparisons of background to LTU samples.

Background Samples – The statistical method proposed in this plan specifies that at least four (4) samples are required to statistically compare background to closure samples. Thus, four samples, approximately upgradient of the LTU will be collected for the anaylsis fo all paramber

Trip Blanks – Trip blanks shall be used during sampling events. Trip blanks will be provided by the laboratory. These samples will be collected at approximately a 10 percent frequency. These samples shall be used to detect any contamination originating from exposure during sample transport and/or potential bottle contamination. Trip blanks will be analyzed for VOCs of Table 3. Trip blanks shall be identified as TB followed by the trip blank number and date, i.e., TB-10 (06-20-99).

Field Blanks – Field blanks will be collected during the soil sampling event. These samples consist of sample bottles which will be filled at the sample collection site with reagent grade water provided by the laboratory. These samples will be collected at approximately a 5 percent frequency. These samples will be

used to evaluate contamination from containers and airborne contaminants. The field blanks will be analyzed for VOCs of Table 3.

Equipment Rinseate Blanks – Rinseate blanks will be collected during soil sampling event that employs non-disposable or non-dedicated sampling equipment. These samples will be collected at approximately a 10 percent frequency. The rinseate blanks will consist of sample bottles which are filled with distilled water poured over or pumped through the appropriate sampling devices after decontamination. Rinseate blanks will be used to detect any contamination from sampling equipment or cross contamination from previously collected samples. These samples will be analyzed for the volatile and semivolatile organic compounds and metals listed on Table 3.

Field Duplicates – Field duplicates will be collected during the soil sampling event. These duplicate samples will documented field precision. These samples will be collected at approximately a 10 percent frequency. The sample and duplicate will be analyzed by the same laboratory for the same parameter(s) (Table 3). Duplicate samples will be submitted as blind samples and will be identified by a unique sequential station number.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) – MS and MSD samples will be collected during the field sampling. These samples will document matrix effects on the samples. One MS and one MSD sample will be collected during each sampling event. These samples will be analyzed for the volatile and semivolatile organic compounds and metals listed on Table 3.

3.4.2.4 Data Quality Objectives

Data Quality Objectives (DQOs) will be developed to accompany the cleanup standards. The DQOs define the level, sufficiency, quality, and quantity of data necessary to demonstrate that a cleanup goal has been achieved or that no further action is necessary for an area. Development and application of DQOs includes the application of standard testing methods and indicator parameters that provide a reasonable qualification/quantification of a target constituent or group of constituents. To the extent practicable, DQOs will rely on analytical methods established in “Test Methods for Evaluating Solid Waste, Physical/Chemical Methods” (EPA SW-846 Third Edition as amended).

3.4.3 FREQUENCY

During the first year of Closure Plan implementation, the sampling program will be implemented two (2) times. Soil core samples will be collected annually thereafter until completion of the sampling in 2004. After 2004, sampling will be completed at the time of final closure or as directed by the Secretary.

3.4.4 CHAIN-OF-CUSTODY CONTROL

Personnel involved in field sampling activities will receive copies of the approved project-sampling plan to familiarize them with the objectives, sample locations, and chain-of-custody procedures to be followed. The sample collector will:

a. Obtain samples using the appropriate sampling techniques.

b. Attach sample labels securely to the sample container at the time the sample is collected. The label will contain the following items: sample number, the sample type, the date and time taken, the preservative used (if any), and the name of the sample collector. Prepared sample labels will be completed legibly in waterproof ink.

c. Use bound field notebooks to record field measurements, observations, and other pertinent information necessary to reconstruct the sample collection processes for future reference.

d. Take the responsibility for the care and custody of the samples until the samples are properly dispatched to the receiving laboratory. The sample collector will ensure that each container is in his physical possession or in his view at all times, or stored in the locked place where no one can tamper with it.

e. Fill out the appropriate chain-of-custody record which includes: collector's name; sample number; signature of collector; date and time of collection; place and address of collection, waste type; and signatures of persons involved in the chain of possession, inclusive dates of possession.

3.4.5 ANALYTICAL PROCEDURES

The analytical procedures for the soil core analysis are summarized on Table 3. Dilution of the samples may be required if target constituents are present in the soil at concentrations outside the range of the analytical instrument calibration. Dilutions are performed to bring the constituent concentrations within the instrument calibration range to provide accurate constituent quantitations. Sample dilution does result in a corresponding increase in the instrument detection level and the reporting level or practical quantitation level.

3.5 SOIL PORE LIQUID MONITORING

Soil pore liquid monitoring will be performed until 90 days after the last waste is applied. The lysimeters will be removed at such time that the final vegetative cover is established. The LTU is equipped with six porous cup pressure-vacuum lysimeters. Each lysimeter is installed 5 feet below the soil surface. The locations and construction details of the lysimeters were previously approved by the KDHE. Two of the six lysimeters are located in background areas; four are located within the active LTU area.

The following equipment may be used to sample the lysimeters:

- a hand-held vacuum pump,
- a nitrogen cylinder with a pressure regulator capable of measuring 10 psi,
- six 1,000-ml graduated glass beakers,
- pH and specific conductivity meter(s),
- six 100-ml glass sample bottles,
- 12 glass volatile sample vials,
- six 1-liter glass sample bottles with Teflon®-lined caps,
- a field log book,
- ice chests and ice,
- chain-of-custody forms.

Soil pore liquid monitoring may be conducted using the following procedures:

1. Soil pore liquid samples may be collected at any time. If liquid is not present in a lysimeter at a desired sampling event, the lysimeter may be checked following a subsequent rainfall. A sample can be collected when liquid is present in the lysimeter.

2. Soil pore liquid samples may be analyzed for pH, specific conductance, and PHC's.

3. A vacuum will be applied to each lysimeter at least 24 hours before sample collection. The hand held vacuum pump will be used to apply approximately 70 centibars of vacuum to each blank hose in the lysimeter control box. The toggle valve will be closed and left for at least 24 hours.

4. Samples will be collected only after the lysimeters have been under a vacuum for at least 24 hours. The toggle valves will be opened and the white hose placed into one of the clean 100-ml beakers. No more than 10 psi of nitrogen pressure will be applied to the black hose to force the sample out of the lysimeter.

5. It is very possible that there will not be adequate sample volume for all analyses. Therefore, the sample containers will be filled in the following order:

    a. 100-ml glass bottle for metals analysis

    b. two 40-ml glass vials for volatile organic analysis

c. 1-liter glass bottle for base/neutral organic analysis

6. Sample containers will be placed into an ice chest and kept cold for shipment to the laboratory.

7. Soil pore samples will be analyzed by a KDHE-certified laboratory. The laboratories will be instructed to use the analysis methods specified in SW846 and required in the permit.

8. The pH meter will be calibrated to laboratory standards prior to use. The meter(s) should also be calibrated after every two lysimeters.

9. A chain-of-custody form will be completed for each ice chest. Laboratory specified chain-of-custody procedures will be followed at all times while the samples are in the custody of TPI.

10. Background concentrations PHC were established pursuant to the 1987 permit but will be redefined for use in this closure plan. Background sampling methodology was discussed in Section 3.2.4.

3.6 BACKGROUND COMPARISONS AND RISK-BASED CONSTITUENT LEVEL EVALUATIONS (40 CFR 264.280(D))

Closure Determination Sampling will be used to determine how the LTU will be closed after completion of the closure period. As described in Section 1.3, General Closure Plan, it is not likely that the LTU will be "clean-closed" due to general groundwater contamination in the area. Consequently, final closure will be completed in place (with or without additional treatment) or ex situ by removal of material not meeting closure standards. The original closure plan identified a risk assessment process that would be used to determine acceptable levels of constituents that could remain in place or used as cleanup levels. The modified closure plan removes the separate risk assessment process deferring to the corrective action process and a consistent cleanup level for SWMUs identified in Part II of the RCRA Permit.

The development and negotiation of cleanup standards under the CMS process will include review and consultation with representatives of KDHE to the extent the standards are applicable to the LTU. The cleanup standards are the levels at which constituents may remain in the environment without posing an unacceptable risk. The cleanup level will be developed based on site-specific land use and exposure assumptions including the risk assessment that was prepared as part of the RCRA Facility Investigation (RFI).

As described in the CMS Work Plan, the EPA Region 9 Preliminary Remediation Goals (PRGs) represent a generic risk level of 1EE-6. These standards will be used as the initial "point of departure" for the screening purposes as initial standards. The PRGs will be revised based on site-specific considerations, land use

assumptions, actual constituent levels, background levels of constituents or if a selected corrective action warrants such a change.

The PRGs will be modified into cleanup standards using the risk assessment that was completed under the RFI effort, a comparison to background constituent levels, and the site-specific fate and transport model.

The following general steps will be used to develop the cleanup standards based on site-specific constituents of concern and site-specific exposure assumptions:

- The exposure scenario (conceptual site model) presented in the RFI report will be used to identify constituent exposure and migration pathways associated with surface water and sediments.
- Constituents of Concern (COCs) will be identified for each complete pathway based on the RFI risk assessment results and typical refinery constituents. For an incomplete pathway, it may be necessary to identify a cleanup standard or action level to assure that site workers and off site receptors are protected during corrective action implementation.
- For each COC, the available analytical data will be compared to the Region 9 PRGs as the initial point of departure. The initial list of constituents for which remediation goals will be developed will be based on this initial comparison. For example, some constituents that exceed or nearly exceed the Region 9 PRGs, will likely be subject to cleanup standards while other constituents that are not likely to be present, may be removed from further consideration for cleanup standards.
- Modifications to the Region 9 PRGs will be developed based on site-specific considerations such as land use assumptions, analytical capabilities, and site-specific exposure assumptions in the risk assessment and site specific fate and transport mechanisms.
- The constituents and constituent levels associated with each SWMU will also be compared to the site screening levels and background levels. If insufficient data exists on which to make such a comparison, it may be necessary to obtain additional data as described later in this plan.
- If the constituent level exceeds the screening level and background level, the SWMU will be considered subject to corrective action. If the constituent levels do not exceed the screening level or background level, no further action will be contemplated for the SWMU.
- DQOs will be used as part of the QA/QC Plan to verify that a sufficient quality and quantity of data are available on which to make the determinations described above.

3.6.1 SCREENING LEVEL RISK ASSESSMENT

The Closure Determination Sampling Program established in this Closure Plan will provide information adequate to evaluate residual constituent concentrations in the LTU treatment zone or unsaturated zone relative to health-based cleanup levels established under the CMS work effort. Further, the collection of

samples at various depths and locations beneath the LTU TZ, over time, will allow evaluation of the relative mobility of these constituents.

This information will be used to determine whether closure of the LTU at acceptable risk levels can be achieved as defined below. The data obtained after treatment is believed to be complete will be evaluated in tiered manner to determine the extent to which untreated residual contamination may pose a risk to potential receptors. Data will be evaluated consistent with current and anticipated land usage as described below.

3.6.1.1 Risk-Based Benchmark Selection

Adequate risk characterization is required to determine if closure of the LTU can be achieved. Selection of meaningful risk-based benchmarks for potentially exposed populations will be performed as described below.

3.6.1.2 Screening Level Risk Assessment – Soils

Human health benchmarks for soils will be selected consistent with the current and anticipated land use of the facility (i.e., industrial). Media cleanup standards will be developed in accordance with the corrective measures of Part II of the Permit. Cleanup standards will be approved by the KDHE prior to use in closure of the LTU.

For chemicals that are not believed to be highly mobile, TPI anticipates that industrial risk-based direct contact criteria published by U.S. EPA Region 9 (U.S EPA 1998), or the appropriate Risk-Based Standards for Kansas (KDHE 2001) will be used as evaluation criteria in this respect. Alternatively, for chemicals that show the potential for migration via groundwater, criteria will be developed based on information presented in the U.S. EPA Technical Background Document Soil Screening Level Guidance (1996) or Risk-Based Standards for Kansas (KDHE 2001) and will be compared to residual contamination data.

3.6.2 EXCEEDANCE-BASED ACTION

An exceedance of a cleanup standard constitutes a basis for action. The appropriate action will be consistent with the corrective action technologies and methods identified through the corrective action process and the CMS. Therefore, this plan defers to the corrective action process as reviewed and approved by the KDHE as it relates to closure of the RCRA Regulated LTU.

4.0 GROUNDWATER MONITORING (40 CFR 264.90)

The current groundwater monitoring system is compliant with 40 CFR 264, Subpart F, and will continue to be sampled and evaluated during the closure implementation. The groundwater monitoring wells, sampling and analysis plans, and reporting procedures are described in Section 15 and Appendix P of the RCRA Part B Permit Application. The groundwater monitoring program has been developed to determine the effectiveness of corrective action. An Engineering Feasibility Plan has been submitted to KDHE to evaluate and address any potential release from this unit (EnecoTech, September 25, 1998).

Groundwater monitoring for the LTU will be continued as defined in Part I of the RCRA permit issued September 24, 2001.

5.0 CLOSURE PRECAUTIONS

The following sections address miscellaneous closure maintenance requirements.

5.1 FOOD CHAIN CROPS (40 CFR 264.280(A)(6))

No food chain crops will be grown on the LTU.

5.2 RUN-ON AND RUN-OFF MANAGEMENT (40 CFR 2643.280(A)(2-4))

There is no storm water run-on to the LTU. The LTU is completely enclosed by a 2-foot high dike that prevents localized run-on. The only water that reaches the LTU is that which falls as precipitation or that which is contained in the wastes applied to the LTU. The existing run-on/run-off controls will continue throughout the closure period until establishment of the vegetative cover as described in Section 2.5 of this plan.

All run-off will flow toward the northeast portion of the north diked LTU area. The 24-hour, 25-year rainfall event for the Arkansas City area is 6.5 inches (U.S. Weather Bureau, 1961, Tech Paper 40). Such a rainfall would produce 90,840 ft3 of water on the LTU. Even under a worst case scenario with no infiltration and no evaporation, this volume of water can be safely contained within the LTU dike with a minimum of 0.3 feet of freeboard. Infiltration will significantly reduce the actual amount of water that must be contained within the dike. A pump is also located at the northeast corner of the LTU. All runoff will be pumped from the LTU to the refinery wastewater treatment system.

5.3 WIND DISPERSAL CONTROL (40 CFR 264.280(A)(5))

Wind dispersal of waste constituents from the LTU has not been a problem in the past. The high water content of the waste coupled with the immediate incorporation of wastes upon application effectively minimizes particulate loss due to wind dispersal. No wastes will be applied during the closure of the LTU and a vegetative cover will be established upon completion of closure implementation.

5.4 DECONTAMINATION OF EQUIPMENT (40 CFR 264.114)

When closure is complete at the facility, TPI will steam clean all facility equipment prior to alternate usage. The resulting wash water will be treated and discharged in accordance with applicable regulations. The only

equipment expected to require decontamination is the tractor, disk and broadcast spreader attachments, and the drainage pump.

5.5 SECURITY

During the closure period all existing security measures will continue as required to prevent unauthorized entry onto the site. Signs are posted and will be maintained at each approach to the site that warn the public "Danger – Keep Out – Authorized Personnel Only." Security precautions are as established in Section 5.0 of the Part B Permit Application and Section II.D. of the Hazardous Waste Management Facility Permit.

5.6 CLOSURE PLAN MODIFICATION (40 CFR 264.290(D) AND 40 CFR 264.112(C))

This plan will be amended by TPI at any time that changes in the operating plans or facility design affect the closure plan implementation. In such event, TPI will issue a request to the Regional Administrator for modification of the closure plan pursuant to 40 CFR 264.112(c)(3).

TPI may not be subject to Section 264.280(a)(8), establishment of a vegetative cover, or Section 264.280(c), post closure care, if TPI can demonstrate to KDHE that the levels of hazardous constituents in the treatment zone do not exceed the background values or risk-based levels of those constituents when using the test(s) specified in the Closure Determination Sampling Plan (Section 3.0), which satisfies 40 CFR Section 264.280(d)(3). TPI may submit this demonstration during the closure or post-closure period.

5.7 CLOSURE CONTACT

The closure contact is identified and can be reached by written letter or telephone contact as listed below:

Ms. Brenda B. Manterola
Manager, Environmental
Valero Energy Corporation

6000 North Loop 1604 West
San Antonio, Texas 78249-1112

PO Box 696000
San Antonio, Texas 78269-6000

Telephone: 210/592-4619

6.0 CERTIFICATION OF CLOSURE OF THE LAND TREATMENT FACILITY (40 CFR 264.115)

Within 60 days of closure of the LTU, TPI will submit to the Secretary of the Kansas Department of Health and Environmental certification and supporting documentation by both TPI and an independent registered professional engineer or an independent qualified soil scientist that the hazardous waste facility has been closed in accordance with the closure plan specifications. Attachment 2 is an example of the Closure Certification Form.

7.0 NOTICE TO LOCAL LAND AUTHORITY (40 CFR 264.119)

If significant levels of hazardous constituents remain at the LTU at the time of Closure Certification, a survey plat prepared in accordance with 40 CFR 264.116 will be submitted to the local zoning authority. The plat filed will contain a notification to restrict disturbance of the hazardous waste disposal unit indicated, in accordance with the applicable 40 CFR 264, Subpart G regulations.

ATTACHMENT 1

LTU REPORTS SUMMARY

1996-1998

February 26, 1997

Ms. Andrea L. Austin, M.S.
Environmental Scientist
Hazardous Waste Facilities Unit
Permit Section
Kansas Department of Health and Environment
Forbes Field, Building 740
Topeka, Kansas 66620

01-0138R-013

Subject: Total Petroleum, Inc.
Arkansas City, KS Refinery
Permit No.: KSD087418695
Annual Land Treatment Unit Report

Dear Ms. Austin:

Enclosed please find the annual report on the lysimeter and soil core analyses performed on Total's land treatment unit (LTU) located at the Arkansas City Refinery in Cowley County, Kansas, see Figure 1. Three lysimeter sampling events were conducted on April 11, 1996, September 11, 1996, and December 21, 1996. Soil core samples were collected on August 28, 1996. A summary of the analytical results and statistical analyses for the lysimeter sampling is presented in Table 1. The laboratory analytical reports are included in Appendix A. The statistical analysis of the data incorporated the detection limit value when performing the statistical evaluation of principal hazardous constituents (PHC) that were not detected in the analyses.

The LTU is divided by a roadway into north and south sections denoted as Plots A and B, respectively. A composite soil-pore liquid sample was collected from each plot during each of the three lysimeter sampling events. The locations of the lysimeters are shown in Attachment IX, Appendix A of the RCRA permit.

A total of four soil core composite samples were collected, one from within the treatment zone and one from below the treatment zone and on both plots. Three locations for the

soil core sampling were selected for each plot using random number drawings to makeup the composite samples, see Figure 2 for sampling locations. Samples at the same depths were then composited from the three borings on each of the north and south plots. This provided a composite treatment zone sample for both the north and south plots and a composite sample from beneath the treatment zone for each plot. A summary of the analytical results and statistical analyses is presented in Table II. The laboratory analytical results are included in Appendix B.

Per the requirements of Sections IV G.7. (a) and (b) of Total's permit, the data was statistically compared to background data from 1987-88 using the average replicate (AR) t-test and is now being submitted. The AR t-test evaluation indicates that there is no statistically significant evidence of a release from the unit. The t^* value for all constituents that could be evaluated were below the t_c values of the background. In this AR t-test, the variance of the original background data is zero for several parameters. This zero variance causes a division by zero error when attempting to perform the calculations. Details of how the AR t-test is applied can be found in Attachment IX Section II p.166 of the permit.

The above referenced permit specifies in Section IV G.4.(c) and (d) that Total shall collect a soil-pore liquid sample from Plot A and a sample from Plot B of the land treatment unit on a biannual basis. The permit allows compositing of samples collected from within a plot as necessary to obtain an adequate sample volume. This section also specifies that this monitoring shall be performed as specified in Attachment IX. This attachment states that the land treatment area has six lysimeters, two in each plot and two which served to assess background characteristics. Prior to sampling these lysimeters, a vacuum is applied about 24 hours prior to sample collection. If sufficient liquid is not present during the routine biannual sampling event, an additional sampling effort will be attempted following a rainfall or significant waste application. Sample volume collected during this second attempt will be utilized on a priority basis to analyze for constituents not analyzed during the initial attempt.

Total has been conducting soil-pore moisture sampling at the Arkansas City Refinery since 1981. It is Total's experience that sample volume collected from these lysimeters in this hydrogeological setting is routinely low and analyses for lower priority constituents can often not be performed because of inadequate sample volume. Total believes that their experience is not differential to soil-pore liquid sampling at other refining land treatment units across the country.

Total intends to continue conducting soil-pore liquid sampling and analyses in accordance with the referenced RCRA permit requirements. This analytical data will continue to be statistically evaluated and reported in accordance with the referenced permit.

If you have any questions or comments regarding this information, please call Mr. James Charles of Total Petroleum at (303) 291-2220.

Sincerely,

ENECOTECH INC.

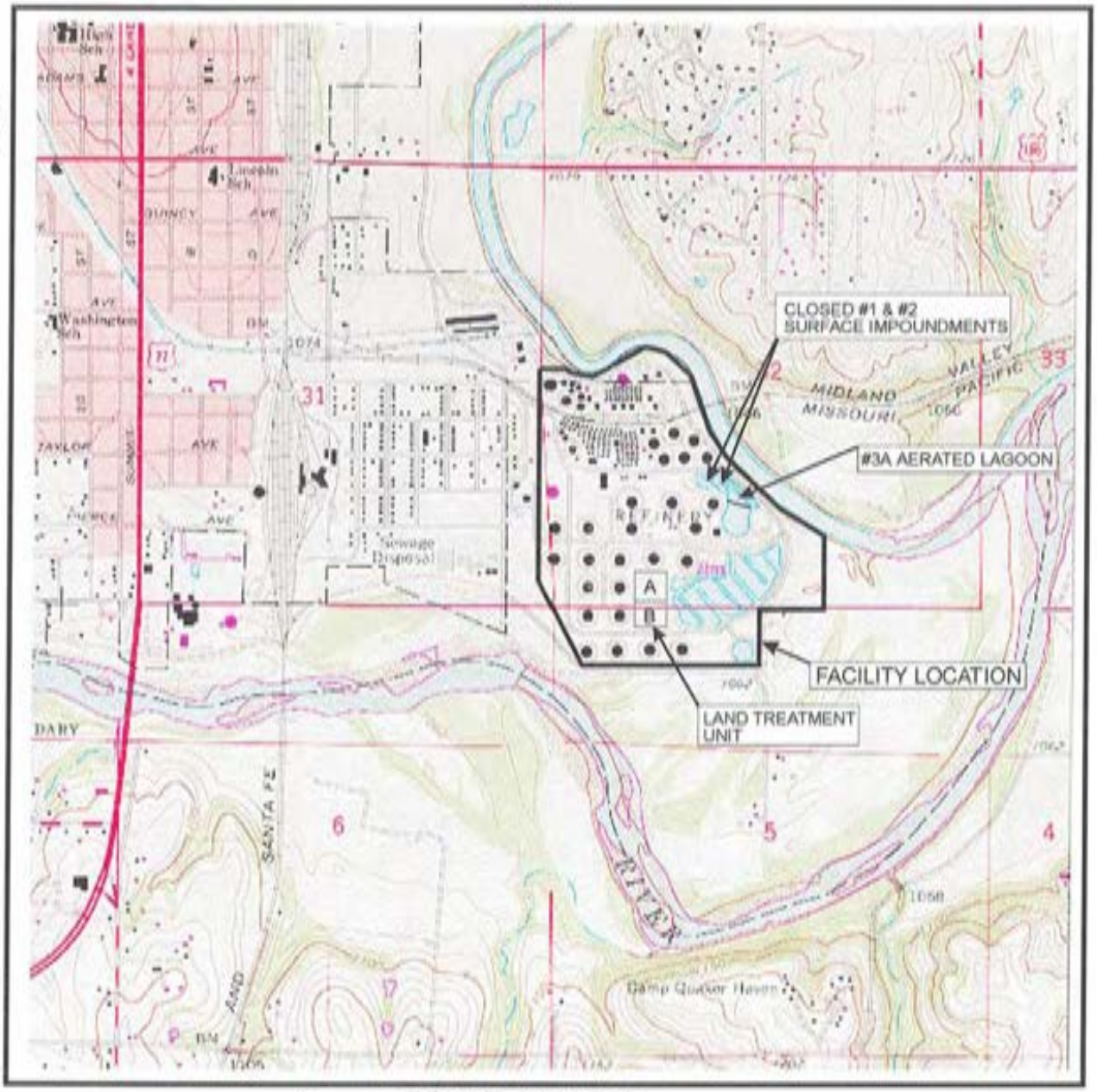
Timothy J. Maes
Project Hydrogeologist

TJM/cad

Attachments: Figure 1, Figure 2, sketch LTU of soil boring locations, Laboratory analytical reports

cc: J. Charles, Total
S. Travis, KDHE

R 4 E



SCALE 1: 24,000

1 1/2 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

.5 0 1 KILOMETER

CONTOUR INTERVAL: 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ARKANSAS CITY, KANS.
N3700-W9700/7.5
1965
PHOTOREVISED 1979
AMS 6558 II SE-SERIES V878

QUADRANGLE LOCATION

EnecoTech
ENVIRONMENTAL CONSULTANTS

FIGURE: 1

SITE LOCATION MAP

TOTAL PETROLEUM, INC.
ARKANSAS CITY REFINERY

PROJECT: TOTAL PETROLEUM, INC.

Table I - Total Petroleum, Inc., Arkansas City Refinery
Land Treatment Unit - 1996 Soil Pore (Lysimeter) Analysis
Event #1 - April 1996

	Background quoted from 9/88 Radian LTU report				mean	variance		t* (1996)	tc	significant		Plot A (North) (ppm) Event #1- April 96
Barium	0.45	0.12	0.24	0.21	0.255	0.0195		2.8503	4.541	NO		0.70
Chromium	< 0.01	< 0.01	< 0.05	< 0.02	0.0225	0.0004		-0.9261	4.541	NO		0.0029
Lead	0.009	< 0.01	< 0.05	0.013	0.0205	0.0004		-0.8382	4.541	NO	2	< 0.002
Benzene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!		0.0499
Toluene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!		0.0576
Xylenes	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!		0.0232
Anthracene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.0000	4	#VALUE!	4.541	#VALUE!	3	NM
Naphthalene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM
Phenanthrene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM
Chrysene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM

	Background quoted from 9/88 Radian LTU report				mean	variance		t* (1996)	tc	significant		Plot B (South) (ppm) Event #1- April 96
Barium	0.45	0.12	0.24	0.21	0.255	0.0195		0.2882	4.541	NO		0.30
Chromium	< 0.01	< 0.01	< 0.05	< 0.02	0.0225	0.0004		-0.9497	4.541	NO		0.0024
Lead	0.009	< 0.01	< 0.05	0.013	0.0205	0.0004		-0.7639	4.541	NO		0.0032
Benzene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!		0.0466
Toluene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!		0.0756
Xylenes	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!		0.0620
Anthracene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.0000	4	#VALUE!	4.541	#VALUE!	3	NM
Naphthalene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM
Phenanthrene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM
Chrysene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM

Notes

1 - NO means that the data does not indicate a significant change.
2 - used the detection limit for calculations.
3 - NM indicates insufficient sample available to perform all tests.
4 - t* cannot be calculated when variance = 0.
All concentrations reported in mg/kg (ppm)

Table I - Total Petroleum, Inc., Arkansas City Refinery
Land Treatment Unit - 1996 Soil Pore (Lysimeter) Analysis
Fall 1996

	Background quoted from 9/88 Radian LTU report				mean	variance		t* (1996)	tc	significant		Plot A (North) (ppm) Fall 1996
Barium	0.45	0.12	0.24	0.21	0.255	0.0195		3.4908	4.541	NO		0.8
Chromium	< 0.01	< 0.01	< 0.05	< 0.02	0.0225	0.0004		-0.6662	4.541	NO		0.0084
Lead	0.009	< 0.01	< 0.05	0.013	0.0205	0.0004		-0.8382	4.541	NO	2	< 0.002
Benzene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!		0.0200
Toluene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!		0.0393
Xylenes	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!		0.0253
Anthracene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.0000	4	#VALUE!	4.541	#VALUE!	3	NM
Naphthalene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM
Phenanthrene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM
Chrysene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM

	Background quoted from 9/88 Radian LTU report				mean	variance		t* (1996)	tc	significant		Plot B (South) (ppm) Fall 1996
Barium	0.45	0.12	0.24	0.21	0.255	0.0195		0.2882	4.541	NO		0.30
Chromium	< 0.01	< 0.01	< 0.05	< 0.02	0.0225	0.0004		-0.8174	4.541	NO		0.0052
Lead	0.009	< 0.01	< 0.05	0.013	0.0205	0.0004		-0.8382	4.541	NO	2	< 0.002
Benzene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!		0.0107
Toluene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!		0.0192
Xylenes	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!		0.0179
Anthracene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.0000	4	#VALUE!	4.541	#VALUE!	3	NM
Naphthalene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM
Phenanthrene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM
Chrysene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM

Notes

1 - NO means that the data does not indicate a significant change.
2 - used the detection limit for calculations.
3 - NM indicates insufficient sample available to perform all tests.
4 - t* cannot be calculated when variance = 0.
All concentrations reported in mg/kg (ppm)

Table I - Total Petroleum, Inc., Arkansas City Refinery
Land Treatment Unit - 1996 Soil Pore (Lysimeter) Analysis
4th Quarter 1996

	Background quoted from 9/88 Radian LTU report				mean	variance		t* (1996)	tc	significant	Plot A (North) (ppm) 4th Quarter 1996	
Barium	0.45	0.12	0.24	0.21	0.255	0.0195		#VALUE!	4.541	#VALUE!	3	NM
Chromium	< 0.01	< 0.01	< 0.05	< 0.02	0.0225	0.0004		#VALUE!	4.541	#VALUE!	3	NM
Lead	0.009	< 0.01	< 0.05	0.013	0.0205	0.0004		#VALUE!	4.541	#VALUE!	3	NM
Benzene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!	2	< 0.005
Toluene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!	2	< 0.005
Xylenes	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!	2	< 0.005
Anthracene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.0000	4	#VALUE!	4.541	#VALUE!	3	NM
Naphthalene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM
Phenanthrene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM
Chrysene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM

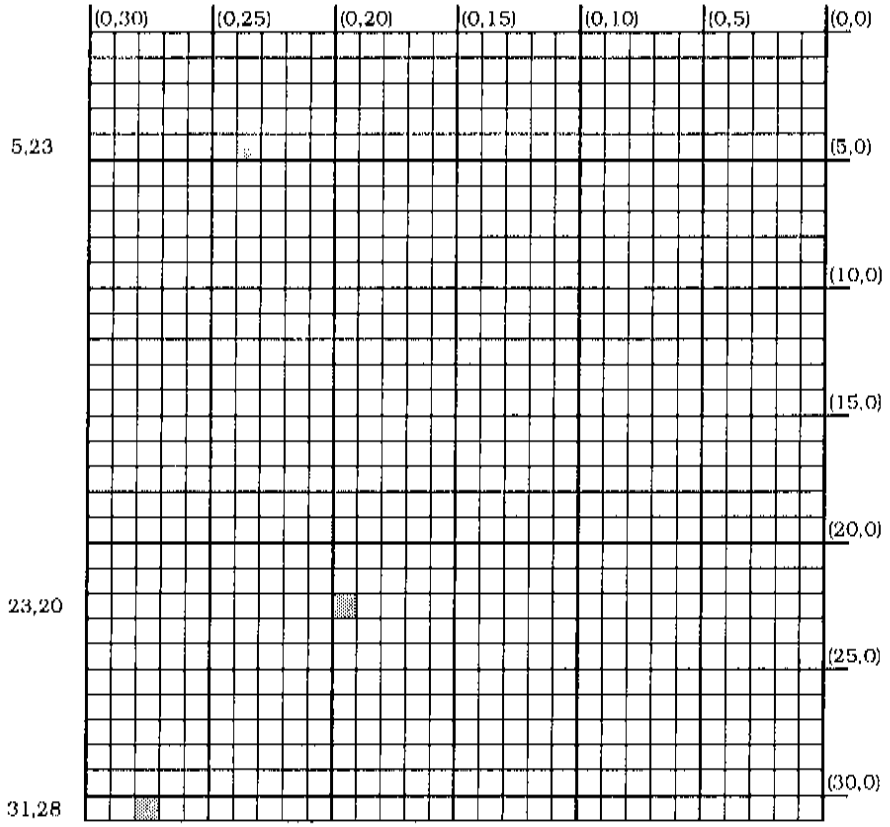
	Background quoted from 9/88 Radian LTU report				mean	variance		t* (1996)	tc	significant	Plot B (South) (ppm) 4th Quarter 1996	
Barium	0.45	0.12	0.24	0.21	0.255	0.0195		-0.0320	4.541	NO		0.25
Chromium	< 0.01	< 0.01	< 0.05	< 0.02	0.0225	0.0004		-0.7938	4.541	NO		0.0057
Lead	0.009	< 0.01	< 0.05	0.013	0.0205	0.0004		-0.1586	4.541	NO		0.017
Benzene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!	2	< 0.005
Toluene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!	2	< 0.005
Xylenes	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!	2	< 0.005
Anthracene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.0000	4	#VALUE!	4.541	#VALUE!	3	NM
Naphthalene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM
Phenanthrene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM
Chrysene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM

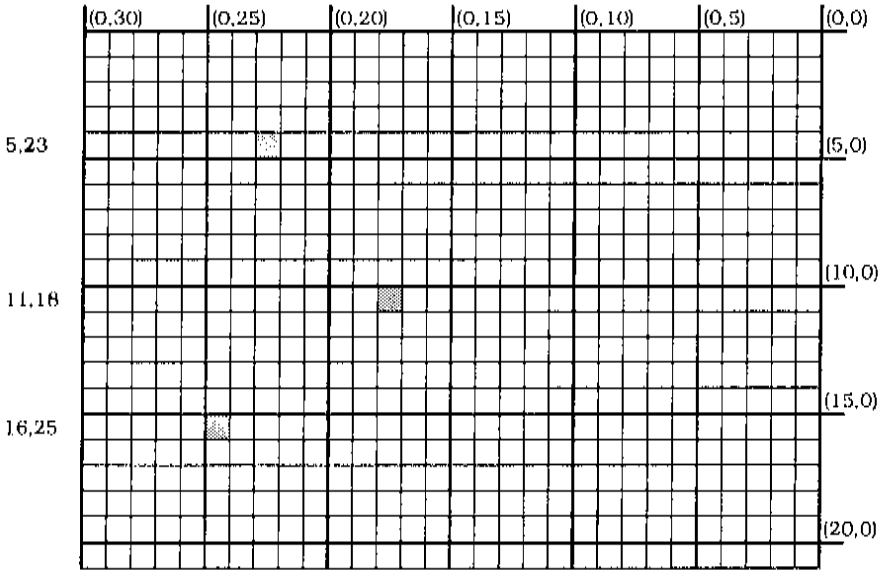
Notes

1 - NO means that the data does not indicate a significant change.
2 - used the detection limit for calculations.
3 - NM indicates insufficient sample available to perform all tests.
4 - t* cannot be calculated when variance = 0.
All concentrations reported in mg/kg (ppm)

Figure 2. - LTU - SOIL SAMPLING LOCATIONS - August 28, 1996
Total Petroleum Inc., Arkansas City Refinery

PLOT A - NORTH - 2.3 acres





PLOT B - SOUTH - 1.6 acres

Notes: From field sketch made by Chad Graves of Total Environmental Services on 8/28/96
= indicates approximate soil core sampling location

Table II - Total Petroleum, Inc. LTU Soil Core - 1996

	Background quoted from 9/88 Radian LTU repo		mean	variance		t* (1996)	tc	sign.	Treatment Zone Plot A-6'	Plot B-6'	mean
Barium	65	24	44.5	840.5		-0.5492	31.821	NO	20	30	25.00
Chromium	5.6	< 0.8	3.2	11.5		1.2750	31.821	NO	9.0	8.0	8.50
Lead	7	3.5	5.25	6.1		1.3197	31.821	NO	< 2.5	16	9.25
Benzene	< 0	< 0	0.002	0.0	4	#DIV/0!	31.821	#DIV/0!	0.58	6.270	3.42
Toluene	< 0	< 0	0.002	0.0	4	#DIV/0!	31.821	#DIV/0!	< 0.05	0.269	0.16
Xylenes	< 0	< 0	0.002	0.0	4	#DIV/0!	31.821	#DIV/0!	0.09	1.380	0.73
Anthracene	< 0.2	< 0.2	0.2	0.0	4	#DIV/0!	31.821	#DIV/0!	< 0.33	< 20	10.17
Naphthalen	< 0.2	< 0.2	0.2	0.0	4	#DIV/0!	31.821	#DIV/0!	< 0.33	< 20	10.17
Phenanthre	< 0.2	< 0.2	0.2	0.0	4	#DIV/0!	31.821	#DIV/0!	0.43	128.000	64.21
Chrysene	< 0.2	< 0.2	0.2	0.0	4	#DIV/0!	31.821	#DIV/0!	0.75	85.200	42.97

	Background quoted from 9/88 Radian LTU repo		mean	variance		t* (1996)	tc	sign.	Below Treatment Zone Plot A-7.5'	Plot B-7.5'	mean
Barium	65	24	44.5	840.5		0.0845	31.821	NO	60	35	47.50
Chromium	5.6	< 0.8	3.2	11.5		2.8386	31.821	NO	11	19	15.00
Lead	7	3.5	5.25	6.1		0.3299	31.821	NO	< 2.5	10	6.25
Benzene	< 0	< 0	0.002	0.0	4	#DIV/0!	31.821	#DIV/0!	0.59	0.533	0.56
Toluene	< 0	< 0	0.002	0.0	4	#DIV/0!	31.821	#DIV/0!	0.05	< 0.05	0.05
Xylenes	< 0	< 0	0.002	0.0	4	#DIV/0!	31.821	#DIV/0!	0.22	0.426	0.33
Anthracene	< 0.2	< 0.2	0.2	0.0	4	#DIV/0!	31.821	#DIV/0!	< 0.33	< 0.667	0.50
Naphthalen	< 0.2	< 0.2	0.2	0.0	4	#DIV/0!	31.821	#DIV/0!	< 0.33	< 0.667	0.50
Phenanthre	< 0.2	< 0.2	0.2	0.0	4	#DIV/0!	31.821	#DIV/0!	< 0.33	4.640	2.49
Chrysene	< 0.2	< 0.2	0.2	0.0	4	#DIV/0!	31.821	#DIV/0!	< 0.33	3.820	2.08

Notes

1 - NO means that the data does not indicate a significant change.
2 - used the detection limit for calculations.
3 - NM indicates insufficient sample available to perform all tests.
4 - t* cannot be calculated when variance = 0.
All concentrations reported in mg/kg (ppm)

1996 ANNUAL LAND TREATMENT UNIT REPORT

APPENDIX - A

LTU Lysimeter Laboratory Analytical Reports

Accurate Labs

April 18, 1996

Client: Total Petroleum Inc.
1400 South "M" Street
Arkansas City, KS 67005

Requested by: Rich Thomas

Project Name:	**Lysimeters 1996 Event # 1**
Sample Locations:	**Plot A** *and* **Plot B**
Date Samples Collected:	April 11, 1996 (Time: 1030)
Date Samples Received:	April 12, 1996 (Time: 1400)
Sample Type:	*Composite*
Sample Matrix:	***Water***
Lab Log Number:	**D5245** *and* **D5246**
Kansas Certification:	E-219 / E1192
Oklahoma Certification:	OWRB-8316 *and* OCC-0218
Method Reference:	40 CFR 136, 261 Method for Chemical Analysis of Water and Waste EPA-600/4-79-020, March, 1983. Test Method for Evaluating Solid Waste, SW-846, 1986. Standard Methods for the Examination of Water and Wastewater, 18th Edition.

Plot A (C5245)

Metals

Parameter	Results,mg/L	PQL*,mg/L	Date/Time of Analysis	Analyst	Method
Barium (Ba)	**0.70**	0.05	04/16/96 / 1030	RF	6010
Chromium (Cr)	**0.0029**	0.002	04/17/96 / 0900	SM/AG	7191
Lead (Pb)	BPQL	0.002	04/16/96 / 0900	SM	7421

Sample prepared by CP on 04/15/96 at 1300 (Method 3020).

VOLATILES - ***GC/Method 8020***

Compound	Results,ug/L	Practical Quantitation Limits, ug/L
Benzene	**49.9**	5.00
Toluene	**57.6**	5.00
Total Xylenes	**23.2**	5.00

Analysis performed by YD on 04/13/96 at 0112.

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects. BPQL: Below Practical Quantitation Limits (if applicable).

(cont.)

Plot B (D5246)

Metals

Parameter	Results,mg/L	PQL*,mg/L	Date/Time of Analysis	Analyst	Method
Barium (Ba)	**0.30**	0.05	04/16/96 / 1030	RF	6010
Chromium (Cr)	**0.0024**	0.002	04/17/96 / 0900	SM/AG	7191
Lead (Pb)	**0.0032**	0.002	04/16/96 / 0900	SM	7421

Sample prepared by CP on 04/15/96 at 1300 (Method 3020).

VOLATILES - ***GC/Method 8020***

Compound	Results,ug/L	Practical Quantitation Limits, ug/L
Benzene	46.6	5.00
Toluene	75.6	5.00
Total Xylenes	62.0	5.00

Analysis performed by YD on 04/13/96 at 0152.

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects. BPQL: Below Practical Quantitation Limits (if applicable).

George Drye,
Laboratory Manager
GD: jm / Lysimt01.doc

QA/QC

April 18, 1996

METALS

Parameter	% Duplicate Recovery	% Spike Recovery
Barium (Ba)	100	104
Chromium (Cr)	99	78
Lead (Pb)	100	84

VOLATILES - Method 8020 (MS/MSD RECOVERIES)

COMPOUND	SAMPLE CONC	SPIKE ADDED	SPIKE RESULT	DUP RESULT	SPIKE % REC	DUP % REC	RPD	RPD LIMIT	% REC LIMIT
BENZENE	0.12	50	53	53	106.1	105.9	0.2	15	75-125
TOLUENE	0.3	50	47	47	93.1	92.9	0.2	15	75-125
ETHYLBENZENE	0.37	50	46	46	90.8	90.6	0.2	15	75-125
m,p-XYLENE	0.34	100	85	84	84.3	83.5	1.0	15	75-125
o-XYLENE	0.5	50	45	45	89.3	88.9	0.5	15	75-125

A blank analysis was run with each batch (~10-15 samples per batch)

№ 10962

Accurate, Inc. Environmental & Laboratory Services

Chain of Custody

For Office Use Only

Client Name: Total Petroleum, Inc
Arkansas City, KS

Project Name: Lysimeters Event 1 1996

Lab Log #	Date Sample Taken	Time Sample Taken	Matrix (Water (W) Soil (S) Sludge (Sl) Specify Other)	GRAB	COMP	Client I.D. Sample Location	TEMP °C °F	# of Containers	Pb, Cr, Ba	Benzene, Toluene, Xylene (all)	Insufficient Sample				
Sample Preservation →									Refrig	HNO3	Refrig HCL	Refrig			
D5245	4/11/96	10:30 Am	W		✓	Plot A	<4	3	✓	2	0				
D5246	4/11/96	10:30 Am	W		✓	Plot B	<4	3	✓	2	0				

Sampled By: Carl West

Relinquished By:	Date/Time	Received By:	Date/Time
Richard Thomas	4/12/96 11:11		4-12-96 1111
Relinquished to Lab By:	Date/Time	Received at Lab By:	Date/Time
	4-12-96 1400		4-12-96 1400

Samples on Ice - 1.0°C

Contact Person: Richard Thomas
Address: Total Petroleum Inc
1400 South M Street
Arkansas City, KS 67005
Phone / Fax Number: 316 442-5100 ext 5720

Send Invoice To: Rhonda Adams
Address: same
Phone / Fax Number:
P.O. #

Accurate Labs

September 18, 1996

Client: Total Petroleum, Inc.
P.O. Box 500
Denver, CO 80201

Requested by: Jim Charles

Project Name:	Lysimeter - Fall 1996
Sample Locations:	LTU Plot A *and* LTU Plot B
Date Samples Collected:	September 11, 1996 (Time: 1000 *for* Plot A & 1030 *for* Plot B)
Date Samples Received:	September 11, 1996 (Time: 1735)
Sample Type:	*Composite*
Sample Matrix:	*Water*
Lab Log Number:	D8838 *and* D8839
Kansas Certification:	E-219 / E1192
Oklahoma Certification:	DEQ 8316 / Drinking Water, DEQ D9602
Method Reference:	40 CFR 136, 261 Method for Chemical Analysis of Water and Waste EPA-600/4-79-020, March, 1983. Test Method for Evaluating Solid Waste, SW-846, 1986. Latest EPA approved Standard Methods for the Examination of Water and Wastewater.

LTU Plot A (D8838)

Metals

Parameter	Results, mg/L	PQL*, mg/L	*Date/Time of Analysis*	*Analyst*	*Method*
Barium (Ba)	0.80	0.05	09/17/96 / 1600	RF	6010
Chromium (Cr)	0.0084	0.002	09/18/96 / 0845	SM	7191
Lead (Pb)	BPQL	0.002	09/16/96 / 0815	SM	7421

Sample prepared by CP on 09/12/96 @ 1400 (Method 3020).

VOLATILES - *GC/ Method 8020A*

Compound	Results, µg/L	Practical Quantitation Limits, µg/L
Benzene	20.0	5.00
Toluene	39.3	5.00
Total Xylenes	25.3	5.00

Analysis performed by YD on 09/16/96@ 1115.

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects. BPQL: Below Practical Quantitation Limits (if applicable).

(cont.)

505 S. Lowry Street ■ Stillwater, OK 74074 ■ 405-372-5300 ■ Fax: 405-372-5396
OKC: 405-236-5333 ■ Tulsa: 918-587-5300 ■ Wichita: 316-683-1123 ■ Enid 405-237-5353

LTU Plot B (D8839)

Metals

Parameter	Results, mg/L	PQL*, mg/L	*Date/Time of Analysis*	*Analyst*	*Method*
Barium (Ba)	0.30	0.05	09/17/96 / 1600	RF	6010
Chromium (Cr)	0.0052	0.002	09/18/96 / 0845	SM	7191
Lead (Pb)	BPQL	0.002	09/16/96 / 0815	SM	7421

Sample prepared by CP on 09/12/96 @ 1400 (Method 3020).

VOLATILES - *GC/ Method 8020A*

Compound	Results, µg/L	Practical Quantitation Limits, µg/L
Benzene	10.7	5.00
Toluene	19.2	5.00
Total Xylenes	17.9	5.00

Analysis performed by YD on 09/16/96@ 1146.

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects. BPQL: Below Practical Quantitation Limits (if applicable).

George Drye,
Laboratory Manager
GD: jm / Lysim02.doc

QA/QC

September 18, 1996

METALS

Parameter	% Duplicate Recovery	% Spike Recovery
Barium (Ba)	100	82
Chromium (Cr)	100	94
Lead (Pb)	100	78

VOLATILES - Method 8020A (MS/MSD RECOVERIES)

COMPOUND	SAMPLE CONC	SPIKE ADDED	SPIKE RESULT	DUP RESULT	SPIKE % REC	DUP % REC	RPD	RPD LIMIT	% REC LIMIT
BENZENE	0.18	50	43	42	84.7	84.5	0.2	15	75-125
TOLUENE	0.35	50	42	43	83.3	84.9	1.8	15	75-125
ETHYLBENZENE	0	50	41	44	82.8	87.1	5.0	15	75-125
m,p-XYLENE	0.14	100	81	82	81.2	81.5	0.3	15	75-125
o-XYLENE	0.11	50	44	45	88.6	90.6	2.2	15	75-125

A blank analysis was run with each batch (~10-15 samples per batch)

Accurate Inc Environmental & Laboratory Services

Chain of Custody

Client Name: Total Petroleum -- Arkansas City

Project Name: Lysimeter - ~~Spring~~ Fall 1996

Lab Log #	Date Sample Taken	Time Sample Taken	Matrix Water (W) Soil (S) Sludge (Sl) Other	GRAB	COMP	Client I.D. Sample Location	TEMP °C, °F	# of Containers	Pb, Cr, Ba	Benzene, Toluene Xylene					
								Sample Preserv	ICE HNO3	ICE HCL	ICE				
D8838	9-11-96	1000	Water		X	LTU Plot A	4c	4	1	2					
D8839	9-11-96	1030	Water		X	LTU Plot B	4c	4	1	2					

Comments: Samples on 3 coolers

Sampled By: Carl H. West

Relinquished By:	Date/Time	Received By:	Date/Time
Carl H. West	9-11-96 / 5pm	M Mathews	9/11/96 13:45
Relinquished By:	Date/Time	Received By:	Date/Time
Relinquished to Lab By: M Mathews	Date/Time 9/11/96 1735	Received at Lab By:	Date/Time 9/11/96 1735

Report To: ~~Rich Thomas~~ Tim Charles
Address: 1400 S. M Street
PO Box 589
Arkansas City, KS 67005
Phone / Fax Number: 316-442-5100 ext.5720 – Fax: 405-442-1544

Send Invoice To:
Address: 1400 S. M Street
PO Box 589
Arkansas City, KS 67005
Phone / Fax Number:

P.O. # _____

Accurate Labs

January 3, 1997

Client: Total Petroleum, Inc.
P.O. Box 500
Denver, CO 80201

Requested by: Jim Charles

Project Name:	4th Quarter Lysimeters
Sample Locations:	LTU South Plot *and* LTU North Plot
Date Samples Collected:	N/A
Date Samples Received:	December 21, 1996 (Time: 1000)
Sample Type:	*Composite*
Sample Matrix:	*Water*
Lab Log Number:	E4053 *and* E4054
Kansas Certification:	E-219 / E1192
Oklahoma Certification:	DEQ 8316 / Drinking Water, DEQ D9602
Method Reference:	40 CFR 136, 261 Method for Chemical Analysis of Water and Waste EPA-600/4-79-020, March, 1983. Test Method for Evaluating Solid Waste, SW-846, 1986. Latest EPA approved Standard Methods for the Examination of Water and Wastewater.

LTU South Plot (E4053)

Metals

Parameter	Results, mg/L	PQL*, mg/L	*Date/Time of Analysis*	*Analyst*	*Method*
Barium (Ba)	0.25	0.0004	12/24/96 / 0900	RF	6010
Chromium (Cr)	0.0057	0.003	12/24/96 / 0900	RF	6010
Lead (Pb)	0.017	0.010	12/24/96 / 0900	RF	6010

Sample prepared by RF on 12/23/96 @ 1200 (Method 3005).

VOLATILES - *GC/ Method 8020A*

Compound	Results, µg/L	Practical Quantitation Limits, µg/L
Benzene	BPQL	5.00
Toluene	BPQL	5.00
Total Xylenes	BPQL	5.00

Analysis performed by YD on 01/02/97@ 2347.

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects. BPQL: Below Practical Quantitation Limits (if applicable).

(cont.)

LTU North Plot (E4054)

VOLATILES - *GC/ Method 8020A*

Compound	Results, µg/L	Practical Quantitation Limits, µg/L*
Benzene	BPQL	5.00
Toluene	BPQL	5.00
Total Xylenes	BPQL	5.00

Analysis performed by YD on 01/03/97@ 0020.

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects. BPQL: Below Practical Quantitation Limits (if applicable).

George Drye,
Laboratory Manager
GD: jm / Lysimr04.doc

QA/QC

January 3, 1997

METALS

Parameter	% Duplicate Recovery	% Spike Recovery
Barium (Ba)	100	99
Chromium (Cr)	100	87
Lead (Pb)	100	77

VOLATILES - Method 8020A (MS/MSD RECOVERIES)

COMPOUND	SAMPLE CONC	SPIKE ADDED	SPIKE RESULT	DUP RESULT	SPIKE % REC	DUP % REC	RPD	RPD LIMIT	% REC LIMIT
BENZENE	0.12	25	23	24	92.2	94.8	2.7	15	75-125
TOLUENE	0.22	75	67	69	89.3	91.9	2.9	15	75-125
ETHYLBENZENE	0	25	23	24	92.6	96.7	4.3	15	75-125
m,p-XYLENE	0.18	50	39	41	78.3	80.7	3.0	15	75-125
o-XYLENE	0	50	47	49	94.7	98.2	3.6	15	75-125
1,2,4-Trimethylbenzene	0	50	45	46	89.4	92.5	3.4	15	75-125

A blank analysis was run with each batch (~10-15 samples per batch)

1996 ANNUAL LAND TREATMENT UNIT REPORT

APPENDIX - B

LTU Soil Core Laboratory Analytical Reports

Accurate Labs

September 16, 1996

Client: Total Petroleum, Inc.
P.O. Box 500
Denver, CO 80201

Requested by: Jim Charles

Project Name: *Land Treatment Unit Soil Core Sampling*

Sample Location: LTU A 6' *and* LTU A 7.5'
Date Samples Collected: August 28, 1996 (Time: N/A)
Date Samples Received: August 28, 1996 (Time: 1825)
Sample Type / Matrix: *Composite / Soil*
Lab Log Number: D8514 *and* D8515
Kansas Certification: E-219 / E1192
Oklahoma Certification: DEQ 8316 / **Drinking Water, DEQ D9602**
Method Reference: 40 CFR 136, 261 Method for Chemical Analysis of Water and Waste EPA-600/4-79-020, March, 1983. Test Method for Evaluating Solid Waste, SW-846, 1986. Latest EPA approved Standard Methods for the Examination of Water and Wastewater.

LTU A 6' (D8514)

Parameter	Results	PQL*	*Date/Time of Analysis*	*Analyst*	*Method*
pH	8.30 *s.u.*	0-14	08/30/96 / 1445	KL	9045
CEC (Cation Exchange Capacity)	3.2 *meq/100 grams*	0.027	09/09/96 / 1100	RF/SM	9081

Sample prepared for CEC by CP on 09/06/96 @ 1400.

Parameter	Results, mg/Kg *	PQL*, mg/Kg	*Date/Time of Analysis*	*Analyst*	*Method*
Barium (Ba)	20	2.5	09/06/96 / 1045	RF	6010
Chromium (Cr)	9.0	2.5	09/06/96 / 1130	RF	6010
Lead (Pb)	BPQL	2.5	09/04/96 / 1530	RF	6010

* *Results are reported as mg/Kg on a dry weight basis.* Samples prepared by CP on 09/03/96 @ 1300 (Method 3051).

Volatiles (GC/MS Method 8260a)

Compound	Results, µg/Kg	Practical Quantitation Limit*, µg/Kg
Benzene	576	50.0
Toluene	BPQL	50.0
Xylenes *(Total)*	85.7	50.0

Analysis performed by GC/DK on 09/09/96 @ 1236.

Semi-Volatiles - Base/Neutral compounds (GC/MS Method 8270)

Compound	Results, µg/Kg	Practical Quantitation Limit*, µg/Kg
Anthracene	BPQL	333
Napthalene	BPQL	333
Phenanthrene	426	333
Chrysene	749	333

Sample prepared by YZ/DK on 09/04/96 @ 1730 (Method 3550). Analysis performed by YZ/DK on 09/09/96 @ 1112.

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects. BPQL: Below Practical Quantitation Limits (if applicable).

(cont.)

LTU A 7.5' (D8515)

Parameter	Results, mg/Kg •	PQL*, mg/Kg	*Date/Time of Analysis*	*Analyst*	*Method*
Barium (Ba)	60	2.5	09/06/96 / 1045	RF	6010
Chromium (Cr)	11	2.5	09/06/96 / 1130	RF	6010
Lead (Pb)	BPQL	2.5	09/04/96 / 1530	RF	6010

• *Results are reported as mg/Kg on a dry weight basis.* Samples prepared by CP on 09/03/96 @ 1300 (Method 3051).

Volatiles (GC/MS Method 8260a)

Compound	Results, µg/Kg	Practical Quantitation Limit*, µg/Kg
Benzene	585	50.0
Toluene	51.8	50.0
Xylenes *(Total)*	224	50.0

Analysis performed by GC/DK on 09/09/96 @ 1307.

Semi-Volatiles - Base/Neutral compounds (GC/MS Method 8270)

Compound	Results, µg/Kg	Practical Quantitation Limit*, µg/Kg
Anthracene	BPQL	333
Napthalene	BPQL	333
Phenanthrene	BPQL	333
Chrysene	BPQL	333

Sample prepared by YZ/DK on 09/04/96 @ 1730 (Method 3550). Analysis performed by YZ/DK on 09/09/96 @ 1026.

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects. BPQL: Below Practical Quantitation Limits (if applicable).

GD:jm / LTU03.doc

September 16, 1996

Client: Total Petroleum, Inc.
P.O. Box 500
Denver, CO 80201

Requested by: Jim Charles

Project Name: *Land Treatment Unit Soil Core Sampling*

Sample Location: LTU B 6' *and* LTU B 7.5'
Date Samples Collected: August 28, 1996 (Time: N/A)
Date Samples Received: August 28, 1996 (Time: 1825)
Sample Type / Matrix: *Composite / Soil*
Lab Log Number: D8516 *and* D8517
Kansas Certification: E-219 / E1192
Oklahoma Certification: DEQ 8316 / Drinking Water, DEQ D9602
Method Reference: 40 CFR 136, 261 Method for Chemical Analysis of Water and Waste EPA-600/4-79-020, March, 1983. Test Method for Evaluating Solid Waste, SW-846, 1986. Latest EPA approved Standard Methods for the Examination of Water and Wastewater.

LTU B 6' (D8516)

Parameter	Results	PQL*	*Date/Time of Analysis*	*Analyst*	*Method*
pH	7.22 *s.u.*	0-14	08/30/96 / 1445	KL	9045
CEC (Cation Exchange Capacity)	4.4 *meq/100 grams*	0.054	09/09/96 / 1100	RF/SM	9081

Sample prepared for CEC by CP on 09/06/96 @ 1400.

Parameter	Results, mg/Kg •	PQL*, mg/Kg	*Date/Time of Analysis*	*Analyst*	*Method*
Barium (Ba)	30	2.5	09/06/96 / 1045	RF	6010
Chromium (Cr)	8.0	2.5	09/06/96 / 1130	RF	6010
Lead (Pb)	16	2.5	09/04/96 / 1530	RF	6010

• *Results are reported as mg/Kg on a dry weight basis.* Samples prepared by CP on 09/03/96 @ 1300 (Method 3051).

Volatiles (GC/MS Method 8260a)

Compound	Results, µg/Kg	Practical Quantitation Limit*, µg/Kg
Benzene	6,270	50.0
Toluene	269	50.0
Xylenes *(Total)*	1,380	50.0

Analysis performed by GC/DK on 09/09/96 @ 1338.

Semi-Volatiles - Base/Neutral compounds (GC/MS Method 8270)

Compound	Results, µg/Kg	Practical Quantitation Limit*, µg/Kg
Anthracene	BPQL	20,000
Napthalene	BPQL	20,000
Phenanthrene	128,000	20,000
Chrysene	85,200	20,000

Sample prepared by YZ/DK on 09/04/96 @ 1730 (Method 3550). Analysis performed by YZ/DK on 09/06/96 @ 0701.

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects. BPQL: Below Practical Quantitation Limits (if applicable).

(cont.)

LTU B 7.5' (D8517)

Parameter	Results, mg/Kg •	PQL*, mg/Kg	*Date/Time of Analysis*	*Analyst*	*Method*
Barium (Ba)	35	2.5	09/06/96 / 1045	RF	6010
Chromium (Cr)	19	2.5	09/06/96 / 1130	RF	6010
Lead (Pb)	10	2.5	09/04/96 / 1530	RF	6010

• *Results are reported as mg/Kg on a dry weight basis.* Samples prepared by CP on 09/03/96 @ 1300 (Method 3051).

Volatiles (GC/MS Method 8260a)

Compound	Results, µg/Kg	Practical Quantitation Limit*, µg/Kg
Benzene	533	50.0
Toluene	BPQL	50.0
Xylenes *(Total)*	426	50.0

Analysis performed by GC/DK on 09/09/96 @ 1409.

Semi-Volatiles - Base/Neutral compounds (GC/MS Method 8270)

Compound	Results, µg/Kg	Practical Quantitation Limit*, µg/Kg
Anthracene	BPQL	667
Napthalene	BPQL	667
Phenanthrene	4,640	667
Chrysene	3,820	667

Sample prepared by YZ/DK on 09/04/96 @ 1730 (Method 3550). Analysis performed by YZ/DK on 09/09/96 @ 1244.

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects. BPQL: Below Practical Quantitation Limits (if applicable).

George Drye,
Laboratory Manager
GD:jm / CTU03.doc

QA/QC

September 16, 1996

Parameter	% Duplicate Recovery	% Spike Recovery
pH	98	N/A
Barium (Ba)	97	106
Chromium (Cr)	100	88
Lead (Pb)	100	107

A blank analysis was run with each batch (~10 samples per batch)

VOLATILES - Method 8260a (MS/MSD RECOVERIES)

COMPOUND	SAMPLE CONC	SPIKE ADDED	SPIKE RESULT	DUP RESULT	SPIKE % REC	DUP % REC	RPD	RPD LIMIT	% REC LIMIT
1,1-DICHLOROETHENE	0.0	10	11	17	112	169	41	14	61-145
BENZENE	0.1	10	14	13	135	132	2	13	76-130
TRICHLOROETHENE	0.1	10	10	10	102	99	3	14	71-120
TOLUENE	0.1	10	10	10	103	100	3	13	76-125
CHLOROBENZENE	0.5	10	10	10	98	96	2	11	76-127

BASE NEUTRAL/ ACIDS-METHOD 8270 (MS/MSD RECOVERIES)

COMPOUND	SAMPLE CONC	SPIKE ADDED	SPIKE RESULT	DUP RESULT	SPIKE % REC	DUP % REC	RPD	RPD LIMIT	% REC LIMIT
PHENOL	0.1	75	54	52	72	70	3	42	12-109
2-CHLOROPHENOL	0.0	75	57	57	75	76	1	40	27-123
1,4-DICHLOROBENZENE	0.0	50	32	31	63	63	1	28	36- 94
N-NITROSO-DI-N-PROPY	0.0	50	38	38	75	76	1	38	41-116
1,2,4-TRICHLOROBENZE	0.0	50	31	30	63	61	3	28	39- 98
4-CHLORO-3-METHYL PH	0.0	75	56	56	75	75	1	42	23- 97
ACENAPTHENE	0.4	50	42	42	83	83	0	31	46-118
4-NITROPHENOL	0.7	75	89	93	118	123	4	50	10- 80
2,4-DINITROTOLUENE	0.2	50	36	38	72	75	4	38	25- 95
PENTACHLOROPHENOL	0.0	75	68	68	91	90	0	50	9-103
PYRENE	4.6	50	40	40	70	71	1	31	26-127

A blank analysis was run with each batch (~10-15 samples per batch)

EnecoTech Inc.
1580 Lincoln Street • Suite 1000
Denver, Colorado 80203
(303) 861-2200 • Fax (303) 861-2201

EnecoTech

February 26, 1998

Ms. Andrea L. Austin, M.S.
Environmental Scientist
Hazardous Waste Facilities Unit
Permit Section
Kansas Department of Health and Environment
Forbes Field, Building 740
Topeka, Kansas 66620

01-0138R-014/500

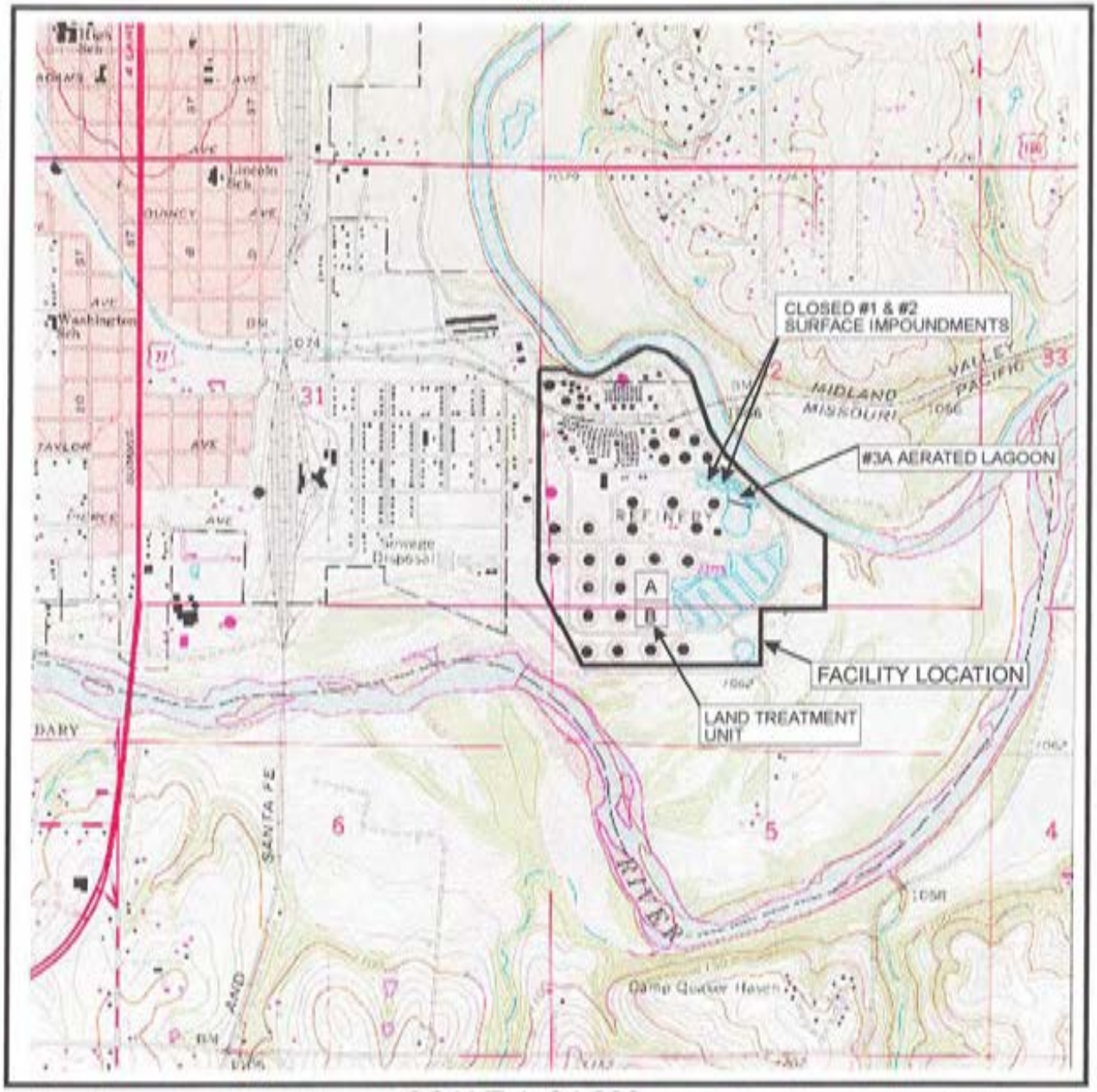
Re: Total Petroleum, Inc.
Arkansas City Refinery
Permit No.: KSD087418695
Land Treatment Unit
Annual Unsaturated Zone Monitoring Report

Dear Ms. Austin:

Enclosed please find the annual unsaturated zone monitoring report for the lysimeter and soil core analyses performed on Total's land treatment unit (LTU) located at the Arkansas City Refinery in Cowley County, Kansas. The site location map for the unit is shown as Figure 1.

Three lysimeter sampling events were conducted on June 27, 1997, July 22, 1997, and August 5, 1997. Insufficient liquid volume was collected during the second and third sampling events to allow any analysis of the soil pore moisture. Consequently, only analytical data from the June 27th sampling event is included in this report. A summary of the lysimeter analytical results that could be obtained from the limited sample volume and the statistical analyses of this data are presented in Table 1. The respective laboratory analytical reports are included in Appendix A. Soil core samples were collected on September 3, 1997. A summary of these analytical results and statistical analyses are presented in Table 2. The soil core laboratory analytical results are included in Appendix B. The required statistical evaluation of lysimeter and soil data indicates that there is no evidence of a release from the land treatment unit.

R 4 E



T 34 S

T 35 S

SCALE 1: 24,000

1 1/2 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

0 .5 0 1 KILOMETER

CONTOUR INTERVAL: 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ARKANSAS CITY, KANS.
N3700-W9700/7.5
1965
PHOTOREVISED 1979
AMS 6568 II SE-SERIES V878

QUADRANGLE LOCATION

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FIGURE: 1

SITE LOCATION MAP

TOTAL PETROLEUM, INC.
ARKANSAS CITY REFINERY

PROJECT: TOTAL PETROLEUM, INC.

	T J M	
	L K B	

Table 1 - Land Treatment Unit - Lysimeter (Soil Pore Moisture) Monitoring
Total Petroleum, Inc., Arkansas City Refinery
June 27, 1997

	Background quoted from 9/88 Radian LTU report				mean	variance	notes	t*	tc	significant	notes	Plot A (North) (mg/l)
Barium	0.45	0.12	0.24	0.21	0.255	0.0195		4.3235	4.541	NO		0.93
Chromium	< 0.01	< 0.01	< 0.05	< 0.02	0.0225	0.0004		-0.9214	4.541	NO	2	< 0.003
Lead	0.009	< 0.01	< 0.05	0.013	0.0205	0.0004		-0.4758	4.541	NO	2	< 0.01
Benzene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!		0.034
Toluene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!	2	< 0.005
Xylenes	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!		0.006
Anthracene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.0000	4	#VALUE!	4.541	#VALUE!	3	NM
Naphthalene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM
Phenanthrene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM
Chrysene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM

	Background quoted from 9/88 Radian LTU report				mean	variance	notes	t*	tc	significant	notes	Plot B (South) (mg/l)
Barium	0.45	0.12	0.24	0.21	0.255	0.0195		#VALUE!	4.541	#VALUE!	3	NM
Chromium	< 0.01	< 0.01	< 0.05	< 0.02	0.0225	0.0004		#VALUE!	4.541	#VALUE!	3	NM
Lead	0.009	< 0.01	< 0.05	0.013	0.0205	0.0004		#VALUE!	4.541	#VALUE!	3	NM
Benzene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!	2	< 0.005
Toluene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!	2	< 0.005
Xylenes	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!	2	< 0.005
Anthracene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.0000	4	#VALUE!	4.541	#VALUE!	3	NM
Naphthalene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM
Phenanthrene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM
Chrysene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NM

Notes

1 - NO means that the data does not indicate a significant change.
2 - used the detection limit for calculations.
3 - NM indicates insufficient sample available to perform all tests.
4 - t* cannot be calculated when variance = 0.
All concentrations reported in mg/l (ppm)

Table 2 - Land Treatment Unit - Soil Core Monitoring
Total Petroleum, Inc., Arkansas City Refinery
September 3, 1997

	Background quoted from 9/88 Radian LTU repo		mean	variance	notes	t*	tc	sign.	Treatment Zone notes	Plot A-6'	notes	Plot B-6'	mean
Barium	65	24	44.5	840.5		-0.1267	31.821	NO		22		58	40.00
Chromium	5.6	< 0.8	3.2	11.5		0.7818	31.821	NO		6.0		6.9	6.45
Lead	7	3.5	5.25	6.1		1.4846	31.821	NO		9.5		10	9.75
Benzene	< 0	< 0	0.002	0.0	4	#DIV/0!	31.821	#DIV/0!	2	< 0.002	2	< 0.002	0.00
Toluene	< 0	< 0	0.002	0.0	4	#DIV/0!	31.821	#DIV/0!		0.008		0.025	0.02
Xylenes	< 0	< 0	0.002	0.0	4	#DIV/0!	31.821	#DIV/0!		0.004		0.010	0.01
Anthracene	< 0.2	< 0.2	0.2	0.0	4	#DIV/0!	31.821	#DIV/0!	2	< 0.333	2	< 0.333	0.33
Naphthalen	< 0.2	< 0.2	0.2	0.0	4	#DIV/0!	31.821	#DIV/0!	2	< 0.333	2	< 0.333	0.33
Phenanthre	< 0.2	< 0.2	0.2	0.0	4	#DIV/0!	31.821	#DIV/0!	2	< 0.333	2	< 0.333	0.33
Chrysene	< 0.2	< 0.2	0.2	0.0	4	#DIV/0!	31.821	#DIV/0!	2	< 0.333	2	< 0.333	0.33

	Background quoted from 9/88 Radian LTU repo		mean	variance	notes	t*	tc	sign.	Below Treatment Zone notes	Plot A-7.5'	notes	Plot B-7.5'	mean
Barium	65	24	44.5	840.5		-0.2253	31.821	NO		17		56	36.50
Chromium	5.6	< 0.8	3.2	11.5		1.6118	31.821	NO		3.8		16	9.90
Lead	7	3.5	5.25	6.1		2.5403	31.821	NO		6.9		19	12.95
Benzene	< 0	< 0	0.002	0.0	4	#DIV/0!	31.821	#DIV/0!	2	< 0.002	2	< 0.02	0.01
Toluene	< 0	< 0	0.002	0.0	4	#DIV/0!	31.821	#DIV/0!		0.03		0.063	0.05
Xylenes	< 0	< 0	0.002	0.0	4	#DIV/0!	31.821	#DIV/0!		0.005		0.031	0.02
Anthracene	< 0.2	< 0.2	0.2	0.0	4	#DIV/0!	31.821	#DIV/0!	2	< 0.333	2	< 0.333	0.33
Naphthalen	< 0.2	< 0.2	0.2	0.0	4	#DIV/0!	31.821	#DIV/0!	2	< 0.333	2	< 0.333	0.33
Phenanthre	< 0.2	< 0.2	0.2	0.0	4	#DIV/0!	31.821	#DIV/0!	2	< 0.333	2	< 0.333	0.33
Chrysene	< 0.2	< 0.2	0.2	0.0	4	#DIV/0!	31.821	#DIV/0!	2	< 0.333	2	< 0.333	0.33

Notes
1 - NO means that the data does not indicate a significant change.
2 - used the detection limit for calculations.
3 - NM indicates insufficient sample available to perform all tests.
4 - t* cannot be calculated when variance = 0.
All concentrations reported in mg/kg (ppm)

The LTU is divided by a roadway into north and south sections denoted as Plots A and B, respectively. An attempt was made to obtain a composite soil pore moisture sample from each plot during each sampling event. The locations of the all lysimeters are shown on Figure 2.

A total of four soil core composite samples were collected; one from a depth of 6 feet and one from a depth of 7.5 feet below ground surface from each plot. The shallow sample is representative of the bottom of the treatment zone whereas the deeper sample is representative of soil immediately below the treatment zone. Three locations for the soil core sampling were selected in each plot using random number drawings. Samples from each of these locations were composited to provide a treatment zone sample and below treatment zone sample from each plot. Figure 3 shows the sampling locations on each plot.

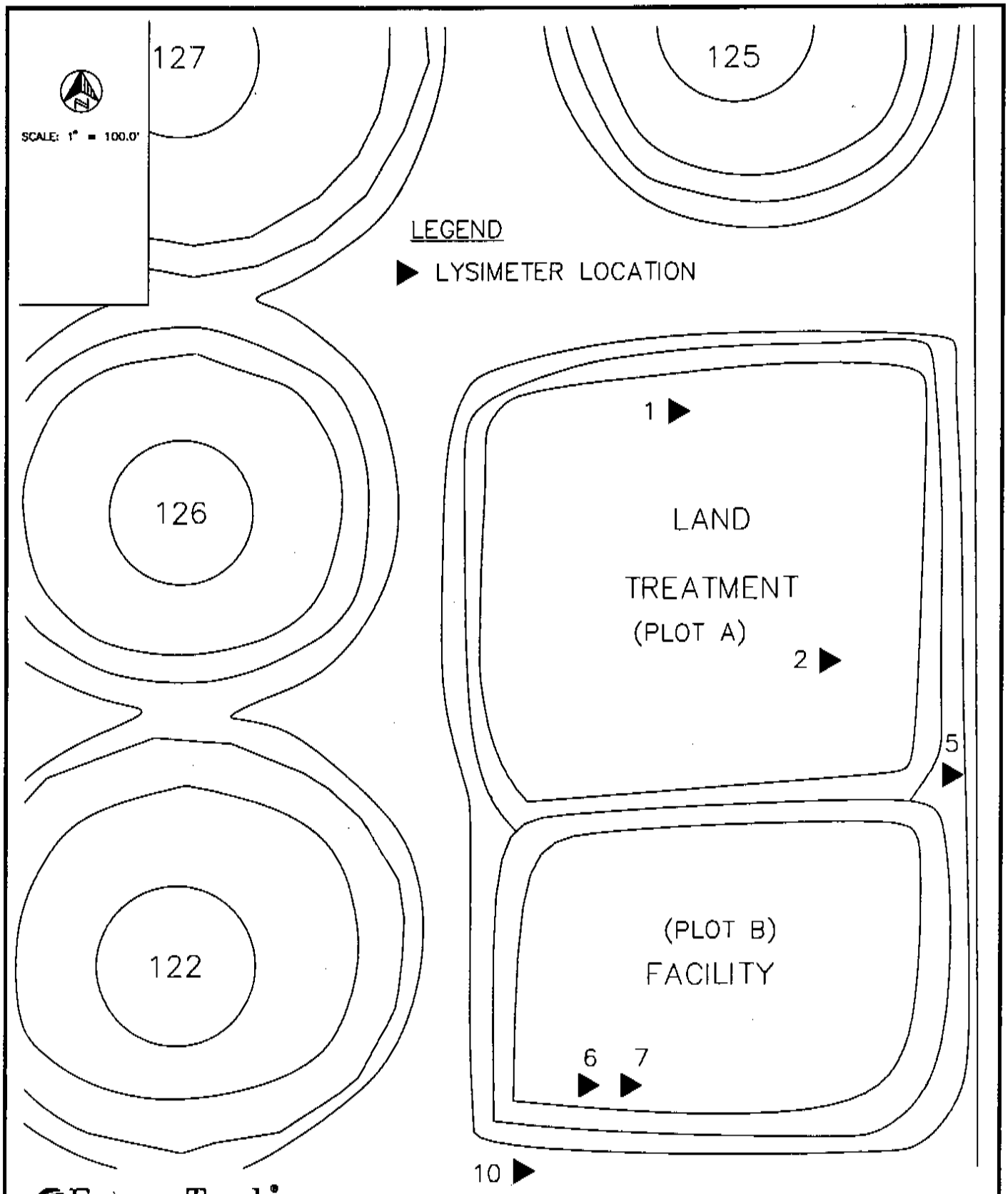
Per the requirements of Sections IV G.7. (a) and (b) of Total's permit, the data was statistically compared to background data from 1987-88 using the average replicate (AR) t-test. The statistical analysis of the data incorporated the detection limit value when performing the statistical evaluation of principal hazardous constituents (PHC) that were not detected in the analyses. The t* value for all constituents that could be evaluated were below the t_c values of the background. In this AR t-test, the variance of the original background data is zero for several parameters. This zero variance causes a division by zero error when attempting to perform the calculations. Details of how the AR t-test is applied can be found in Attachment IX, Section II, p.166 of the permit.

The above referenced permit specifies in Section IV G.4.(c) and (d) that Total shall collect a soil pore moisture sample from Plot A and a sample from Plot B of the land treatment unit on a biannual basis. The permit allows compositing of samples collected from within a plot as necessary to obtain an adequate sample volume. This section also specifies that this monitoring shall be performed as specified in Attachment IX. This attachment states that the land treatment area has six lysimeters, two in each plot and two which served to assess background characteristics. Prior to sampling the plot lysimeters, a vacuum was applied a minimum of 24 hours prior to sample collection. The second and third lysimeter sampling events each utilized sample collection periods exceeding 48 hours and still did not produce sufficient liquid volume to perform any constituent analyses.

Total has been conducting soil pore moisture sampling at the Arkansas City Refinery since 1981. It is Total's experience that sample volume collected from these lysimeters in this hydrogeological setting is routinely low and analyses for lower priority constituents can often not be performed because of inadequate sample volume. Total believes that their experience is not differential to soil pore moisture sampling at other refining land treatment units across the country.

Recycled Paper

EnvoTech



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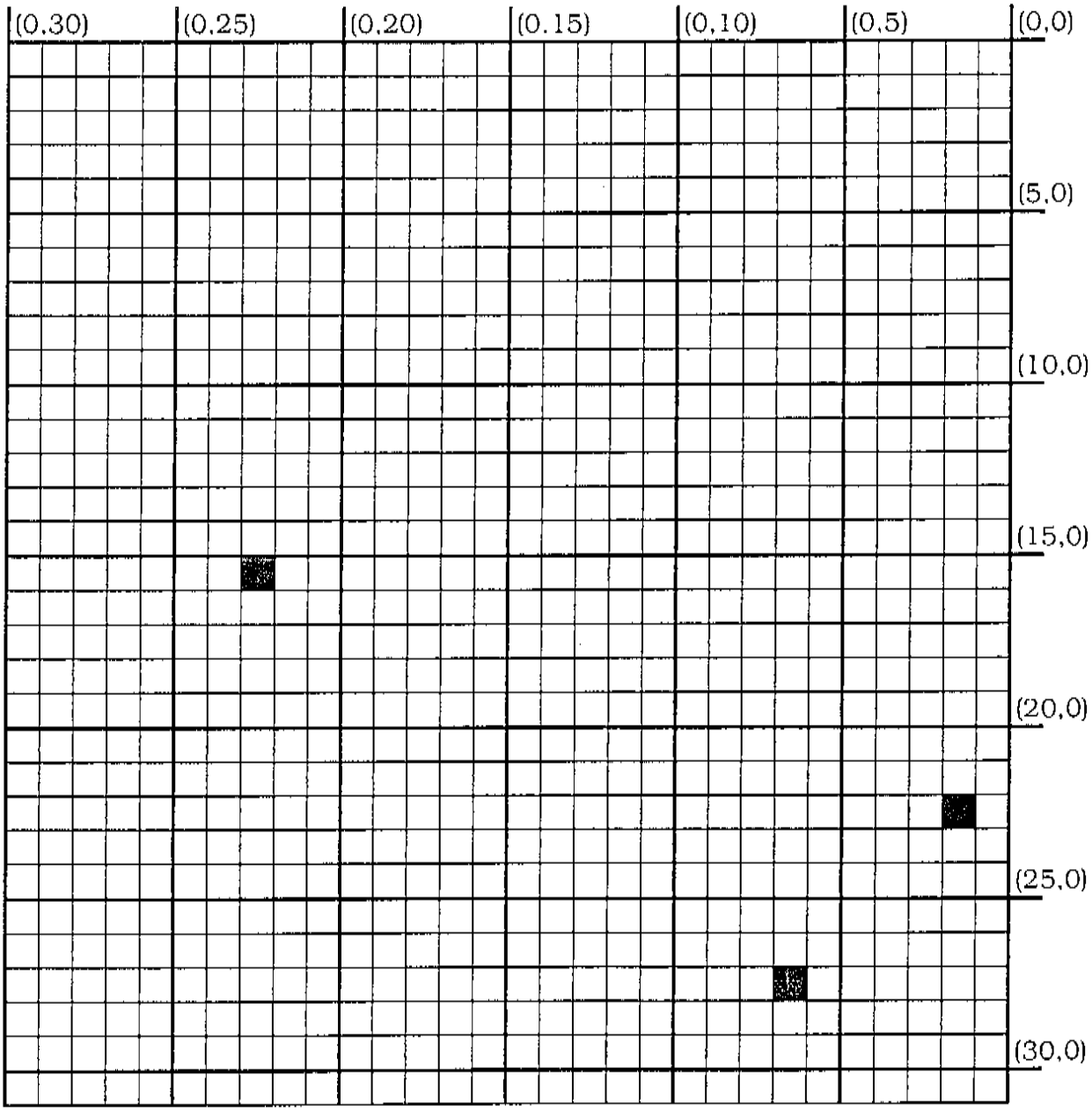
Project: TOTAL PETROLEUM, INC.	LYSIMETER LOCATIONS
ARKANSAS CITY REFINERY ARKANSAS CITY, KANSAS	

File No.:	138R-014	ACAD File No.:	LMETER	Date:	2/10/98	REV.:	
Drawn By:	LKB	Design By:	DE	Checked By:		Approved By:	Figure No.: 2

Figure 3a. - LTU - SOIL SAMPLING LOCATIONS - September 3, 1997
Total Petroleum Inc., Arkansas City Refinery

PLOT A - NORTH - 2.3 acres

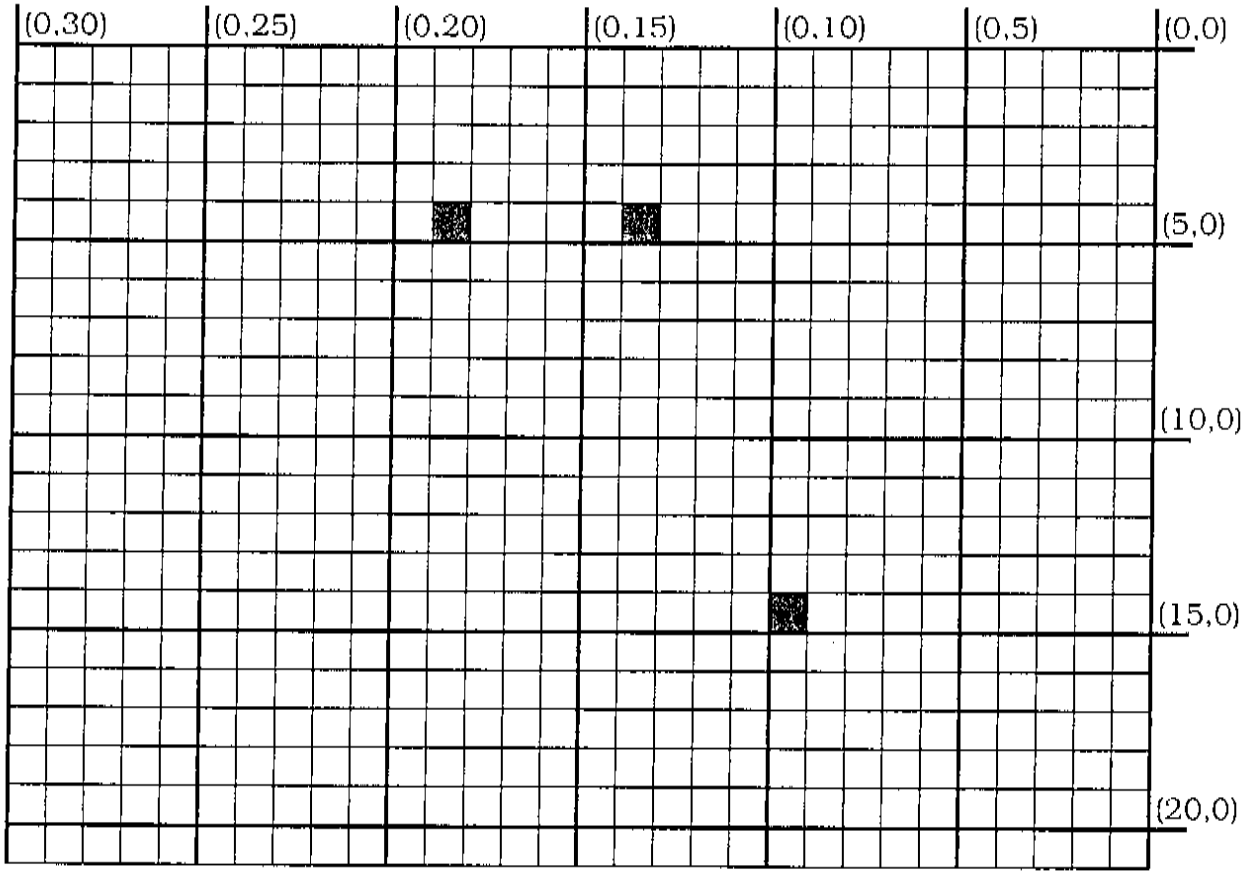


Notes: From field sketch made by Chuck Gay of Total Environmental Services on 9/3/97

■ = indicates approximate soil core sampling location

Figure 3b. - LTU - SOIL SAMPLING LOCATIONS - September 3, 1997
Total Petroleum Inc., Arkansas City Refinery

PLOT B - SOUTH - 1.6 acres



Notes: From field sketch made by Chuck Gay of Total Environmental Services on 9/3/97

= indicates approximate soil core sampling location

If you have any questions or comments regarding this information, please call me at (303) 861-2200 or Brenda Manterola of Ultramar Diamond Shamrock Corporation at (210) 592-4619.

Sincerely,

ENECOTECH INC.

Jay Mednick, P.G.
Principal

JM/dh

cc: Brenda Manterola, Ultramar Diamond Shamrock
Chuck Gay, Total Environmental Services, Arkansas City Refinery
Ken Herstowski, U.S. EPA Region VII
Steve Travis, KDHE

Attachment: Appendices A & B

Recycled Paper

1997 ANNUAL UNSATURATED ZONE MONITORING REPORT
LAND TREATMENT UNIT

APPENDIX - A

LTU Lysimeter Laboratory Analytical Report

Recycled Paper

Accurate Labs

July 8, 1997

Client: Total Petroleum, Inc.
P.O. Box 500
Denver, CO 80201

Requested by: Jim Charles

Project Name:	**2nd Quarter Lysimeters**
Sample Locations:	**LTU Plot A *and* LTU Plot B**
Date Samples Collected:	June 27, 1997 (Time: 0919)
Date Samples Received:	June 27, 1997 (Time: 1705)
Sample Type:	*Grab*
Sample Matrix:	***Water***
Lab Log Number:	**E9189 *and* E9190**
EPA Certified:	**ICR OK 001**
Kansas Certification:	E-10219
Oklahoma Certification:	DEQ 8316 / **Drinking Water, DEQ D9602**
Method Reference:	40 CFR 136, 261 Method for Chemical Analysis of Water and Waste EPA-600/4-79-020, March, 1983. Test Method for Evaluating Solid Waste, SW-846, 1986. Latest EPA approved Standard Methods for the Examination of Water and Wastewater.

LTU Plot A (E9189)

Metals

Parameter	Results, mg/L	PQL*, mg/L	*Date/Time of Analysis*	*Analyst*	*Method*
Barium (Ba)	**0.93**	0.0004	07/01/97 / 1830	RF	6010
Chromium (Cr)	BPQL	0.003	07/01/97 / 1830	RF	6010
Lead (Pb)	BPQL	0.01	07/01/97 / 1830	RF	6010

Sample prepared by CP on 06/30/97 @ 1300 (Method 3005).

VOLATILES - *GC/ Method 8020A*

Compound	Results, µg/L	Practical Quantitation Limits, µg/L
Benzene	**33.5**	5.00
Toluene	BPQL	5.00
Total Xylenes	**5.70**	5.00

Analysis performed by YD on 06/30/97@ 1624.

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects. BPQL: Below Practical Quantitation Limits (if applicable).

(cont.)

LTU Plot B (E9190)

VOLATILES - ***GC/ Method 8020A***

Compound	Results, µg/L	Practical Quantitation Limits, µg/L
Benzene	BPQL	5.00
Toluene	BPQL	5.00
Total Xylenes	BPQL	5.00

Analysis performed by YD on 06/30/97@ 1701.

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects. **BPQL:** Below Practical Quantitation Limits (if applicable).

George Drye
Lab Manager

jm /Lysemt01.doc

Reviewed by: Derek Kelly
QA/QC Officer

Accurate Labs

QA/QC

July 8, 1997

METALS

Parameter	% Duplicate Recovery	% Spike Recovery
Barium (Ba)	99	103
Chromium (Cr)	WAL	107
Lead (Pb)	WAL	105

WAL = Within Acceptable Limits

VOLATILES - Method 8020A (MS/MSD RECOVERIES)

COMPOUND	SAMPLE CONC	SPIKE ADDED	SPIKE RESULT	DUP RESULT	SPIKE % REC	DUP % REC	RPD	RPD LIMIT	% REC LIMIT
BENZENE	0.2	25	25	25	99.9	100.2	0.4	15	75-125
TOLUENE	0	75	73	74	97.8	99.0	1.3	15	75-125
ETHYLBENZENE	0	25	25	25	100.2	98.5	1.7	15	75-125
m,p-XYLENE	0	50	47	48	93.5	95.4	1.9	15	75-125
o-XYLENE	0	50	49	49	97.0	98.7	1.7	15	75-125
1,2,4-Trimethylbenzene	0	50	46	47	91.5	93.1	1.7	15	75-125

TPH - Method 8015A modified	SAMPLE CONC	SPIKE ADDED	SPIKE RESULT	DUP RESULT	SPIKE % REC	DUP % REC	RPD	RPD LIMIT	%REC LIMIT
GROTPH	0	0.45	0.384	0.382	85.3	84.9	0.5	15	75-125

A blank analysis was run with each batch (~10-15 samples per batch)

505 S. Lowry Street ■ Stillwater, OK 74074 ■ 405-372-5300 ■ Fax: 405-372-5396

OKC: 405-236-5333 ■ Tulsa: 918-587-5300 ■ Wichita: 316-683-1123 ■ Enid 405-237-5353

Chain-of-Custody Record

PROJECT #

PROJECT NAME: Total Petroleum, Inc. 2nd QTR Lysimeters

SAMPLED BY (SIGNATURE): [signature]

SAMPLED BY (PRINTED): Chuck Gay

DATE	TIME	COMP	GRAB	SAMPLE IDENTIFICATION	# OF CONTAINERS	Benzene, Toluene, Xylene / HCl	Pb, Cr, Ba / HNO3							REMARKS
6/27/97	0919		X	LTU Plot A	3	2	1							E9189
6/27/97	0919		X	LTU Plot B	2	2								E9190

RELINQUISHED BY (SIGNATURE):	RELINQUISHED BY (PRINTED):	DATE/TIME	RECEIVED BY (SIGNATURE):	RECEIVED BY (PRINTED):	DATE/TIME
[signature]	Chuck Gay	6/27/97 1350			
[signature]	Chuck Gay	6/27/97 1705			

RECEIVED AT LABORATORY BY (SIGNATURE/PRINTED): [signature] Derek Kelly — DATE/TIME: 6/27/97 1705

SHIPPED VIA: Seal #:

SEND REPORT TO
Attention: Jim Charles
Address
Phone # FAX #

SEND INVOICE TO
Attention: Purchase Order No
Address: Same CAS Price Quote No
Phone # FAX #

1997 ANNUAL UNSATURATED ZONE MONITORING REPORT
LAND TREATMENT UNIT

APPENDIX - B

LTU Soil Core Laboratory Analytical Report

Accurate Labs

September 23, 1997

Client: Total Petroleum, Inc.
P.O. Box 500
Denver, CO 80201

Requested by: Jim Charles

Project Name:	**Land Treatment Unit – Soil Core**
Sample Locations:	**Plot A** *(see below)*
Date Samples Collected:	September 3, 1997 (Time: N/A)
Date Samples Received:	September 4, 1997 (Time: 1650)
Sample Type/ Matrix:	*Grab / Soil*
Lab Log Number:	**F2123-F2124**
EPA Certified:	**ICR OK 001**
Kansas Certification:	E-10219
Oklahoma Certification:	DEQ 8316 / **Drinking Water, DEQ D9602**
Method Reference:	40 CFR 136, 261 Method for Chemical Analysis of Water and Waste EPA-600/4-79-020, March, 1983. Test Method for Evaluating Solid Waste, SW-846, 1986. Latest EPA approved Standard Methods for the Examination of Water and Wastewater.

Plot A 6' (F2123)

Parameter	Results	PQL*	Date/Time of Analysis	Analyst	Method
pH, *s.u.*	**8.57** *s.u.*	0-14	09/08/97 / 1025	RT	9045
CEC (Cation Exchange Capacity)	**2.2** *meq/100 grams*	0.027	09/05/97 / 1500	SM	200.7

Sample for CEC prepared by CP on 09/05/97 at 0900 (Method 9081).

Metals

Parameter	Results, mg/Kg •	PQL*, mg/Kg	Date/Time of Analysis	Analyst	Method
Barium (Ba)	**22**	0.040	09/08/97 / 1330	RF	6010
Chromium (Cr)	**6.0**	0.30	09/08/97 / 1645	RF	6010
Lead (Pb)	**9.5**	1.0	09/08/97 / 1330	RF	6010

Sample prepared by CP on 09/05/97 @ 1300 (Method 3051). • *Results are given in mg/Kg on a dry weight basis.*

VOLATILES - ***GC/ Method 8020A***

Compound	Results, mg /Kg	Practical Quantitation Limits, mg /Kg
Benzene	BPQL	0.002
Toluene	**0.008**	0.002
Total Xylenes	**0.004**	0.002

Analysis performed by LI on 09/17/97@ 1535.

SEMI-VOLATILES - ***GC/ Method 8270B***

Compound	Results, mg /Kg	Practical Quantitation Limits, mg /Kg
Anthrancene	BPQL	0.333
Chrysene	BPQL	0.333
Naphthalene	BPQL	0.333
Phenanthrene	BPQL	0.333

Sample prepared by CH on 09/15/97 at 1600 (Method 3550). Analysis performed by KC on 09/18/97@ 2017.

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects. BPQL: Below Practical Quantitation Limits (if applicable).

(cont.)

Plot A 7.5' (F2124)

Parameter	Results	PQL*	Date/Time of Analysis	Analyst	Method
pH, *s.u.*	8.33 *s.u.*	0-14	09/08/97 / 1025	RT	9045
CEC (Cation Exchange Capacity)	1.7 *meq/100 grams*	0.027	09/05/97 / 1500	SM	200.7

Sample for CEC prepared by CP on 09/05/97 at 0900 (Method 9081).

Metals

Parameter	Results, mg/Kg •	PQL*, mg/Kg	*Date/Time of Analysis*	*Analyst*	*Method*
Barium (Ba)	17	0.040	09/08/97 / 1330	RF	6010
Chromium (Cr)	3.8	0.30	09/08/97 / 1645	RF	6010
Lead (Pb)	6.9	1.0	09/08/97 / 1330	RF	6010

Sample prepared by CP on 09/05/97 @ 1300 (Method 3051). • *Results are given in mg/Kg on a dry weight basis.*

VOLATILES - *GC/ Method 8020A*

Compound	Results, mg /Kg	Practical Quantitation Limits, mg /Kg
Benzene	BPQL	0.002
Toluene	0.030	0.002
Total Xylenes	0.005	0.002

Analysis performed by LI on 09/17/97@ 1608.

SEMI-VOLATILES - *GC/ Method 8270B*

Compound	Results, mg /Kg	Practical Quantitation Limits, mg /Kg
Anthrancene	BPQL	0.333
Chrysene	BPQL	0.333
Naphthalene	BPQL	0.333
Phenanthrene	BPQL	0.333

Sample prepared by CH on 09/15/97 at 1600 (Method 3550). Analysis performed by KC on 09/18/97@ 2111.

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects. BPQL: Below Practical Quantitation Limits (if applicable).

(cont.)

Accurate Labs

September 23, 1997

Client: Total Petroleum, Inc.
P.O. Box 500
Denver, CO 80201

Requested by: Jim Charles

Project Name:	**Land Treatment Unit – Soil Core**
Sample Locations:	**Plot B** ***(see below)***
Date Samples Collected:	September 3, 1997 (Time: N/A)
Date Samples Received:	September 4, 1997 (Time: 1650)
Sample Type/ Matrix:	*Grab / Soil*
Lab Log Number:	**F2125-F2126**
EPA Certified:	**ICR OK 001**
Kansas Certification:	E-10219
Oklahoma Certification:	DEQ 8316 / **Drinking Water, DEQ D9602**
Method Reference:	40 CFR 136, 261 Method for Chemical Analysis of Water and Waste EPA-600/4-79-020, March, 1983. Test Method for Evaluating Solid Waste, SW-846, 1986. Latest EPA approved Standard Methods for the Examination of Water and Wastewater.

Plot B 6' (F2125)

Parameter	Results	PQL*	Date/Time of Analysis	Analyst	Method
pH, *s.u.*	7.54 *s.u.*	0-14	09/08/97 / 1025	RT	9045
CEC (Cation Exchange Capacity)	11 *meq/100 grams*	0.11	09/05/97 / 1500	SM	200.7

Sample for CEC prepared by CP on 09/05/97 at 0900 (Method 9081).

Metals

Parameter	Results, mg/Kg *	PQL*, mg/Kg	Date/Time of Analysis	Analyst	Method
Barium (Ba)	58	0.040	09/08/97 / 1330	RF	6010
Chromium (Cr)	6.9	0.30	09/08/97 / 1645	RF	6010
Lead (Pb)	10	1.0	09/08/97 / 1330	RF	6010

Sample prepared by CP on 09/05/97 @ 1300 (Method 3051). * *Results are given in mg/Kg on a dry weight basis.*

VOLATILES - ***GC/ Method 8020A***

Compound	Results, mg /Kg	Practical Quantitation Limits, mg /Kg
Benzene	BPQL	0.002
Toluene	0.025	0.002
Total Xylenes	0.010	0.002

Analysis performed by LI on 09/17/97@ 1717.

SEMI-VOLATILES - ***GC/ Method 8270B***

Compound	Results, mg /Kg	Practical Quantitation Limits, mg /Kg
Anthrancene	BPQL	0.333
Chrysene	BPQL	0.333
Naphthalene	BPQL	0.333
Phenanthrene	BPQL	0.333

Sample prepared by CH on 09/15/97 at 1600 (Method 3550). Analysis performed by KC on 09/18/97@ 2205.

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects. BPQL: Below Practical Quantitation Limits (if applicable).

(cont.)

Plot B 7.5' (F2126)

Parameter	Results	PQL*	Date/Time of Analysis	Analyst	Method
pH, *s.u.*	**8.02** *s.u.*	0-14	09/08/97 / 1025	RT	9045
CEC (Cation Exchange Capacity)	**7.4** *meq/100 grams*	0.11	09/05/97 / 1500	SM	200.7

Sample for CEC prepared by CP on 09/05/97 at 0900 (Method 9081).

Metals

Parameter	Results, mg/Kg •	PQL*, mg/Kg	Date/Time of Analysis	Analyst	Method
Barium (Ba)	**56**	0.040	09/08/97 / 1330	RF	6010
Chromium (Cr)	**16**	0.30	09/08/97 / 1645	RF	6010
Lead (Pb)	**19**	1.0	09/08/97 / 1330	RF	6010

Sample prepared by CP on 09/05/97 @ 1300 (Method 3051). • *Results are given in mg/Kg on a dry weight basis.*

VOLATILES - *GC/ Method 8020A*

Compound	Results, mg /Kg	Practical Quantitation Limits, mg /Kg
Benzene	BPQL	0.020
Toluene	**0.063**	0.020
Total Xylenes	**0.031**	0.020

Analysis performed by LI on 09/17/97@ 1823.

SEMI-VOLATILES - *GC/ Method 8270B*

Compound	Results, mg /Kg	Practical Quantitation Limits, mg /Kg
Anthrancene	BPQL	0.333
Chrysene	BPQL	0.333
Naphthalene	BPQL	0.333
Phenanthrene	BPQL	0.333

Sample prepared by CH on 09/15/97 at 1600 (Method 3550). Analysis performed by KC on 09/18/97@ 2259.

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects. **BPQL:** Below Practical Quantitation Limits (if applicable).

George Drye
Lab Manager

sr / LTU01s-core

Reviewed by: Derek Kelly
QA/QC Officer

Accurate Labs

QA/QC

September 23, 1997

METALS

Parameter	% Duplicate Recovery	% Spike Recovery
PH	99	N/A
Barium (Ba)	86	92
Chromium (Cr)	69	88
Lead (Pb)	77	116

WAL = Within Acceptable Limits

VOLATILES - Method 8260A (MS/MSD RECOVERIES)

COMPOUND	SAMPLE CONC	SPIKE ADDED	SPIKE RESULT	DUP RESULT	SPIKE % REC	DUP % REC	RPD	RPD LIMIT	% REC LIMIT
1,1-DICHLOROETHENE	0.1	100	137	142	136	142	4	22	59-172
BENZENE	0.2	100	118	125	118	125	6	21	66-142
TRICHLOROETHENE	0.0	100	105	109	105	109	4	24	62-137
TOLUENE	5.0	100	98	104	93	99	6	21	59-139
CHLOROBENZENE	0.1	100	109	118	109	118	8	21	60-133

BASE NEUTRAL/ ACIDS-METHOD 8270B (MS/MSD RECOVERIES)

COMPOUND	SAMPLE CONC	SPIKE ADDED	SPIKE RESULT	DUP RESULT	SPIKE % REC	DUP % REC	RPD	RPD LIMIT	% REC LIMIT
PHENOL	0.0	75	46	47	62	63	1	35	26-90
2-CHLOROPHENOL	0.0	75	43	43	58	58	1	50	25-102
1,4-DICHLOROBENZENE	0.0	50	32	32	64	64	0	27	28-104
N-NITROSO-DI-N-PROPY	0.0	50	40	40	79	80	1	38	41-126
1,2,4-TRICHLOROBENZE	0.0	50	30	29	59	59	1	23	38-107
4-CHLORO-3-METHYL PH	0.0	75	44	45	59	60	1	33	25-103
ACENAPTHENE	0.0	50	26	27	51	53	4	19	31-137
4-NITROPHENOL	0.0	75	69	76	92	101	10	50	11-114
2,4-DINITROTOLUENE	0.0	50	38	41	75	82	8	47	28-89
PENTACHLOROPHENOL	0.0	75	56	62	75	82	9	47	17-109
PYRENE	0.0	50	38	42	76	83	10	36	35-142

A blank analysis was run with each batch (~10-15 samples per batch)

505 S. Lowry Street ■ Stillwater, OK 74074 ■ 405-372-5300 ■ Fax: 405-372-5396

OKC: 405-236-5333 ■ Tulsa: 918-587-5300 ■ Wichita: 316-683-1123 ■ Enid 405-237-5353

Chain-of-Custody Record

Total

see Attached sheet

PROJECT #:

PROJECT NAME: Land Trearment Unit - Soil Core

SAMPLED BY (SIGNATURE): Chuck Gay / Travis C. Williams

SAMPLED BY (PRINTED): Chuck Gay / Travis C. Williams

DATE	TIME	COMP	GRAB	SAMPLE IDENTIFICATION	# OF CONTAINERS	pH 9045	CEC 9080	VOL Organics	Metals	Semi-VOL			REMARKS
9/3/97		X		Plot A 6'	1								F2123
9/3/97		X		Plot A 7.5'	1								F2124
9/3/97		X		Plot B 6'	1								F2125
9/3/97		X		Plot B 7.5'	1								F2126

RELINQUISHED BY (SIGNATURE): Chuck Gay — RELINQUISHED BY (PRINTED): Chuck Gay — DATE/TIME: 9/4/97 1650

RECEIVED BY (SIGNATURE): — RECEIVED BY (PRINTED): — DATE/TIME:

RELINQUISHED BY (SIGNATURE): Travis C. Williams — RELINQUISHED BY (PRINTED): Travis C. Williams — DATE/TIME: 9/4/97 1650

RECEIVED BY (SIGNATURE): — RECEIVED BY (PRINTED): — DATE/TIME:

RECEIVED AT LABORATORY BY (SIGNATURE/PRINTED): Cheryl Elliott — DATE/TIME: 9/4/97 1650

SHIPPED VIA: — Bill #:

SEND REPORT TO: Total Petroleum, Inc.
Attention: Jim Charles
Address:
Phone #: FAX #:

SEND INVOICE TO:
Attention: Same
Address:
Phone #:
Purchase Order No.:
CAS Price Quote No.:
FAX #:

BOISE COX PRINTING SALINA KANSAS — White — Laboratory Copy — Yellow — Client Copy — CAS 13-90-09-1 OK

EnecoTech Inc.
1580 Lincoln Street • Suite 1000
Denver, Colorado 80203
(303) 861-2200 • Fax (303) 861-2201

EnecoTech®

March 1, 1999

Ms. Andrea L. Austin, M.S.
Environmental Officer
Permits Section
Bureau of Waste Management
Kansas Department of Health and Environment
Forbes Field, Building 740
Topeka, Kansas 66620

01-0138R-014.005-205

Re: 1998 Annual Unsaturated Zone Monitoring Report
Land Treatment Unit (LTU)
TPI Petroleum, Inc. - Arkansas City Refinery
Permit Number: KSD087418695

Dear Ms. Austin:

Enclosed is the annual unsaturated zone monitoring report for the Land Treatment Unit (LTU) located at the TPI Petroleum, Inc. (TPI), Arkansas City Refinery in Cowley County, Kansas. The purpose of the unsaturated zone monitoring is to determine whether hazardous constituents migrate out of the LTU treatment zone. The Tables and Figures referenced in this report are presented following the discussion of the data. The site location map for the unit is shown as Figure 1.

The LTU is divided by a roadway into north and south sections, denoted as Plots A and B, respectively. The sampling involved collection of soil pore water samples and soil samples from LTU plots A and B. Soil pore water samples were collected from the unsaturated zone and soil samples were collected from within the treatment zone and beneath the treatment zone as described in Section IV G. 4. of the RCRA Permit. The RCRA permit requires the soil pore water and the below treatment zone soil samples to be analyzed for the following principal hazardous constituents (PHCs): lead, chromium, benzene, toluene xylene, anthracene, naphthalene, phenanthrene and chrysene. The soil samples from within the treatment zone are to be analyzed for cation exchange capacity and pH. The sampling program requires the soil pore water samples to be tested for pH and conductivity. A summary of the laboratory analytical results obtained from samples collected from Plot A and Plot B are presented on Tables 1 and 2

Recycled Paper

respectively. The laboratory analyses for the soil pore water and soil core samples are included in Appendices A and B respectively.

Soil Pore (Lysimeter)

Section IV of the RCRA permit specifies that TPI shall collect soil pore water samples from Plot A and from Plot B of the land treatment unit on a biannual basis. The permit allows compositing of samples collected from within a plot as necessary to obtain an adequate sample volume. This section also specifies that this monitoring shall be performed as specified in the environmental monitoring plan included in Attachment IX of the RCRA permit.

The lysimeter sampling events were conducted on June 24, 1998 and December 28, 1998. The locations of the lysimeters are shown on Figure 2. A vacuum was applied to the lysimeters for a period of at least 24 hours prior to sample collection. A sufficient volume of liquid could not be collected during the second sampling event in December 1998 to analyze the semivolatile PHCs (anthracene, chrysene, naphthalene and phenanthrene) in the sample collected from Plot B. There was insufficient sample volume from the lysimeters to test the soil pore water for pH or conductivity from either Plot A or Plot B.

Soil Core

The RCRA permit specifies that TPI shall collect soil core samples from Plots A and B of the land treatment unit on an annual basis. The permit specifies that three samples shall be collected from within each plot. The three samples from both Plot A and Plot B may be composited into one sample for each plot. The composited samples will be analyzed for the same PHCs.

Soil core samples were collected on December 17 and 23, 1998. Four soil core composite samples were collected; one from a depth of 4 to 4.5 feet below the ground surface and one from a depth of 7 to 7.5 feet below the ground surface from each plot. The shallow sample is representative of the treatment zone whereas the deeper sample is representative of soil below the treatment zone. Three locations for the soil core sampling were randomly selected in each plot. Samples from each of these locations were composited to provide a treatment zone sample and a below treatment zone sample from each plot. Figures 3 and 4 show the sampling locations on each plot.

Discussion and Conclusions

Soil pore moisture sampling has been conducted at the Arkansas City Refinery since 1981. It is TPI's experience that sample volume collected from these lysimeters in this hydrogeological setting is routinely low and analyses for lower priority constituents often can not be performed because of inadequate sample volume.

Per the requirements of Section IV G.7. of the RCRA permit, the soil pore water and soil core data were statistically compared to background data from 1987-88 using the average replicate (AR) t-test. The statistical analysis of the soil pore water and soil core data incorporated the detection limit value when performing the statistical evaluation of principal hazardous constituents (PHC) that were not detected in the analyses. The t* value for all constituents that could be evaluated were below the t_c values of the background. The t* statistic could not be calculated for several parameters because variance of the original background data is zero. This zero variance causes a division by zero error when attempting to perform the calculations. The AR t-test was applied as described in Attachment IX, Section II, p.166 of the RCRA permit.

The statistical analyses of the soil pore water data from the two sampling events are presented in Tables 3 and 4 and the statistical analyses of the soil core analytical results are presented in Table 5.

The statistical analysis of the analytical data for both the soil pore and soil core sampling events has been performed and reviewed in accordance with Section IV G.7 of the permit. The data does not indicate any evidence of a release from the LTU.

If you have any questions or comments regarding this information, please contact me at (303) 861-2200 or Brenda Manterola of Ultramar Diamond Shamrock Corporation at (210) 592-4619.

Sincerely,

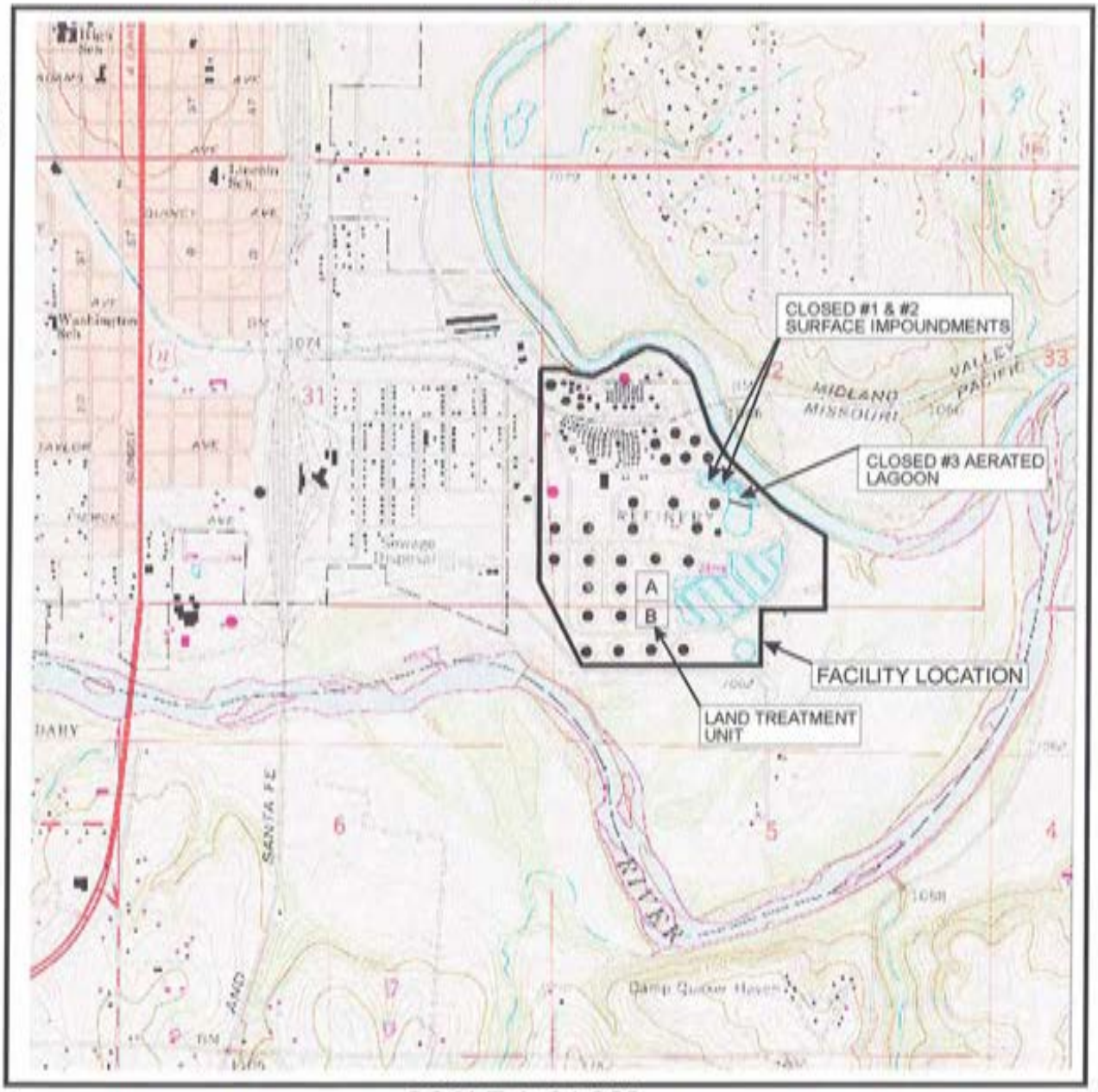
ENECOTECH INC.

Jay Mednick
Principal

cc: Harold Green, Ultramar Diamond Shamrock Corporation, Arkansas City Refinery
Ken Herstowski, U.S. EPA Region VII
Brenda Manterola, Ultramar Diamond Shamrock Corporation
Steve Travis, KDHE

Attachments: Appendix A
Appendix B

R 4 E



SCALE 1: 24,000

1 1/2 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

0 .5 0 1 KILOMETER

CONTOUR INTERVAL: 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ARKANSAS CITY, KANS.
N3700-W9700/7.5
1965
PHOTOREVISED 1979
AMS 6558 II SE-SERIES V878

QUADRANGLE LOCATION

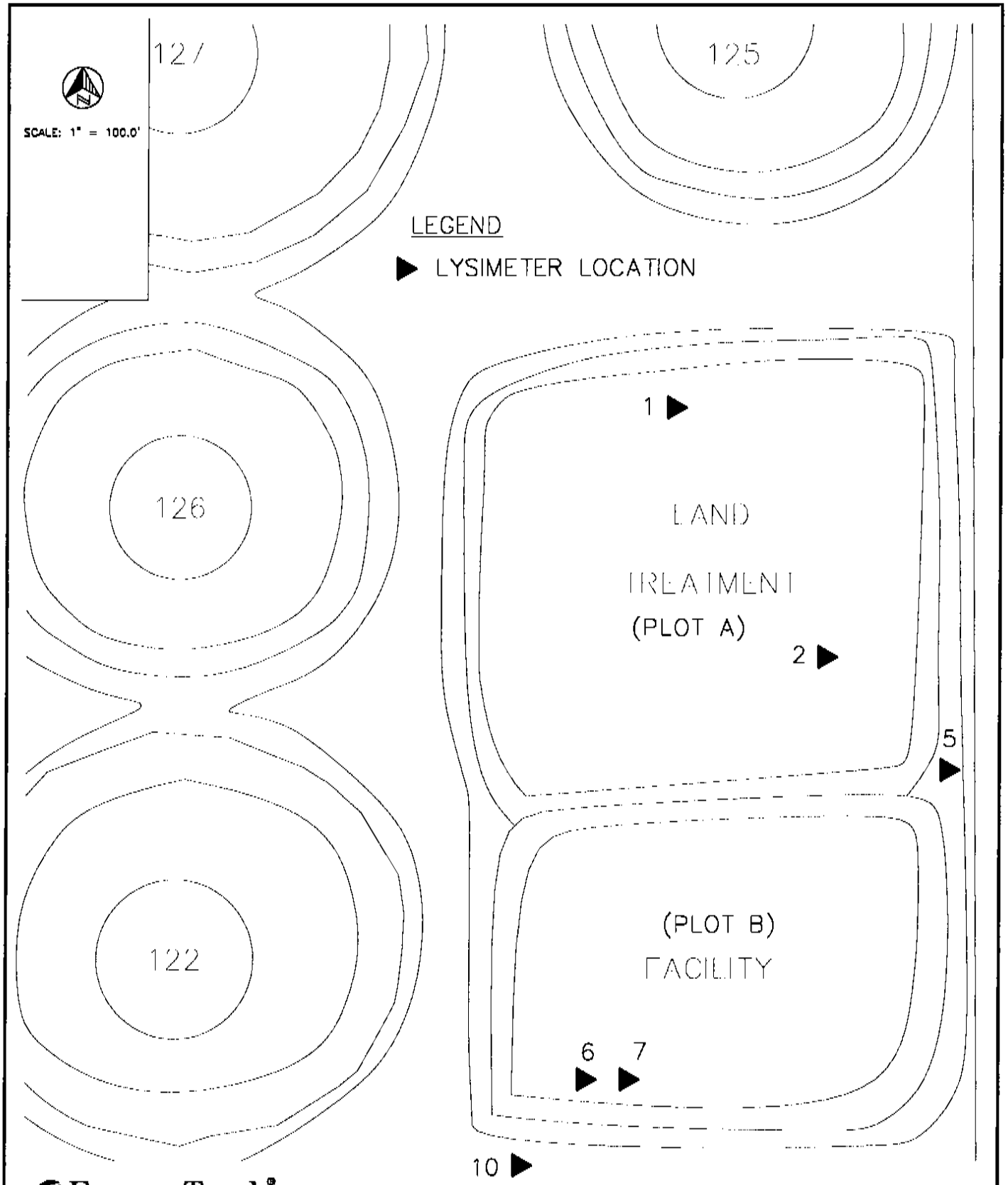
EnecoTech
ENVIRONMENTAL CONSULTANTS

FIGURE: 1

SITE LOCATION MAP

PROJECT: TPI PETROLEUM INC. - ARKANSAS CITY REFINERY

1308-015	DESIGNED: J F M	APPROVED:	
1308015.DWG	DRAWN: L K B	DATE: 9/29/97	REV:



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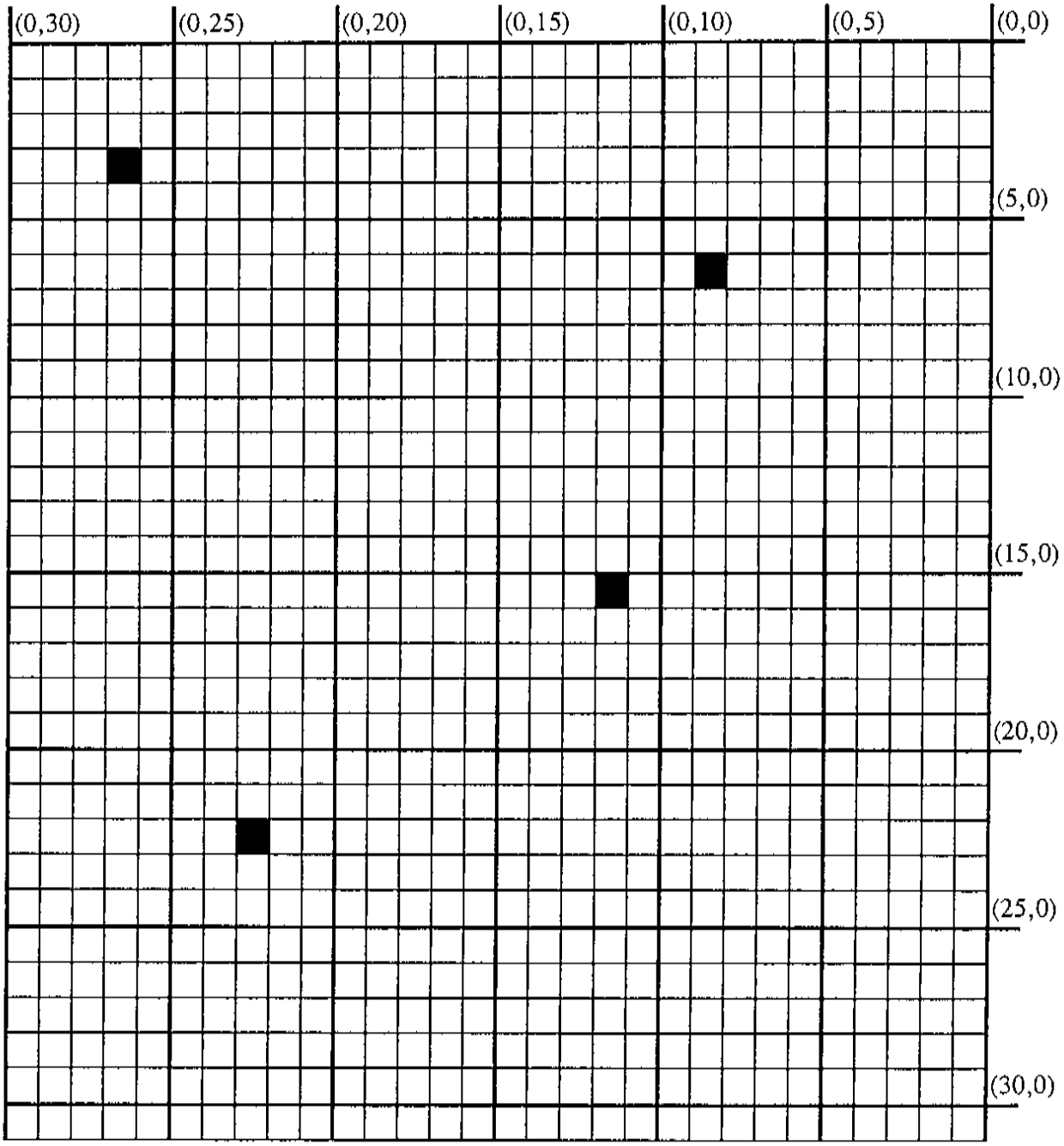
Project: TPI PETROLEUM, INC.	LYSIMETER LOCATIONS
ARKANSAS CITY REFINERY ARKANSAS CITY, KANSAS	

File No.:	138R-014	ACAD File No.:	LMETER	Date:	2/10/98	REV.:	
Drawn By:	LKB	Design By:	DE	Checked By:		Approved By:	Figure No.: 2

Figure 3 - LTU - SOIL SAMPLING LOCATIONS - December 1998
TPI Petroleum Inc., Arkansas City Refinery

PLOT A - NORTH - 2.3 acres



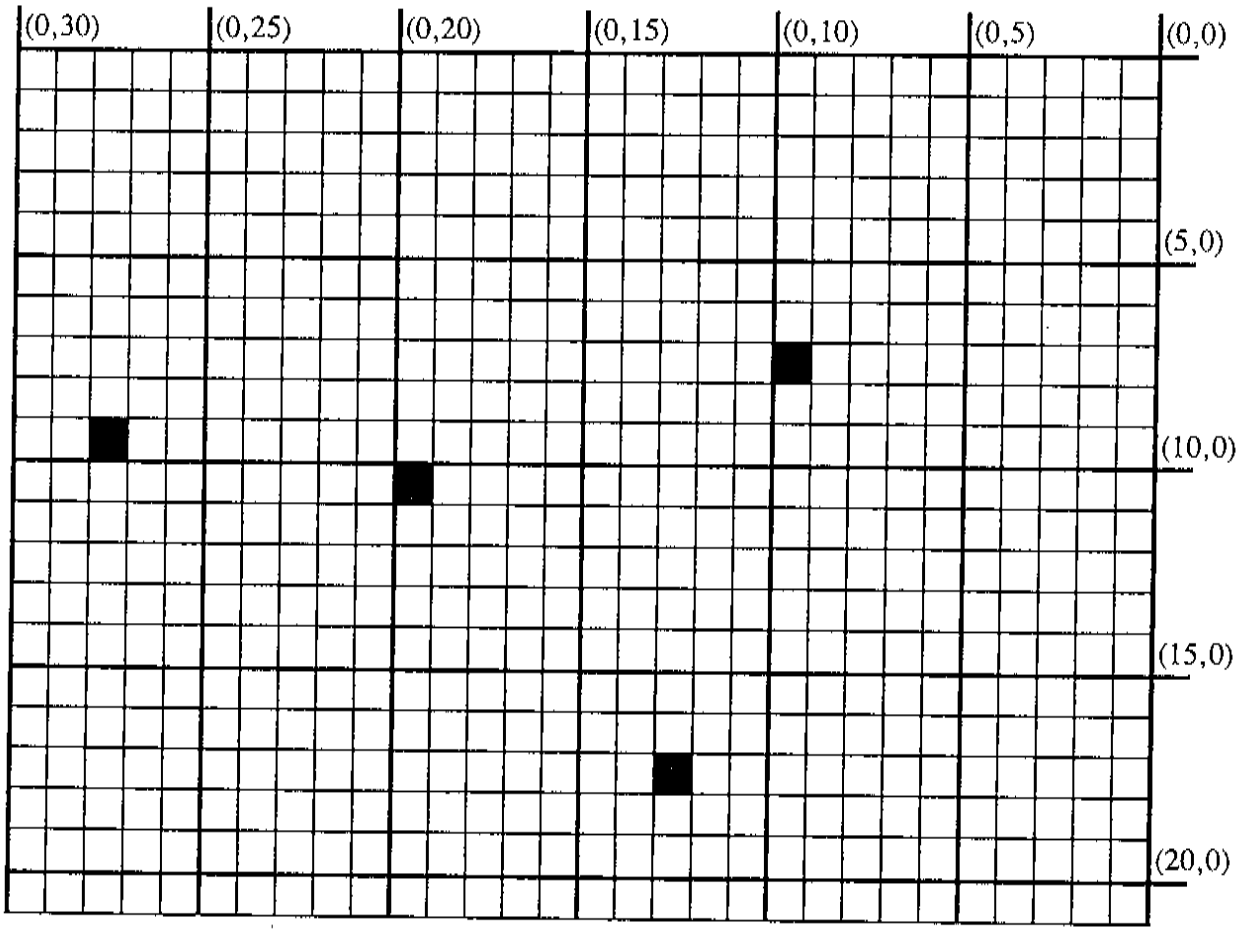
Notes: ■ = indicates approximate soil core sampling location

n:\arkcity\138r014\005\98ltu\Ltu98
Sampling Locations

EnecoTech

Figure 4 - LTU - SOIL SAMPLING LOCATIONS - December 1998
TPI Petroleum Inc., Arkansas City Refinery

PLOT B - SOUTH - 1.6 acres



Notes: ■ = indicates approximate soil core sampling location

n:\arkcity\138r014\005\98ltu\Ltu98
Sampling Locations

EnecoTech

Table 1 - Summary of Laboratory Analytical Results LTU Plot A

Constituent/Parameter	Lysimeter 1st Semiannual	Lysimeter 2nd Semiannual	Soil (within treatment zone)	Soil (beneath treatment zone)
	(Units mg/l)[1]		(Units mg/kg)[1]	
Sample ID	AREA #1	LYSLTU-NORTH	A	LTU-ABTZ
Sample Date	6/24/98	12/28/98	12/17/98	12/23/98
Benzene	<0.005	<0.005		<0.005
Toluene	<0.005	<0.005		<0.005
Xylenes (total)	<0.005	<0.005		<0.005
Naphthalene	<0.010	<0.050		0.340 J
Phenanthrene	<0.010	<0.050		8.800
Anthracene	<0.010	<0.050		1.000 J
Chrysene	<0.010	<0.050		8.800
Chromium	<0.003	0.0035 B		4.5
Lead	0.085	0.0075		2.3
CEC (meq/l)			14.3	
pH (s.u.)	7.36[2]	NS	8.1	
Conductivity (umhos/cm)	1189[2]	NS		

Notes:
Blank Cell indicates analysis not required.
NS indicates "No Sample" due to insufficient sample volume.
1) Units are as shown unless noted otherwise next to the parameter name.
2) Laboratory measurement.

Table 2 - Summary of Laboratory Analytical Result LTU Plot B

Constituent/Parameter	Lysimeter 1st Semiannual	Lysimeter 2nd Semiannual	Soil (within treatment zone)	Soil (beneath treatment zone)
	(Units mg/l)[1]		(Units mg/kg)[1]	
SAMPLE ID	AREA #2	LYSLTU-SOUTH	B	LTU-BBTZ
Sample Date	6/24/98	12/28/98	12/17/98	12/23/98
Benzene	<0.005	<0.005		<0.005
Toluene	<0.005	<0.005		<0.005
Xylenes (total)	<0.005	<0.005		<0.005
Naphthalene	<0.020	NS		<0.360
Phenanthrene	<0.020	NS		<0.360
Anthracene	<0.020	NS		<0.360
Chrysene	<0.020	NS		<0.360
Chromium	<0.033	<0.0007		10.6
Lead	0.048	<0.0015		36.1
CEC (meq/l)			11.3	
pH (s.u.)	7.56[2]	NS	7.9	
Conductivity (umhos/cm)	3340[2]	NS		

Notes:
Blank Cell indicates analysis not required.
NS indicates "No Sample" due to insufficient sample volume.
1) Units are as shown unless noted otherwise next to the parameter name.
2) Laboratory measurement.

Table 3 - Land Treatment Unit - Lysimeter (Soil Pore Moisture) Monitoring
TPI Petroleum, Inc., Arkansas City Refinery
June 24, 1998

	Background quoted from 9/88 Radian LTU report				mean	variance	notes	t*	tc	significant	Plot A (North) notes	(mg/l)
Chromium	< 0.01	< 0.01	< 0.05	< 0.02	0.0225	0.0004		-0.9214	4.541	NO	1,2	< 0.003
Lead	0.009	< 0.01	< 0.05	0.013	0.0205	0.0004		2.9225	4.541	NO	1	0.085
Benzene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	3	#DIV/0!	4.541	#DIV/0!	2	< 0.005
Toluene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	3	#DIV/0!	4.541	#DIV/0!	2	< 0.005
Xylenes	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	3	#DIV/0!	4.541	#DIV/0!	2	< 0.005
Anthracene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.0000	3	#DIV/0!	4.541	#DIV/0!	2	< 0.010
Naphthalene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	3	#DIV/0!	4.541	#DIV/0!	2	< 0.010
Phenanthrene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	3	#DIV/0!	4.541	#DIV/0!	2	< 0.010
Chrysene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	3	#DIV/0!	4.541	#DIV/0!	2	< 0.010

	Background quoted from 9/88 Radian LTU report				mean	variance	notes	t*	tc	significant	Plot B (South) notes	(mg/l)
Chromium	< 0.01	< 0.01	< 0.05	< 0.02	0.0225	0.0004		0.4961	4.541	NO	1	0.033
Lead	0.009	< 0.01	< 0.05	0.013	0.0205	0.0004		1.2460	4.541	NO	1	0.048
Benzene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	3	#DIV/0!	4.541	#DIV/0!	2	< 0.005
Toluene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	3	#DIV/0!	4.541	#DIV/0!	2	< 0.005
Xylenes	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	3	#DIV/0!	4.541	#DIV/0!	2	< 0.005
Anthracene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.0000	3	#DIV/0!	4.541	#DIV/0!	2	< 0.020
Naphthalene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	3	#DIV/0!	4.541	#DIV/0!	2	< 0.020
Phenanthrene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	3	#DIV/0!	4.541	#DIV/0!	2	< 0.020
Chrysene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	3	#DIV/0!	4.541	#DIV/0!	2	< 0.020

Notes

1 - NO means that the data does not indicate a significant change.

2 - used the detection limit for calculations.

3 - t* cannot be calculated when variance = 0.

All concentrations reported in mg/l (ppm)

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Table 4 - Land Treatment Unit - Lysimeter (Soil Pore Moisture) Monitoring
TPI Petroleum, Inc., Arkansas City Refinery
December 28, 1998

	Background quoted from 9/88 Radian LTU report				mean	variance	notes	t*	tc	significant	Plot A (North) notes	(mg/l)
Chromium	< 0.01	< 0.01	< 0.05	< 0.02	0.0225	0.0004		-0.8977	4.541	NO	1	0.0035
Lead	0.009	< 0.01	< 0.05	0.013	0.0205	0.0004		-0.5890	4.541	NO	1	0.0075
Benzene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!	2	< 0.005
Toluene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!	2	< 0.005
Xylenes	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!	2	< 0.005
Anthracene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.0000	4	#DIV/0!	4.541	#DIV/0!	2	< 0.05
Naphthalene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#DIV/0!	4.541	#DIV/0!	2	< 0.05
Phenanthrene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#DIV/0!	4.541	#DIV/0!	2	< 0.05
Chrysene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#DIV/0!	4.541	#DIV/0!	2	< 0.05

	Background quoted from 9/88 Radian LTU report				mean	variance	notes	t*	tc	significant	Plot B (South) notes	(mg/l)
Chromium	< 0.01	< 0.01	< 0.05	< 0.02	0.0225	0.0004		-1.0300	4.541	NO	2	< 0.0007
Lead	0.009	< 0.01	< 0.05	0.013	0.0205	0.0004		-0.8609	4.541	NO	2	< 0.0015
Benzene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!	2	< 0.005
Toluene	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!	2	< 0.005
Xylenes	< 0.005	< 0.005	< 0.005	< 0.005	0.005	0.0000	4	#DIV/0!	4.541	#DIV/0!	2	< 0.005
Anthracene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.0000	4	#VALUE!	4.541	#VALUE!	3	NS
Naphthalene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NS
Phenanthrene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NS
Chrysene	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.000	4	#VALUE!	4.541	#VALUE!	3	NS

Notes

1 - NO means that the data does not indicate a significant change.
2 - used the detection limit for calculations.
3 - NS indicates insufficient sample available to perform all tests.
4 - t* cannot be calculated when variance = 0.
All concentrations reported in mg/l (ppm)

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Table 5 - Land Treatment Unit - Soil Core Monitoring
TPI Petroleum, Inc., Arkansas City Refinery
December 17-23, 1998

	Background quoted from 9/88 Radian LTU report		mean	variance	notes	t*	tc	sign.	Below Treatment Zone notes	Plot A-7'	notes	Plot B-7'	mean
Chromium	5.6	0.8	3.2	11.5		1.0464	31.821	NO		4.5		10.6	7.55
Lead	7	3.5	5.25	6.1		4.6023	31.821	NO		2.3		36.1	19.20
Benzene	< 0.002	0.002	0.002	0.0	3	#DIV/0!	31.821	#DIV/0!	3	0.005	2	0.005	0.01
Toluene	< 0.002	0.002	0.002	0.0	3	#DIV/0!	31.821	#DIV/0!	3	0.005	2	0.005	0.01
Xylenes	< 0.002	0.002	0.002	0.0	3	#DIV/0!	31.821	#DIV/0!	3	0.005	2	0.005	0.01
Anthracene	< 0.2	0.2	0.2	0.0	3	#DIV/0!	31.821	#DIV/0!	3	1	2	0.36	0.68
Naphthalene	< 0.2	0.2	0.2	0.0	3	#DIV/0!	31.821	#DIV/0!	3	0.34	2	0.36	0.35
Phenanthrene	< 0.2	0.2	0.2	0.0	3	#DIV/0!	31.821	#DIV/0!	3	8.8	2	0.36	4.58
Chrysene	< 0.2	0.2	0.2	0.0	3	#DIV/0!	31.821	#DIV/0!	3	8.8	2	0.36	4.58

Notes
1 - NO means that the data does not indicate a significant change.
2 - used the detection limit for calculations.
3 - t* cannot be calculated when variance = 0.
All concentrations reported in mg/kg (ppm)

Recycled Paper

APPENDIX - A

1998 ANNUAL UNSATURATED ZONE MONITORING REPORT
LAND TREATMENT UNIT

LTU Lysimeter Laboratory Analytical Reports

EnecoTech

Accurate

Labs & Training Center

July 8, 1998

Client: Ultimar, Diamond, Shamrock
P.O. Box 696300
San Antonio, TX 78269-6000

Requested by: Brenda Manterola

Project Name:	*TPIAC RCRA Ground Water Monitoring - 2nd Quarter, 1998*
Site Name/Location:	Total Petroleum Inc. /Arkansas City, KS
Sample Location:	Area # 1 (lys. 1,2,5)
Date Samples Collected:	June 24, 1998 (Time: 1120)
Date Samples Received:	June 26, 1998 (Time: 1030) - sample temp. upon arrival at lab = < 4° C
Sample Type:	*Composite*
Sample Matrix:	*Water*
Lab Log Number:	**G1754**
EPA Certified:	**ICR OK 001**
Kansas Certification:	E-10219
Oklahoma Certification:	DEQ 8316 / **Drinking Water, DEQ D9602**
Method Reference:	40 CFR 136, 261 Method for Chemical Analysis of Water and Waste EPA-600/4-79-020, March, 1983. Test Method for Evaluating Solid Waste, SW-846, 1986. Latest EPA approved Standard Methods for the Examination of Water and Wastewater.

TOTAL METALS

Parameter	Results, µg/L	PQL*, µg/L	*Date/Time of Analysis*	*Analyst*	*Method*
Barium (Ba)	560	0.40	06/29/98 / 1115	SG	200.7
Chromium (Cr)	BPQL	3.0	06/29/98 / 1115	SG	200.7
Lead (Pb)	85	10	06/29/98 / 1115	SG	200.7

Samples for Metals prepared by SG on 06/26/98 @ 1100 (Method 200.7).

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects. **BPQL: Below Practical Quantitation Limits (if applicable).**

(cont.)

505 S. Lowry Street ■ Stillwater, OK 74074 ■ 405-372-5300 ■ Fax: 405-372-5396
OKC: 405-236-5333 ■ Tulsa: 918-587-5300 ■ Wichita: 316-683-1123 ■ Enid 405-237-5353

VOLATILE ORGANIC COMPOUNDS - METHOD 8260

Compound	Results, µg/L	Practical Quantitation Limits*, µg/L
Benzene	BPQL	5.0
Toluene	BPQL	5.0
Total Xylenes	BPQL	5.0

Analysis performed by YD on 06/29/98 @ 1712.

BASE, NEUTRAL & ACID EXTRACTABLE ORGANICS - GC/MS METHOD 8270

Compound	Results, µg/L	Practical Quantitation Limits*, µg/L
Anthracene	BPQL	10.0
Chrysene	BPQL	10.0
Naphthalene	BPQL	10.0
Phenanthrene	BPQL	10.0

Sample prepared by CS/JL/PF on 06/30/98 @ 1400 (Method 3510).
Analysis performed by LI on 07/03/98 @ 0337.

Parameter	Results	PQL*	*Date/Time of Analysis*	*Analyst*	*Method*
pH	7.36 *s.u.*	0-14 *s.u.*	07/03/98 / 1215	RA	150.1
Conductivity	1,189 µmhos/cm	0.1 µmhos/cm	07/03/98 / 1220	RA	120.1

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects. BPQL: Below Practical Quantitation Limits (if applicable).

Accurate

Labs & Training Center

July 8, 1998

Client: Ultimar, Diamond, Shamrock
P.O. Box 696300
San Antonio, TX 78269-6000

Requested by: Brenda Manterola

Project Name:	*TPIAC RCRA Ground Water Monitoring - 2nd Quarter, 1998*
Site Name/Location:	Total Petroleum Inc./Arkansas City, KS
Sample Location:	Area # 2 (lys. 6,7)
Date Samples Collected:	June 24, 1998 (Time: 1310)
Date Samples Received:	June 26, 1998 (Time: 1030) - sample temp. upon arrival at lab = < 4° C
Sample Type:	*Composite*
Sample Matrix:	*Water*
Lab Log Number:	G1755
EPA Certified:	ICR OK 001
Kansas Certification:	E-10219
Oklahoma Certification:	DEQ 8316 / Drinking Water, DEQ D9602
Method Reference:	40 CFR 136, 261 Method for Chemical Analysis of Water and Waste EPA-600/4-79-020, March, 1983. Test Method for Evaluating Solid Waste, SW-846, 1986. Latest EPA approved Standard Methods for the Examination of Water and Wastewater.

TOTAL METALS

Parameter	Results, µg/L	PQL*, µg/L	*Date/Time of Analysis*	*Analyst*	*Method*
Barium (Ba)	280	0.40	06/29/98 / 1115	SG	200.7
Chromium (Cr)	33	3.0	06/29/98 / 1115	SG	200.7
Lead (Pb)	48	10	06/29/98 / 1115	SG	200.7

Samples for Metals prepared by SG on 06/26/98 @ 1100 (Method 200.7).

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects. BPQL: Below Practical Quantitation Limits (if applicable).

(cont.)

505 S. Lowry Street ■ Stillwater, OK 74074 ■ 405-372-5300 ■ Fax: 405-372-5396
OKC: 405-236-5333 ■ Tulsa: 918-587-5300 ■ Wichita: 316-683-1123 ■ Enid 405-237-5353

VOLATILE ORGANIC COMPOUNDS - METHOD 8260

Compound	Results, µg/L	Practical Quantitation Limits*, µg/L
Benzene	BPQL	5.0
Toluene	BPQL	5.0
Total Xylenes	BPQL	5.0

Analysis performed by YD on 06/29/98 @ 1752.

BASE, NEUTRAL & ACID EXTRACTABLE ORGANICS - GC/MS METHOD 8270

Compound	Results, µg/L	Practical Quantitation Limits*, µg/L
Anthracene	BPQL	20.0
Chrysene	BPQL	20.0
Naphthalene	BPQL	20.0
Phenanthrene	BPQL	20.0

Sample prepared by CS/JL/PF on 06/30/98 @ 1400 (Method 3510).
Analysis performed by LI on 07/03/98 @ 0428.

Parameter	Results	PQL*	*Date/Time of Analysis*	*Analyst*	*Method*
pH	7.56 *s.u.*	0-14 *s.u.*	07/03/98 / 1215	RA	150.1
Conductivity	3,340 µmhos/cm	0.1 µmhos/cm	07/03/98 / 1220	RA	120.1

* Practical Quantitation Limit - the method detection limit (MDL) adjusted for any dilutions or other changes made to the sample to deal with interferences/matrix effects. BPQL: Below Practical Quantitation Limits (if applicable).

1

INORGANIC ANALYSES DATA SHEET

CLIENT SAMPLE ID

LYSLTUNORTH

Lab Name: SOUTHWEST_LAB_OF_OK_____ Contract:UDSC_____

Lab Code: SWOK__ Case No.: 36926 SAS No.: _____ SDG No.: 36926_

Matrix (soil/water): WATER Lab Sample ID: 36926.01

Level (low/med): LOW__ Date Received: 12/28/98

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7440-47-3	Chromium_	3.5	B		P_
7439-92-1	Lead_____	7.5			P_

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

CLIENT_I.D.=LYS-LTU-NORTH

FORM I - IN

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

LYSLTU-NORTH

Lab Name: SWL-TULSA Contract: ARKCITYLTU

Lab Code: SWOK Case No.: UDSC SAS No.: SDG No.: 36926

Matrix: (soil/water) WATER Lab Sample ID: 36926.01

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: K25964.D

Level: (low/med) LOW Date Received: 12/28/98

% Moisture: not dec. _____ Date Analyzed: 12/30/98

Column: (pack/cap) CAP Dilution Factor: 1.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
71-43-2	BENZENE	5	U
108-88-3	TOLUENE	5	U
1330-20-7	Xylene (Total)	5	U

1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

LYSLTUNORTH

Lab Name: SWL-TULSA Contract: ARK CITY/LT

Lab Code: SWOK Case No.: UDSC SAS No.: SDG No.: 36926

Matrix: (soil/water) WATER Lab Sample ID: 36926.01

Sample wt/vol: 200 (g/mL) ML Lab File ID: M12778.D

Level: (low/med) LOW Date Received: 12/28/98

% Moisture: not dec. 0 dec. Date Extracted: 12/29/98

Extraction: (SepF/Cont/Sonc) CONT Date Analyzed: 12/31/98

Concentrated Extract Volume: 1000(uL)

GPC Cleanup: (Y/N) N pH: 7.6 Dilution Factor: 1.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
91-20-3	Naphthalene	50	U
85-01-8	Phenanthrene	50	U
120-12-7	Anthracene	50	U
218-01-9	Chrysene	50	U

FORM I SV-1

INORGANIC ANALYSES DATA SHEET

CLIENT SAMPLE ID

LYSLTUSOUTH

Lab Name: SOUTHWEST_LAB_OF_OK Contract: UDSC
Lab Code: SWOK Case No.: 36926 SAS No.: SDG No.: 36926
Matrix (soil/water): WATER Lab Sample ID: 36926.02
Level (low/med): LOW Date Received: 12/28/98
% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7440-47-3	Chromium	0.70	U		P
7439-92-1	Lead	1.5	U		P

Color Before: COLORLESS Clarity Before: CLEAR Texture:
Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:
CLIENT_I.D.=LYS-LTU-SOUTH

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

LYSLTU-SOUTH

Lab Name: SWL-TULSA Contract: ARKCITYLTU

Lab Code: SWOK Case No.: UDSC SAS No.: SDG No.: 36926

Matrix: (soil/water) WATER Lab Sample ID: 36926.02

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: K25971.D

Level: (low/med) LOW Date Received: 12/28/98

% Moisture: not dec. _____ Date Analyzed: 12/30/98

Column: (pack/cap) CAP Dilution Factor: 1.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
71-43-2	BENZENE	5	U
108-88-3	TOLUENE	5	U
1330-20-7	Xylene (Total)	5	U

CHAIN OF CUSTODY RECORD

SOUTHWEST LABORATORY OF OKLAHOMA, INC.
1700 W. Albany • Broken Arrow, Oklahoma 74012-1421
Office 918-251-2858 • Fax 918-251-2599

TM

SAMPLING FIRM: ENECOTECH

CLIENT CONTACT: JAY MEDNICK

PHONE NUMBER: 303-861-2200

P.O. or PROPOSAL NUMBER: 0138R014

PROJECT NAME: UDS - ARK. CITY

SAMPLER (Signature): [illegible]

ANALYTICAL TESTS REQUESTED

SAMPLE ID	DATE (1998)	TIME	COMP	GRAB	LOCATION	MATRIX	NUMBER OF CONTAINERS	VOC's	SVA's	METALS					REMARKS
1	12-28	11:15	X		LYS-LTU-NORTH	WATER	3	1	1	1					ONLY COLLECTED ≈250 mL FOR SEMI
1	1	12:00	X		LYS-LTU-SOUTH	WATER	2	1	—	1					
				X	TBD 122898	DI WATER	2	2	—	—					TRIP BLANK

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
[illegible]	12-28 1998	13:55	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY: (Signature)
			E. Chinlong

REMARKS:

[SR012-1192-03]

APPENDIX - B

1998 ANNUAL UNSATURATED ZONE MONITORING REPORT
LAND TREATMENT UNIT

LTU Soil Core Laboratory Analytical Reports

EnecoTech

SOUTHWEST LABORATORY OF OKLAHOMA, INC.
1700 West Albany Broken Arrow, Oklahoma 74012 Office (918) 251-2858 Fax (918) 251-2599

ULTRAMAR DIAMOND SHAMROCK CORPORATI
6000 N. LOOP 1604 WEST
SAN ANTONIO, TX 78249

REPORT : 36858.01

REPORTED : 01/18/99

Attn: STEVE NICHOLS

PROJECT : ARK CITY/0138R-014
LAB# : 36858.01
SAMPLE #: LTU-AWTZ
LOCATION: GROUNDWATE

SAMPLED : 12/17/98
SUBMITTED: 12/18/98

MATRIX : Soil

%MOISTURE: 0.0

MISCELLANEOUS

PARAMETER	RESULTS	UNITS	DATE PREPARED	DATE ANALYZED	REFERENCE METHOD
CEC*	14.3	MEQ/1		01/12/99	SW 9081
pH*	8.1	su		12/23/98	SM 4500H/EPA 150.1

COMPOUND* = RESULTS REPORTED AS RECEIVED

1
INORGANIC ANALYSES DATA SHEET

CLIENT SAMPLE ID

LTUABTZ

Lab Name: SOUTHWEST_LAB_OF_OK Contract: UDSC
Lab Code: SWOK Case No.: 36925 SAS No.: SDG No.: 36925
Matrix (soil/water): SOIL Lab Sample ID: 36925.01
Level (low/med): LOW Date Received: 12/24/98
% Solids: 97.6

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7440-47-3	Chromium	4.5			P
7439-92-1	Lead	2.3			P

Color Before: BROWN Clarity Before: Texture: MEDIUM
Color After: YELLOW Clarity After: CLEAR Artifacts:

Comments:
CLIENT_ID=LTU-ABTZ

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

LTU-ABTZ

Lab Name: SWL-TULSA Contract: ARKCITYLTU

Lab Code: SWOK Case No.: UDSC SAS No.: SDG No.: 36925

Matrix: (soil/water) SOIL Lab Sample ID: 36925.01

Sample wt/vol: 5.0 (g/mL) G Lab File ID: I39896.D

Level: (low/med) LOW Date Received: 12/28/98

% Moisture: not dec. 2 Date Analyzed: 12/29/98

Column: (pack/cap) CAP Dilution Factor: 1.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
71-43-2	BENZENE	5	U
108-88-3	TOLUENE	5	U
1330-20-7	XYLENES(total)	5	U

1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

LTU-ABTZ

Lab Name: SWL-TULSA Contract: ARK CITY/LT

Lab Code: SWOK Case No.: UDSC SAS No.: SDG No.: 36925

Matrix: (soil/water) SOIL Lab Sample ID: 36925.01

Sample wt/vol: 30.9 (g/mL) G Lab File ID: P19132.D

Level: (low/med) LOW Date Received: 12/28/98

% Moisture: not dec. 2 dec. Date Extracted:12/30/98

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 01/07/99

Concentrated Extract Volume: 5000(uL)

GPC Cleanup: (Y/N) N pH: 8.8 Dilution Factor: 1.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	340	J
85-01-8	Phenanthrene	8800	
120-12-7	Anthracene	1000	J
218-01-9	Chrysene	8800	

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 West Albany Broken Arrow, Oklahoma 74012 Office (918) 251-2858 Fax (918) 251-2599

ULTRAMAR DIAMOND SHAMROCK CORPORATI
6000 N. LOOP 1604 WEST
SAN ANTONIO, TX 78249

REPORT : 36858.02

Attn: STEVE NICHOLS

REPORTED : 01/18/99

PROJECT : ARK CITY/0138R-014
LAB# : 36858.02
SAMPLE #: LTU-BWTZ
LOCATION: GROUNDWATE

SAMPLED : 12/17/98
SUBMITTED: 12/18/98

MATRIX : Soil

%MOISTURE: 0.0

MISCELLANEOUS

PARAMETER	RESULTS	UNITS	DATE PREPARED	DATE ANALYZED	REFERENCE METHOD
EC*	11.3	MEQ/l		01/12/99	SW 9081
H*	7.9	su		12/23/98	SM 4500H/EPA 150.1

MPOUND* = RESULTS REPORTED AS RECEIVED

INORGANIC ANALYSES DATA SHEET

CLIENT SAMPLE ID

LTUBBTZ

Lab Name: SOUTHWEST_LAB_OF_OK Contract: UDSC
Lab Code: SWOK Case No.: 36925 SAS No.: SDG No.: 36925
Matrix (soil/water): SOIL Lab Sample ID: 36925.02
Level (low/med): LOW Date Received: 12/24/98
% Solids: 91.5

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7440-47-3	Chromium	10.6			P
7439-92-1	Lead	36.1			P

Color Before: BROWN Clarity Before: Texture: MEDIUM
Color After: YELLOW Clarity After: CLEAR Artifacts:

Comments:
CLIENT_I.D.=LTU-BBTZ

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

LTU-BBTZ

Lab Name: SWL-TULSA Contract: ARKCITYLTU

Lab Code: SWOK Case No.: UDSC SAS No.: SDG No.: 36925

Matrix: (soil/water) SOIL Lab Sample ID: 36925.02

Sample wt/vol: 5.0 (g/mL) G Lab File ID: I39897.D

Level: (low/med) LOW Date Received: 12/28/98

% Moisture: not dec. 8 Date Analyzed: 12/29/98

Column: (pack/cap) CAP Dilution Factor: 1.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
71-43-2	BENZENE	5	U
108-88-3	TOLUENE	5	U
1330-20-7	XYLENES(total)	5	U

1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

LTU-BBTZ

Lab Name: SWL-TULSA Contract: ARK CITY/LT

Lab Code: SWOK Case No.: UDSC SAS No.: SDG No.: 36925

Matrix: (soil/water) SOIL Lab Sample ID: 36925.02

Sample wt/vol: 30.1 (g/mL) G Lab File ID: P19048.D

Level: (low/med) LOW Date Received: 12/28/98

% Moisture: not dec. 8 dec. Date Extracted: 12/30/98

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 01/04/99

Concentrated Extract Volume: 1000(uL)

GPC Cleanup: (Y/N) N pH: 8.0 Dilution Factor: 1.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	360	U
85-01-8	Phenanthrene	360	U
120-12-7	Anthracene	360	U
218-01-9	Chrysene	360	U

CHAIN OF CUSTODY RECORD

SOUTHWEST LABORATORY OF OKLAHOMA, INC.
1700 W. Albany • Broken Arrow, Oklahoma 74012-1421
Office. 918-251-2858 • Fax 918-251-2599

TM

SAMPLING FIRM: ENECOTECH

CLIENT CONTACT: JAY MEDNICK

PHONE NUMBER: 303-861-2200

P.O. or PROPOSAL NUMBER: 0138R014

PROJECT NAME: UDS-ARK. CITY

SAMPLER (Signature):

SAMPLE ID	DATE	TIME	COMP	GRAB	LOCATION	MATRIX	NUMBER OF CONTAINERS	pH	CATION EXC. CAP.	METALS	VOCS	BASE NEUTRALS				REMARKS
1	12-23 1998	10:00	X		LTU-ABTZ	SOIL	2	X	X	X	X	X	—	—	—	
	12-23	11:00	X		LTU-BBTZ	SOIL	2	X	X	X	X	X	—	—	—	
				X	TBD122398	WTR	2	—	—		X	—	—	—	—	TRIP BLANK

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)
	12-23 1998	1310	
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY (Signature) 12/24/98 13:10 E. Maimbourg

REMARKS

012-1102-03]

ATTACHMENT 2

CLOSURE CERTIFICATION FORM

40 CFR SECTION 265.115 CERTIFICATION OF CLOSURE FOR THE LAND TREATMENT UNIT

We hereby certify that we have reviewed the steps taken during closure of the Land Treatment Unit and questioned those individuals who supervised those steps and found that the Land Treatment Unit was closed in accordance with the closure plan approved for that unit by the Kansas Department of Health and Environment.

OWNER/OPERATOR CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name _____ Date _____

Title _____

Company _____

PROFESSIONAL ENGINEER OR QUALIFIED SOIL SCIENTIST

Name _____ Date _____

Title _____

Company _____

TABLES

TABLE 1

CLOSURE ACTIVITY SCHEDULE

Months after Closure Implementation

Closure Activity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Continued Operation												
Annual Unsaturated Soil Zone Monitoring				♦								
Closure Determination Sampling				♦							♦	
Establish Vegetative Cover												♦
Certify Closure												♦
Groundwater Monitoring	♦						♦					

Notes:
Groundwater sampling requirements specified in Section 15 and Appendix P of the Part B Permit Application will supercede this table. The vegetative cover will be established during the growing season, which may not coincide with this timeline.

TABLE 2

VEGETATIVE COVER GRASSES

Name	Species	Characteristics	Percent of Seed Mix
Switch grass	*Panicum virgatum*	Warm-season, perennial	25%
Big Bluestem	*Andropogon gerardi*	Warm-season, perennial	25%
Little Bluestem	*Andropogon scoparius*	Warm-season, perennial	15%
Indian grass	*Sorghastrum nutans*	Warm-season, perennial	15%
Canada Wildrye	*Elymus canadensis*	Cool-season, perennial	10%
Scribner Panicum	*Panicum scribnerianum*	Cool-season, perennial	10%

Sources: SCS Soil Survey of Cowley County, Kansas.
Pasture and Range Plants, Philips Petroleum Company, Bartlesville, OK, 1963.
Forage, The Science of Grasslands and Agriculture, Health, ME, Iowa State University Press, 1978.

This seed mixture may be modified if recommended by the soil conservation service or other qualified specialist.

TABLE 3

PRINCIPAL HAZARDOUS CONSTITUTENTS (PHCs)

	SOIL (PQL)[1] (mg/kg)	SW-846 Method
DETECTED AT REFINERY		
2-Methylnaphthalene*	0.33	8270
Naphthalene	0.33	8270
Nitrobenzene	0.33	8270
Phenanthrene	0.33	8270
Phenol	0.33	8270
Pyrene	0.33	8270
Pyridine	0.33	8270
INORGANICS		
Antimony	105	6010B
Arsenic	1	6010B
Barium	1	6010B
Beryllium	0.1	6010B
Cadmium	0.3	6010B
Chromium	0.5	6010B
Cyanides	0.5	6010B
Lead	0.3	9010
Mercury	0.033	7471
Nickel	1	6010B
Selenium	0.5	6010B
Silver	7	6010B
Vanadium	0.6	6010B
Zinc	2	6010B
ORGANICS: 8260		
Benzene	0.005	5035/8260
Carbon disulfide	0.005	5035/8260
Chloroform	0.005	5035/8260
1,2-Dichloroethane	0.005	5035/8260
1,1-Dichloroethylene	0.005	5035/8260
1,4-Dioxane	0.005	5035/8260
Ethylbenzene	0.005	5035/8260
Ethylene dibromide	0.005	5035/8260
Methyl ethyl ketone	0.005	5035/8260
Styrene	0.005	5035/8260

[1]PQL = Practical Quantitation Limit (These are target values. Matrix interference may increase PQLs.) The analytical method detection level will be lower than the PQL.

TABLE 3 (continued)

	SOIL (PQL)[1] (mg/kg)	SW-846 Method
ORGANICS: 8260 (continued)		
Tetrachloroethylene	0.005	5035/8260
Toluene	0.005	5035/8260
1,1,1-Trichloroethane	0.005	5035/8260
Trichloroethylene	0.005	5035/8260
1,2,4-Trimethylbenzene	0.005	5035/8260
1,3,5-Trimethylbenzene	0.005	5035/8260
Xylenes (Total)	0.005	5035/8260
ORGANICS: 8270		
Ancenaphthalene	0.33	8270
Anthracene	0.33	8270
Benzo(a)anthracene	0.33	8270
Benzo(b)fluoranthene	0.33	8270
Benzo(a)pyrene	0.33	8270
Bis(2-ethylhexyl)-phthalate	0.33	8270
Butyl benzyl phthalate	0.33	8270
Chrysene	0.33	8270
Cresols (methylphenol)	0.33	8270
Dibenz(a,h)anthracene	0.33	8270
Di-n-butyl phthalate	0.33	8270
1,2-Dichlorobenzene	0.33	8270
1,4-Dichlorobenzene	0.33	8270
7,12-Dimethylben(a)-anthracene	0.33	8270
2,4-Dimethylphenol	0.33	8270
2,4-Dinitrotoluene	0.33	8270
Di-n-octyl phthalate	0.33	8270
Fluoranthene	0.33	8270
Fluorene	0.33	8270
Indeno(1,2,3-cd)pyrene	0.33	8270
1-Methylnaphthalene	0.33	8270
GENERAL PARAMETERS		
pH	NA	9045
Oil and grease	50	413.2
Cation exchange capacity	NA	-
Total organic carbon	0.01%	AS890-30
Moisture content	0.1%	413.1

[1]PQL = Practical Quantitation Limit (These are target values. Matrix interference may increase PQLs.) The analytical method detection level will be lower than the PQL.

TABLE 4

Groundwater Protection Values
for Compliance Monitoring Evaluation
UDS, Inc. - Arkansas City, Kansas

PARAMETER	GWPS[c] µg/L
Carbon disulfide	1.2E+04 [Suter]
Nitrobenzene	3 3E+03 [kaac/100]
2,4-Dinitrotoluene	2.8E+03 [k]
1,4-Dioxane	3.4E+04 [m]
Chloroform	1.5E+04 [fcc]
1,1,2-Dichlorobenzene	9.4E+03 [k]
1,4-Dichlorobenzene	9.4E+03 [k]
Bis(2-ethylhexyl)-phthalate	4.4E+03 [fcc]
Naphthalene	7.6E+03 [k]
Trichloroethylene	2.7E+05 [k]
Acenaphthene	6.4E+03 [k]
Methyl ethyl ketone	2.7E+04 [m]
2,4-Dimethylphenol	6.5E+03 [k]
Di-n-octyl phthalate	3.7E+01 [fcc]
Butyl benzyl phthalate	2.7E+02 [R9]
1,2-Dichloroethane	2.5E+04 [k]
Phenol	3.2E+04 [k]
Fluroanthene	4.9E+02 [fav/100]
Fluorene	1.5E+02 [m]
Tetrachloroethylene	1.0E+04 [k]
1,1-Dichloroethylene	1.4E+03 [kacc]
1,1,1-Trichloroethane	2 2 E+03 [kaac/100]
Styrene	9.8E+02 [m]
Chlorobenzene	6.2E+02
Ethylbenzene	3.9E+03 [fav/100]
Toluene	2.2E+03 [k]
Cresols (methylphenols)	1.0E+03 [m]
Xylenes (Total)	4.3E+02 [m]
Di-n-butyl phthalate	3.7E+01 [k]
Phenanthrene	7.8E+01 [k]
Benzene	6.5E+02 [fav]
Chromium	1.2E+04 [k]
Antimony	3.7E+02 [k]
Cadmium	2.5E+02 [k]
Nickel	4.2E+03 [kh]
Lead	3.8E+02 [kh]
Beryllium	6.5E+01 [k]
Arsenic	6.2E+02 [k]
Mercury	2.5E+00 [m]

TABLE 4

Groundwater Protection Values for Compliance Monitoring Evaluation UDS, Inc. - Arkansas City, Kansas

PARAMETER	GWPS[c] µg/L
Selenium	6.2E+01 [k]
Barium	2.3E+03 [m]
Silver	2.0E+02 [kh]
Vanadium	1.5E+02 [m]
Zinc	2.8E+03 [m]
Cyanides	6.4E+01 [k]
7,12-Dimethylbenz(a)-anthracene	1.2E-03 [NA]
Benzo (a) anthracene	1.2E-03 [NA]
Benzo (a) pyrene	2.5E+00 [NA]
Benzo (b) fluoranthene	1.1E-03 [NA]
Chrysene	1.2E-01 [NA]
lndeno(1,2,3-cd)pyrene	7.4E-04 [NA]
Pyrene	1.7E+00 [NA]
Ethylene dibromide	6.2E-01 [NA]
Pyridine	3.7E-02 [NA]
Anthracene	2.2E+04 [NA]
Dibenz (a,h) anthracene	1.1E-01 [NA]
1,2,4-Trimethylbenzene	2.6E+04 [NA]
1,3,5-Trimethylbenzene	2.2E+04 [NA]
2-Methylnaphthalene	7.0E+05 [NA]
1-Methylnaphthalene	7.0E+05 [NA]

A – Surface water protection standard (SWPS).
B –Flow weighted SWPS: Qriver/Qgw 7.4E3.
C– Groundwater Protection Standard: SWPS/(Af*UF).
a – KDHE Risk Based Standards (March 24, 1999)
b – USEPA 1999a. Maximum contaminant levels
c – USEPA 1999b Region 9 Tap Water Risk Based Concentration
d – Criteria consistent with KDHE policy for protection of groundwater
k– KDHE 1999. Water Quality Standards – Proposed
fav – Freshwater Acute Value
fcc – Freshwater Chronic Value
R9 – USEPA Region 9 Chronic Screening Value
h – assumed hardness of 200 mg/L
S – Suter 1996. EC20 Population.
M – Criteria consistent with KDHE policy for protection of groundwater
NA – Insufficient data for development of surface water protection standard, value listed is human health protection standard+A49

APPENDIX J

Post-Closure Plan for LTU

APPENDIX J

POST-CLOSURE CARE PLAN FOR THE LAND TREATMENT UNIT

ARKANSAS CITY, KANSAS REFINERY

[40 CFR §264.117, §264.118, §264.280]

APPENDIX J

POST-CLOSURE CARE PLAN FOR THE LAND TREATMENT UNIT

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APPENDIX J

POST-CLOSURE CARE PLAN LAND TREATMENT UNIT
[40 CFR §264.117, §264.118, §264.280]

1.0 SCOPE

This Post-Closure Care Plan describes post-closure monitoring and maintenance activities for the Land Treatment Unit (LTU) at the Total Petroleum, Inc. (Total) Refinery in Arkansas City, Kansas. The LTU is a Hazardous Waste Treatment Unit that is permitted under 40 CFR 264. This plan outlines the steps necessary to provide proper post-closure care for the LTU.

2.0 SUMMARY OF CLOSURE ACTIVITIES AND CLOSURE STATUS

Waste addition to the LTU has recently ceased but physical closure of the LTU has not been conducted. Post-closure activities for the LTU will begin upon completion of the closure activities specified in the LTU Closure Plan. However, the LTU will be exempt from any and all post-closure requirements if closure is performed in accordance with the approved Closure Plan and clean-closure objectives specified in the approved plan are satisfied pursuant to 40 CFR 264.280(d).

The Post-Closure monitoring and maintenance activities for the LTU specified in this plan are based upon the assumption that closure of the LTU consists of grading to control run-on and runoff, placement of approximately 6-inches of topsoil over the Unit, and seeding to establish a vegetative cover. Further, it is assumed that unsaturated zone and groundwater monitoring will continue through post-closure for the purposes of this Plan and the associated cost estimate. This post-closure plan may require amendment should closure sampling results indicate that a more aggressive closure strategy is required. In this event, a revised Post-Closure Care Plan will be submitted to KDHE along with the required revisions to the LTU Closure Plan, prior to closure certification.

3.0 POST-CLOSURE CARE (40 CFR 264.118)

Post-closure care activities will consist of inspecting, monitoring and maintaining the LTU. The monitoring and maintenance activities will be conducted in accordance with the requirements of 40 CFR 264.117(a). As such, this plan has been prepared in accordance with the requirements of 40 CFR 264.118(a) and (b), and 40 CFR 264.280(c) Post-closure care will consist of the following:

1 Continued operations (including pH control) necessary to enhance degradation and transformation and sustain immobilization of hazardous constituents in the treatment zone to the extent that such measures are consistent with other post-closure activities (40 CFR 264.280(c)(l)). Maintenance of the vegetative cover is expected to ensure optimum pH, microbial action and soil moisture content to satisfy these conditions. Treatment zone pH will be monitored to verify that optimum pH is maintained during the unsaturated zone monitoring described below. Should the monitoring results indicate that the treatment zone pH has decreased below a pH of 6.5, lime will be applied to increase the soil pH.

2 Maintenance of the vegetative cover (40 CFR 264.280(c)(2)). A permanent vegetative cover will be maintained by periodic mowing and fertilizing as deemed necessary by Total Petroleum, Inc. Localized reseeding will also be performed if needed.

3 Preventing run-on and runoff from eroding or otherwise damaging the final covers. Run-on will be prevented by a series of drainage ditches completely surrounding the LTU. Runoff will be controlled by grading the LTU to allow precipitation to drain to the surrounding ditches. Preliminary design plans for the final LTU grading are included in the LTU Closure Plan. Potential damage from runoff will be minimized by the grade of final slopes, approximately one percent (1%) to three percent (3%). Any erosion damage that is identified during inspections will be repaired and steps will be taken to prevent such future damage.

4 Prohibiting the growth of food chain crops on the facility throughout the post-closure care period.

5 Maintaining and monitoring the groundwater monitoring system according to the "Groundwater Monitoring Plan" prepared for this site (Section 15, 1998 Permit Renewal Application). The monitor wells will be visually inspected during the scheduled inspections for any signs of breakage, failure or significant deterioration in construction materials. The specific inspection items are provided in Section 6 of the 1998 Permit Renewal Application. The materials and methods of construction provide for a useful life in excess of thirty to forty years under normal use and wear. There are no pumps or valves or other moving parts to replace. The design of the well casing, screens and gravel packs coupled with the low pumping rate and frequency should allow them to function maintenance or replacement-free for the intended life of the wells. Of course, the monitor wells will be inspected during sampling events. Funds are provided under miscellaneous contingency costs, for minor repairs to exposed monitor well casings or caps. These repairs will be made as needed to maintain the integrity of the wells. The 1ow probability of occurrence coupled with the low costs of renovations or replacement minimize any need for providing well replacement costs. However, should replacement of a well be required, KDHE will be notified of the intended well replacement and the replacement will not be conducted until approved by KDHE.

6 Unsaturated zone monitoring at a frequency of once every 2 years. The unsaturated zone monitoring will consist of conducting soil cores within the LTU following procedures similar to those used during LTU operations prior to closure. Sampling and analysis details are provided in Attachment I to this post-closure plan.

Post-closure inspections will be routinely conducted as specified in Section 6 of this Permit Application to identify any of the above maintenance needs. The purpose of the inspections is to detect any deterioration, malfunction or failure of run-on and runoff controls, unit or equipment failure, malfunction, or deterioration associated with the Facility that might represent an operating problem or a hazard to human health or the environment. Routine maintenance activities are limited to maintenance of the vegetative cover for the Units by mowing and application of fertilizer as necessary. All other maintenance activities will be performed on an as needed basis based on observations made during the scheduled inspections.

Inspection forms for documentation of inspections and any necessary corrective actions are included in Section 6 of this Permit Application. A separate inspection form will be completed for each scheduled inspection. The inspection forms will be maintained as described in Section 6.

4.0 SITE SECURITY (40 CFR 264.117(b))

During the post-closure period all existing security measures will continue as required to prevent unauthorized entry onto the site. These site security measures are described in greater detail in Section 5 of this Permit Application. Signs will be posted and maintained to be legible and visible at a distance of 25 feet from all reasonable approaches to the LTU. The signs will warn the public "Danger Keep-Out Authorized Personnel Only".

Post-closure use of the LTU will not be allowed to disturb any component of the containment system or functions of the monitoring systems.

5.0 EXPOSURE INFORMATION (40 CFR 270.10(j))

The potential for the public to be exposed to hazardous wastes or hazardous constituents through releases related to the LTU is minimal during the post-closure care period for the following reasons:

1. There will be no active transportation or handling of hazardous wastes or hazardous constituents related to the LTU during the post-closure care period, thus minimizing the potential for a release.
2. Inspection and maintenance of the protective surface layer over the LTU will ensure that hazardous
3. Groundwater monitoring will be conducted to identify any releases to groundwater.
4. Corrective action activities are currently being conducted at the site to capture and treat groundwater affected by site activities.
5. The potential pathways of human exposure resulting from a release are limited. Site security measures limit access to the site and the LTU.
6. As described in the Groundwater Monitoring Plan (Section 15 of the Permit Application), corrective actions are being conducted to address affected groundwater. These corrective actions are designed to capture affected groundwater and prevent potential off-site migration. The prevention of off-site migration will minimize the potential for human exposure via a groundwater ingestion pathway.

6.0 POST-CLOSURE CARE PERIOD (40 CFR 264.117(a))

Total will continue post-closure care for the LTU for 30 years after completing closure in accordance with the requirements of 40 CFR 117(a)(l), unless a shorter period is approved in accordance with 40 CFR 117(a)(2)(i) or the LTU is determined to be no longer subject to regulation under 40 CFR 264.280(d). Based on an assumed LTU closure date in the year 2001, post-closure care is scheduled to be complete in the year 2031.

7.0 POST-CLOSURE CERTIFICATION (40 CFR 264.120)

No later than 60 days after completion of the established post-closure care period, a certification that the post-closure care period for the unit was performed in accordance with the specifications in the approved Post-Closure Care Plan will be submitted to KDHE. The certification will be signed by the owner or operator and an independent registered professional engineer.

8.0 POST-CLOSURE CONTACT (40 CFR 264.118(b)(3))

Ms. Brenda B. Epperson of MRP Properties Company, LLC will serve as the post-closure care period contact and can be reached by written letter or telephone at the following:

Ms. Brenda B. Epperson	Environmental Manager, MRP Properties Company, LLC (210) 592-4619
Physical Address:	One Valero Way San Antonio, TX 78249-1112
Mailing Address:	PO Box 696000 San Antonio, TX 78269-6000

9.0 POST-CLOSURE COSTS AND FINANCIAL ASSURANCE (40 CFR 264, Subpart H)

Post-closure cost estimates are provided in Appendix L of the 1998 Permit Renewal Application. Cost assurance and liability coverage will be maintained until the end of the post-closure care period. The financial mechanism chosen to provide post-closure cost assurance and the mechanism chosen to provide liability coverage are described in Section 14 of this Permit Application.

10.0 PLAN AMENDMENTS (40 CFR 264.118(d))

This Post-Closure Care Plan will be amended when operating plans or facility design affect this post- closure plan subject to the approval of KDHE. Amendments to the plan will be conducted in accordance with the requirements of 40 CFR 264.118(d).

APPENDIX J, ATTACHMENT 1

LAND TREATMENT UNIT POST-CLOSURE UNSATURATED ZONE MONITORING

Unsaturated zone monitoring conducted during the post-closure care period for the LTU will consist of soil core sampling and analysis similar to that specified in Total's 1987 operating permit. Soil samples collected from within the treatment zone will be analyzed for pH to evaluate the need to apply soil amendments. Soil samples collected from below the treatment zone will be analyzed for the following principal hazardous constituents (PHCs):

- barium
- chromium
- lead
- benzene
- toluene
- xylene
- anthracene
- naphthalene
- phenanthrene
- chrysene

Soil core monitoring will be performed according to the following procedures:

1. Total will conduct LTU soil core monitoring event once every 2 years.
2. At each soil core monitoring event, Total will collect soil core samples from three randomly selected locations within each of Plots A and B.
3. Soil core samples will be collected using a bucket auger. The auger will be decontaminated before use. At each sample location, the auger will be advanced to the center of the treatment zone. This depth will be determined by final site grading contours and by visual characterization of soil cuttings. If the treatment zone is indistinguishable, the auger will be advanced to a depth of 3.5 feet below the initial soil surface. The within-treatment-zone sample will be collected from the soil interval between 3.5 and 4.0 feet below the initial soil surface. This is 0.5-feet deeper than samples collected during LTU operations to account for the 6-inch layer of topsoil placed over the LTU during closure. The auger will be reinserted into the borehole and advanced to the base of the treatment zone. Again, if this is indistinguishable by visual characterization of the data, or from review of final grading contours, the auger will be advanced to a depth of 5.0 feet below the initial soil surface. The auger will be removed and decontaminated to prevent contamination of the sample to be collected from below the treatment zone. After decontamination, the auger will be reinserted into the borehole and advanced six more inches. The below-treatment-zone sample will be collected from the soil interval between 5.0 and 5.5 feet below the initial soil surface.
4. The three soil core samples collected from each depth interval will be mixed to provide one composite sample from within the treatment zone and one composite sample from below the treatment zone for each plot.

5. The composite soil core samples collected from within the treatment zone will be analyzed for soil pH and PHCs. The composite sample made up of soil cores collected from below the treatment zone will be analyzed for PHCs.
6. The samples collected for soil pH analysis will be placed into 250 ml glass bottles. The samples collected for PHC analysis will be placed into a 125 ml glass bottle for volatile organic analysis and into a 250 ml glass bottle for general parameters and base/neutral organic analysis.
7. Each borehole will be back-filled with grout comprised of native soil and cement, compacted to field bulk density. The fill soil will be placed carefully to avoid contamination of the soil below the treatment zone.
8. Sample containers will be placed into an ice chest and maintained at the temperature of 4 degrees Celsius for shipment to the laboratory.
9. Soil core samples will be analyzed by a KDHE approved laboratory. The laboratories will be instructed to use the following analysis methods:

Analysis	Method Number	Reference
General Parameters		
pH	9045	SW-846
CEC	9080	SW-846
Metals		
barium	6010	SW-846
lead	7420/6010	SW-846
chromium	7190/6010	SW-846
Volatile Organics		
benzene	8260	SW-846
toluene	8260	SW-846
xylene	8260	SW-846
Base/Neutrals		
anthracene	8270	SW-846
naphthalene	8270	SW-846
phenanthrene	8270	SW-846
chrysene	8270	SW-846

10. A chain of custody form will be completed for each ice chest. Laboratory specified chain of custody procedures will be followed at all times while the samples are in the custody of Total.
11. Background concentrations of each PHC were established pursuant to the 1987 permit. All subsequent soil core PHC analysis results will be statistically compared to the background values using the average replicate (AR) t-test method.

APPENDIX K

Post-Closure Plan #1, #2, and #3A

APPENDIX K

POST-CLOSURE CARE PLAN FOR THE #1 AND #2 SURFACE IMPOUNDMENTS AND #3A AERATED LAGOON

ARKANSAS CITY, KANSAS REFINERY

[40 CFR §265.117, §265.118, §265.228]

APPENDIX K

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APPENDIX K

POST-CLOSURE CARE PLAN (40 CFR §265.117, §265.118, §265.228)

1.0 SCOPE

This Post-Closure Care Plan describes post-closure monitoring and maintenance activities for the #1 and #2 surface impoundments and #3A aerated lagoon at the former Total refinery in Arkansas City, Kansas. These three Hazardous Waste Management Units have been physically closed. Post-closure care is being conducted under 40 CFR 265 requirements. This plan outlines the steps necessary to provide proper post-closure care for these units.

2.0 SUMMARY OF CLOSURE ACTIVITIES

Closure has been certified for the #1 and #2 surface impoundments and for the #3A aerated lagoon. Summaries of closure activities for each unit follow.

2.1 #1 and #2 Surface Impoundments

Closure of the #1 and #2 surface impoundments was certified in 1988. Closure activities included dewatering, sludge removal, soil removal, placement of backfill, and construction of a cap with a vegetative cover. An engineered low permeability cap consisting of 2 feet of compacted clay was constructed over the #1 surface impoundment due to the remaining presence of affected soils in the unit. The clay was overlain with one foot of topsoil as a final protective cover. The cap for the #2 surface impoundment consisted of compacted backfill soil overlain with one foot of topsoil. The #2 surface impoundment was not required to have an engineered low permeability cap because it was closed by removal and decontamination under 40 CFR §265.228 rather than as a landfill. Both units were graded to control run-on and runoff.

2.2 #3A Aerated Lagoon

Closure activities for the #3A aerated lagoon were conducted in 1997 and closure was certified in February 1998. Closure activities included removal of soil impacted above the KDHE risk-based non- residential closure cleanup standards, backfill of the impoundment with clean fill, placement of a one-foot protective surface layer, and establishment of a vegetative cover. The approved closure plan specified that Total would conduct post-closure care and monitoring of the unit.

3.0 POST-CLOSURE CARE (40 CFR §265.118)

Post-closure care activities will consist of inspecting, monitoring and maintaining the closed units. The monitoring and maintenance activities will be conducted in accordance with the requirements of 40 CFR §265.117(a). As such, this plan has been prepared in accordance with the requirements of 40 CFR §265.118(a) and (b), and 40 CFR §265.228(b).

Post-closure care will consist of the following:

1. Maintaining the integrity and effectiveness of the final cover for each unit. Repairs will be made to the cap or protective surface layer as necessary to correct the effects of settling, subsidence, erosion, flood damage, standing water or other events during the post-closure period.

2. Maintaining and monitoring the groundwater monitoring system according to the "Groundwater Monitoring Plan" provided in Section 15 of this Permit Application. The monitoring wells will be visually inspected during the scheduled inspections for any signs of breakage, failure or significant deterioration in construction materials. The specific inspection items and schedule are provided in Section 6 of this Permit Application. The materials and methods of construction provide for a useful life in excess of thirty to forty years under normal use and wear. There are no pumps or valves or other moving parts to replace. The design of the well casing, screens and gravel packs coupled with the low pumping rate and frequency should allow them to function maintenance or replacement-free for the intended life of the wells. Of course, the monitor wells will be inspected during sampling events. Funds are provided under miscellaneous contingency costs, for minor repairs to exposed monitor well casings or caps. These repairs will be made as needed to maintain the integrity of the wells. The low probability of occurrence coupled with the low costs of renovations or replacement minimize any need for providing well replacement costs. However, should replacement of a well be required, KDHE will be notified of the intended well replacement and the replacement will not be conducted until approved by KDHE.
3. Preventing run-on and runoff from eroding or otherwise damaging the final covers. The Units are entirely surrounded by systems of dikes and ditches, which prevent surface run-on. Potential damage from runoff is minimized by the grade of final slopes, approximately one percent (1%). Any erosion damage that is identified during inspections will be repaired and steps will be taken to prevent such future damage.
4. Periodic mowing and fertilizing of the native vegetative cover will be performed as necessary to maintain the effectiveness of the final covers.
5. Maintaining the area warning signs posted as security measures under Section 5 of the Permit Application. The warning signs are to be legible and visible at a distance of 25 feet from all reasonable approaches.

Post-closure inspections will identify any of the above maintenance needs. The purpose of the inspections is to detect any deterioration, malfunction or failure of run-on and runoff controls, unit or equipment failure, malfunction, or deterioration associated with the facility that might represent an operating problem or a hazard to human health or the environment. The schedule for post-closure inspections is outlined in Section 6 of this Permit Application. Routine maintenance activities are limited to maintenance of the vegetative covers for the Units by mowing and application of fertilizer as necessary. All other maintenance activities will be performed on an as needed basis based on observations made during the scheduled inspections.

Inspection forms for documentation of inspections and any necessary corrective actions are included in Section 6 of this Permit Application. The inspection forms will be maintained as described in Section 6.

4.0 SITE SECURITY (40 CFR §265.117(b))

During the post-closure period all existing security measures will continue as required to prevent unauthorized entry onto the site. These site security measures are described in greater detail in Section 5 of this Permit Application. Signs will be posted and maintained to be legible and visible at a distance of 25 feet from all reasonable approaches to the units. The signs will warn the public "Danger – Keep Out – Authorized Personnel Only."

Post-closure use of the units will not be allowed to disturb any component of the containment system or functions of the monitoring systems.

5.0 EXPOSURE INFORMATION (40 CFR §270.10(j))

The potential for the public to be exposed to hazardous wastes or hazardous constituents through releases related to the three units described herein is minimal during the post-closure care period for the following reasons:

1. There will be no active transportation or handling of hazardous wastes or hazardous constituents related to the units during the post-closure care period, thus minimizing the potential for a release. Inspection and maintenance of the protective surface layer over each unit will ensure that hazardous wastes or hazardous constituents are not released to the air or to surface water during storm events. Groundwater monitoring will be conducted to identify any releases to groundwater. Corrective action activities are currently being conducted at the site to capture and treat groundwater affected by site activities.
2. The potential pathways of human exposure resulting from a release are limited. Site security measures limit access to the site. As described in the Groundwater Monitoring Plan (Section 15 of the Permit Application), corrective actions are being conducted to address affected groundwater. These corrective actions are designed to capture affected groundwater and prevent potential off-site migration . The prevention of off-site migration will minimize the potential for human exposure via a groundwater ingestion pathway.

6.0 POST-CLOSURE CARE PERIOD (40 CFR §265.117(a))

The facility will continue post-closure care for each unit for 30 years after completing closure of the Unit in accordance with the requirements of 40 CFR 117(a)(l), unless a shorter period is approved in accordance with 40 CFR 117(a)(2)(i). Post-closure care for the #1 and #2 surface impoundments is scheduled to be complete in the year 2018. Post-closure care for the #3A aerated lagoon is scheduled to be complete in the year 2028.

7.0 POST-CLOSURE CERTIFICATION (40 CFR §265.120)

No later than 60 days after completion of the established post-closure care period for each unit, a certification that the post-closure care period for the unit was performed in accordance with the specifications in the approved post-closure plan will be submitted to KDHE. The certification will be signed by the owner or operator and an independent registered professional engineer.

8.0 POST-CLOSURE CONTACT (40 CFR §265.118(b)(3))

Ms. Brenda B. Epperson of MRP Properties Company, LLC will serve as the post-closure care period contact and can be reached by written letter or telephone at the following:

Ms. Brenda B. Epperson	Environmental Manager MRP Properties Company, LLC (21 0) 345-4619
Physical Address:	One Valero Way San Antonio, TX 78249-1112

Mailing Address:	PO Box 696000 San Antonio, TX 78269-6000

9.0 POST-CLOSURE COSTS AND FINANCIAL ASSURANCE (40 CFR §265, Subpart H)

Post-closure cost estimates are provided in Appendix L. Cost assurance and liability coverage will be maintained until the end of the post-closure care period. The financial mechanism chosen to provide post-closure cost assurance and the mechanism chosen to provide liability coverage are described in Section 14 of this Permit Application.

10.0 PLAN AMENDMENTS (40 CFR §265.118(d))

This Post-Closure Care Plan will be amended when operating plans or facility design affect this post-closure plan subject to the approval of KDHE. Amendments to the plan will be conducted in accordance with the requirements of 40 CFR §265.118(d).

APPENDIX L

Cost Estimates for Closure and Post-Closure

APPENDIX L – TABLE 1
LAND TREATMENT UNIT
CLOSURE COST ESTIMATES

Revised May, 2011

Item / Description	Estimated Quantity	Unit	Unit Cost	Total Cost	Comments
CONSTRUCT FINAL COVER					
Construction survey	1	Lump	$ 2,000	$ 2,000	50-foot grid over 4-acre work area
Develop Earthwork Specs	80	Hour	$ 100	$ 8,000	Average rate for engineering team
Remove Lysimeters	7	Each	$ 150	$ 1,050	
Regrade Surface and Demo Concrete Structures	1	Lump	$ 10,460	$ 10,460	Local Ark City contractor bid - May 2011
Hydro or Air Seeding incl. Fertilizer	4	Acre	$ 375	$ 1,500	Local Ark City contractor bid - May 2011
As-built Report & Certification	120	Hour	$ 90	$ 10,800	Average rate for report team
Total Construction of Final Cover				**$ 33,810**	
OTHER CLOSURE COSTS					
Notation on Property Deed	1	Lump	$ 1,500	$ 1,500	
Total Other Costs				**$ 1,500**	
TOTAL CLOSURE COSTS					
Subtotal Closure Costs				**$ 35,310**	
Contingency Cost (10%)				$ 3,531	
TOTAL LTU CLOSURE COSTS				**$ 38,841**	

APPENDIX L – TABLE 2
LAND TREATMENT UNIT
POST-CLOSURE CARE COST ESTIMATES

Revised May, 2011

Item / Description	Estimated Quantity	Unit	Unit Cost	Total Cost	Comments
Annual Inspection/Maintenance					
Inspection Costs					
Conduct Semi-Annual Inspections	2	Hour	$ 60	$ 120	1 Hour; 2x/yr; average rate for technician
Maintenance Costs					
Mowing	3	Each	$ 200	$ 600	Mowing cost rate is $50/acre; 4 acres required
Miscellaneous Annual Maintenance	1	Lump	$ 200	$ 200	
Total Annual Costs				$ 920	
Total Long-Term Inspection/Maintenance Costs	30	Year	$ 920	$ 27,600	
LTU Groundwater Corrective Action Well P&A					
Plug and Abandon Wells	32	Each	$ 250	$ 8,000	Typical market rate for shallow P&A per KDHE standards
TOTAL LTU POST-CLOSURE COSTS				**$ 35,600**	

APPENDIX L – TABLE 3
#1 AND # 2 SURFACE IMPOUNDMENTS
POST-CLOSURE CARE COST ESTIMATES

Revised May, 2011

Item / Description	Estimated Quantity	Unit	Unit Cost	Total Cost	Comments
Inspection Costs					
Conduct semi-annual inspections of closed units	2	Hour	$ 60	$ 120	1 Hour; 2x/yr; average rate for technician
Maintenance Costs					
Mowing	3	Each	$ 50	$ 150	Mowing cost rate is $50/acre; 1 acre required
Miscellaneous Annual Maintenance	1	Lump	$ 200	$ 200	
Total Annual Costs				**$ 470**	
Total Long-Term Costs	30	Year	$ 470	**$ 14,100**	
TOTAL #1 & #2 CSI POST-CLOSURE COSTS				**$ 14,100**	

APPENDIX L – TABLE 4
#3A AERATED LAGOON
POST-CLOSURE CARE COST ESTIMATES

Revised May, 2011

Item / Description	Estimated Quantity	Unit	Unit Cost	Total Cost	Comments
Inspection Costs					
Conduct semi-annual inspections of closed units	2	Hour	$ 60	$ 120	1 Hour; 2x/yr; average rate for technician
Maintenance Costs					
Mowing	3	Each	$ 50	$ 150	Mowing cost rate is $50/acre; 1 acre required
Miscellaneous Annual Maintenance	1	Lump	$ 200	$ 200	
Total Annual Costs				**$ 470**	
Total Long-Term Costs	30	Year	$ 470	**$ 14,100**	
TOTAL #3A POST-CLOSURE COSTS				**$ 14,100**	

APPENDIX L – TABLE 5
WASTE MANAGEMENT AREA
POST-CLOSURE CARE COST ESTIMATES
FOR GROUNDWATER MONITORING

Revised May, 2011

ITEM	DESCRIPTION	AMOUNT
Monitoring		
Bioreactor Influent Sample Collection - quarterly		
Labor & Sampling Equipment	3 samples/event, 40 events/10 years	$38,720
Laboratory Fees	BTEX, 3 samples/event, 40 events/10 years	$17,600
Semiannual Groundwater Sampling		
Labor & Sampling Equipment		$3,080
Laboratory Fees	BTEX 12 wells/event/17 events/10 years	$28,050
GWPS Groundwater Sampling		
Labor & Sampling Equipment	12 wells/event/3 events/10 years	$28,329
Laboratory Fees	GWPS 12 wells/event/3 events/10 years	$23,787
Appendix IX Groundwater Sampling		
Labor & Sampling Equipment	Labor and equipment included in the semiannual event cost	--
Laboratory Fees	Appendix IX 3 wells/event/2 events/10 years	$81,517
Static Water Level Monitoring		
Quarterly Groundwater Level Gauging	20 wells/event/4 events per year/10 years	$9,800
Monitor Well Maintenance		
Well Maintenance/Equipment Replacement	Lump sum over 30 year period	$10,000
Data Management & Annual Reporting		
Data Management & Annual reporting	10 Semiannual & 10 Annual Report/10 years	$256,500
Total Monitoring Cost 10 Year Permit Period		$497,383
Total Monitoring Costs	30 years	**$1,492,149**

TOTAL WMA POST-CLOSURE COSTS **Note: 30 year period begins with issuance of new permit**

APPENDIX L – TABLE 6
GROUNDWATER CORRECTIVE ACTION
OPERATION & MAINTENANCE COST ESTIMATES

Revised May, 2011

Item / Description	Estimated Quantity	Unit	Unit Cost	Total Cost	Comments
Operation and Maintenance (Overall Labor)	520	Hour	$ 60	$ 31,200	2 hours average/day assumed; 5 days/week
Groundwater Pump/Motor Replacement (Parts)	2	Each	$ 3,300	$ 6,600	Assume each pump/motor has approx. 5-year service life; ~2 pumps replaced /year
Product Pump Motor/Gear Replacement (Parts)	3	Each	$ 500	$ 1,500	Assume motor and gears have a 1-year service life; 3 pumps replaced/year
Bioreactor Aeration Blower/Motor Replacement (Pa	0.29	Each	$ 5,400	$ 1,543	Each blower has a 30,000 hour (3.5-year) service life; duplex blowers operate at 50% duty
Bioreactor Flow Meter Replacement (Parts)	0.67	Each	$ 1,011	$ 674	Assume 3-year service life. There are 2 in service; 2/3 replacements per year
Wellhead Flow Meter Replacement (Parts)	3.00	Each	$ 911	$ 2,733	Assume 3-year service life. There are 9 in service; ~3 replacements per year
Electricity	1138800	KWH	$ 0.063	$ 71,744	Actual average power cost from 2010 electric bills; 130 KW x 8760 hours/year
Well Treatment	1	Lump	$ 30,000	$ 30,000	Treat wells as needed to maintain efficiency; based on actual operations using KS vendor
Data Management/System Optimization/Reporting	250	Hour	$ 75	$ 18,750	Monitor performance of wells: efficiency, gradient reversal.
Total Annual Costs				**$ 164,744**	
Total Long-Term Costs	20	Year	$ 164,744	**$ 3,294,885**	
TOTAL GROUNDWATER CORRECTIVE ACTION COSTS				**$ 3,294,885**	

APPENDIX L – NOTES

Revised May, 2011

TABLE 1 – LTU CLOSURE COST ESTIMATES

1. Groundwater Monitoring Costs are only applicable until the permit renewal is issued (i.e. for year 1).
2. SVE-AS Construction Costs are only applicable until the system is constructed.
3. All other costs are only applicable until closure is completed. Currently estimated at 3 years.

TABLE 2 – LTU POST-CLOSURE CARE COST ESTIMATES

1. SVE-AS system is estimated to be operating for 5 years.
2. All other costs are applicable for 30 years. The post-closure care period will begin when closure is achieved.

TABLE 3 - #1 AND #2 POST-CLOSURE CARE COST ESTIMATES

1. Inspection and maintenance costs are applicable for 30 years after the permit renewal is issued.
2. GW monitoring is only applicable until the permit renewal is issued (i.e., for year 1).

TABLE 4 - #3A POST-CLOSURE CARE COST ESTIMATES

1. Inspection and maintenance costs are applicable for 30 years after the permit renewal is issued.
2. GW monitoring is only applicable until the permit renewal is issued (i.e., for year 1).

TABLE 5 – WMA POST-CLOSURE CARE COST ESTIMATES

1. The post-closure care period (30 years) begins after the permit renewal is issued.

TABLE 6 – ICM GROUNDWATER RECOVERY & TREATMENT SYSTEM O&M

1. During the life of the post-closure permit (i.e., years 1 through 10), financial assurance must be maintained at 20 years.

Bureau of Waste Management
Curtis State Office Building
1000 SW Jackson, Suite 320
Topeka, KS 66612-1366

Kansas

phone: 785-296-1600
fax: 785-296-1592
email: bwmweb@kdheks.gov
www.kdheks.gov/waste

Robert Moser, MD, Secretary.

Department of Health & Environment

Sam Brownback, Governor

April 29, 2011

Mr. Steve Nichols
Valero Energy Corporation
P.O. Box 696000
San Antonio, Texas 78269-6000

Re: Financial Test and Corporate Guarantee
EPA ID No. KSD087418695
KS Solid Waste Permit No. 0523
Arkansas City, KS 67005-3760

Dear Mr. Nichols:

The Bureau of Waste Management reviewed the referenced documents submitted as evidence of financial assurance for the referenced Kansas permits. Valero meets the requirements of 40 CFR 264/265, Subpart H and K.A.R. 28-29-2108, financial assurance provided by the corporate financial test. If you have any questions, please contact me at bbusby@kdheks.gov or at 785-296-0680. Thanks for your assistance.

Sincerely,

Brian L. Busby
Financial Assurance Auditor
Bureau of Waste Management

APPENDIX L

Corporate Guarantee

Bureau of Waste Management
Curtis State Office Building
1000 SW Jackson, Suite 320
Topeka, KS 66612-1366

Robert Moser, MD, Secretary

Kansas

Department of Health & Environment

phone: 785-296-1600
fax: 785-296-1592
email: bwmweb@kdheks.gov
www.kdheks.gov/waste

Sam Brownback, Governor

April 29, 2011

Mr. Steve Nichols
Valero Energy Corporation
P.O. Box 696000
San Antonio, Texas 78269-6000

Re: Financial Test and Corporate Guarantee
EPA ID No. KSD087418695
KS Solid Waste Permit No. 0523
Arkansas City, KS 67005-3760

Dear Mr. Nichols:

The Bureau of Waste Management reviewed the referenced documents submitted as evidence of financial assurance for the referenced Kansas permits. Valero meets the requirements of 40 CFR 264/265, Subpart H and K.A.R. 28-29-2108, financial assurance provided by the corporate financial test. If you have any questions, please contact me at bbusby@kdheks.gov or at 785-296-0680. Thanks for your assistance.

Sincerely,

Brian L. Busby
Financial Assurance Auditor
Bureau of Waste Management

Added 8/29/11

VALERO

bcc: Kent Biggerstaff w/attachments
Delia Cervantes
Brenda Epperson

File: MS-AR-65 w/ full copy

C:\Documents and Settings\lt572k\Desktop\Financial Assurance 2009\KS 2008\KS-CovLet 03-2009.doc

March 30, 2011

Mr. Brian Busby
Financial Assurance Accountant
Bureau of Waste Management
Kansas Department of Health & Environment
1000 SW Jackson, Suite 320
Topeka, Kansas 66612-1366

Dear Mr. Busby:

Re: **RCRA Financial Assurance**
Michigan Reutilization, LLC, Arkansas City

Michigan Reutilization, LLC (MR) currently demonstrates financial assurance for its hazardous waste management facilities and construction/debris landfill with a corporate guarantee for closure, post-closure and liability coverage. Valero Energy Corporation provides the corporate guarantee.

The following documents demonstrate financial responsibility for the hazardous waste and solid waste management facilities at MR's Arkansas City facility:

1) Letter from CFO worded in accordance with 40 CFR 264.151(g) certifying our use of the financial test;

2) Corporate Guarantees for Liability coverage and closure/post-closure;

3) CPA's report on examination (2010 Form 10-K, page 55)

4) Special report from the CPA containing information requested by 40 CFR 264 and for K.A.R. 28-29-2108.

5) Kansas forms SW-1275, 1280 and 1285.

Please note that we inflated the 2010 costs for 2011. The closure costs in the CFO letter reflect this change.

You may call me at (210) 345-4616 if you have any questions about the enclosed.

Sincerely,

/ for

Steve Nichols
Enclosures

P.O. BOX 696000 • SAN ANTONIO, TEXAS 78269-6000 • 210-345-4616 • FAX 210-170-4169

Added 8/29/11

VALERO

Michael S. Ciskowski
Executive Vice President
and Chief Financial Officer

March 25, 2011

Secretary
Kansas Department of Health and Environment
Division of Environment
Bureau of Waste Management
1000 SW Jackson, Suite 320
Topeka, Kansas 66612-1366

Dear Sir or Madam:

I am the chief financial officer of Valero Energy Corporation, P.O. Box 696000, San Antonio, Texas, 78269-6000. This letter is in support of the use of the financial test to demonstrate financial responsibility for liability coverage and closure and/or post-closure care as specified in subpart H of 40 CFR parts 264 and 265.

The firm identified above is the owner or operator of the following facilities for which liability coverage for both sudden and nonsudden accidental occurrences is being demonstrated through the financial test specified in subpart H of 40 CFR parts 264 and 265: ..... None

The firm identified above guarantees, through the guarantee specified in subpart H of 40 CFR parts 264 and 265, liability coverage for both sudden and nonsudden accidental occurrences at the following facilities owned or operated by the following:

MRP Properties Company, LLC
EPA I.D. No. KSD087418695
Arkansas City Refinery
1400 South M Street
Arkansas City, KS 67005-3760

The firm identified above is the direct or higher-tier parent corporation of the owner or operator.

1. The firm identified above owns or operates the following facilities for which financial assurance for closure or post-closure care or liability coverage is demonstrated through the financial test specified in subpart H of 40 CFR parts 264 and 265. The current closure and/or post-closure cost estimates covered by the test are shown for each facility: ..... None

2. The firm identified above guarantees through the guarantee specified in subpart H of 40 CFR parts 264 and 265, the closure and post-closure care or liability coverage of the following facilities owned or operated by the guaranteed party. The current cost estimates for closure or post-closure care so guaranteed are shown for each facility:

Valero Energy Corporation • One Valero Way • San Antonio, Texas 78249-1616
Post Office Box 696000 • San Antonio, Texas 78269-6000 • Telephone (210) 345-2146 • Facsimile (210) 345-2497
Mike.Ciskowski@valero.com

Added 8/29/11

Facility	Closure Cost	Post-Closure Cost	Other Cost
MRP Properties Company, LLC EPA I.D. No. KSD087418695 Arkansas City Refinery 1400 South M Street Arkansas City, KS 67005-3760	$146,757	$5,229,318	
MRP Properties Company, LLC Solid Waste Permit No. 523 Arkansas City Refinery 1400 South M Street Arkansas City, KS 67005-3760 (per KSL Chapter 65-3407(h))	$217,245	N/A	

3. In States where KDHE is not administering the financial requirements of subpart H of 40 CFR parts 264 and 265, this firm is demonstrating financial assurance for the closure or post-closure care of the following facilities through the use of a test equivalent or substantially equivalent to the financial test specified in subpart H of 40 CFR parts 264 and 265. The current closure or post-closure cost estimates covered by such a test are shown for each facility:

	Facility	Closure Cost	Post-Closure Cost	Other Cost
1a)	Valero Refining Company - Oklahoma EPA I.D. No. OKD057705972 Valero Ardmore Refinery P.O. Box 188 Ardmore, OK 73402-0188	N/A	$6,999,385	
1b)	Valero Refining Company - Oklahoma Solid Waste Permit No. 3510014 Valero Ardmore Refinery P.O. Box 188 Ardmore, OK 73402-0188 (Required by 27A OK Stat. Supp. 1997, Section 2-10-701(c)(4))	N/A	$221,269	
2a)	Diamond Shamrock Refining Company, L.P. EPA I.D. No. TXD059685339 Valero McKee Refinery HCR-1, (P.O. Box 36) Sunray, Texas 79086 TCEQ No. 30871	$4,147,788	$962,232	
2b)	Corrective Action Required by Compliance Plan No. 50229			$563,652

	Facility	Closure Cost	Post-Closure Cost	Other Cost
2c)	Diamond Shamrock Refining Company, L.P. EPA I.D. No. TXD990709966 Valero Three Rivers Refinery 301 Leroy Street, (P.O. Box 490) Three Rivers, Texas 78701 TCEQ No. 31553	N/A	$219,334	
2d)	Corrective Action Required by Compliance Plan No. 50100			$6,706,637
3a)	Valero Refining Texas, L.P. EPA I.D. No. TXD008132268 Valero Corpus Christi Refinery 1300 Cantwell Lane Corpus Christi, TX 78407 Permit No. 50261 Hazardous Waste Management (per 30 TAC 335 §37.100)	N/A	$123,451	
3b)	Corrective Action Required by Compliance Plan No. 50261			$441,119
3c)	Valero Refining Texas, L.P. EPA I.D. No. TXD074604166 Valero Corpus Christi Refinery West Plant 5900 Up River Road Corpus Christi, TX 78407 GW Response Action Plan (Agreed Order 97-0358-IH-E)			$547,045
4a)	The Premcor Refining Group, Inc. EPA I.D. No. TXD008090409 Valero Port Arthur Refinery 1801 South Gulfway Drive Port Arthur, TX 77640 Hazardous Industrial Solid Waste Facility - Corrective Action Management Unit (CAMU) (per 30 TAC 335 §37.100)	N/A	$2,853,148	
5a)	Valero Refining New Orleans, L.L.C. Permit No. P-0214R1 Valero St. Charles Refinery 14902 River Road Norco, LA 70079 New Sarpy Pond	$1,362,999	$1,283,700	

	Facility	Closure Cost	Post-Closure Cost	Other Cost
5b)	Valero Refining New Orleans, L.L.C. Permit No. P-0415 Valero St. Charles Refinery 14902 River Road Norco, LA 70079 GATX Pond	$1,684,345	$1,486,100	
5c)	Valero Refining New Orleans, L.L.C. Permit No. P-0214R1 Valero St. Charles Refinery 14902 River Road Norco, LA 70079 East Plant Ponds	$3,680,300	$1,281,500	

4. The firm identified above owns or operates the following hazardous waste management facilities for which financial assurance for closure or, if a disposal facility, post-closure care, is not demonstrated either to KDHE or a State through the financial test or any other financial assurance mechanisms specified in subpart H of 40 CFR parts 264 and 265 or equivalent or substantially equivalent State mechanisms. The current closure and/or post-closure cost estimates not covered by such financial assurance are shown for each facility: ..... None

5. This firm is the owner or operator or guarantor of the following UIC facilities for which financial assurance for plugging and abandonment is required under part 144 and is assured through a financial test. The current closure cost estimates as required by 40 CFR §144.62 are shown for each facility:

Facility	Well I.D.	Plugging and Abandonment Cost
Diamond Shamrock Refining Company, L.P. EPA I.D. No TXD059685339 Valero McKee Refinery HCR-1, (P.O. Box 36) Sunray, Texas 79086	WDW-020 WDW-102 WDW-192 WDW-225 WDW-226 WDW-332	$179,198 $238,709 $240,359 $176,420 $176,421 $221,751
Diamond Shamrock Refining Company, L.P. EPA I.D. No. TXD990709966 Valero Three Rivers Refinery 301 Leroy Street, (P.O. Box 490) Three Rivers, Texas 78701	WDW-404 WDW-405 WDW-406	$193,857 $193,857 $193,857

This firm is required to file a Form 10-K with the Securities and Exchange Commission (SEC) for the latest fiscal year.

The fiscal year of this firm ends on December 31. The figures for the following items marked with an asterisk are derived from this firm's independently audited, year-end financial statements for the latest completed fiscal year, ended December 31, 2010

Part B. Closure or Post-Closure Care and Liability Coverage

ALTERNATIVE II

1.	Sum of current closure and post-closure cost estimates (total of all cost estimates listed above)	$41,971,753
2.	Amount of annual aggregate liability coverage to be demonstrated: *$8 million RCRA and UIC requirements; $2 million UST requirement, $1 million Kansas solid waste liability requirement, and $1 million Louisiana solid waste liability requirement.*	$12,000,000
3.	Sum of lines 1 and 2	$53,971,753
4.	Current bond rating of most recent issuance and name of rating service	A+/A-1 Standard & Poor's
5.	Date of issuance of bond	12/17/2010
6.	Date of maturity of bond	12/01/2040
*7.	Tangible net worth (if any portion of the closure or post-closure cost estimates is included in "total liabilities" on your financial statements you may add that portion to this line)	$14,801,000,000
*8.	Total assets in the U.S. (required only if less than 90% of assets are located in the U.S.)	$31,385,000,000

		YES	NO
9.	Is line 7 at least $10 million?	X	
10.	Is line 7 at least 6 times line 3?	X	
*11.	Are at least 90% of assets located in the U.S.? If not, complete line 12.		X
12.	Is line 8 at least 6 times line 3?	X	

I hereby certify that the wording of this letter is identical to the wording specified in 40 CFR §264.151(g) as such regulations were constituted on the date shown immediately below.

Michael S. Ciskowski
Executive Vice President and Chief Financial Officer
March 25, 2011

CORPORATE GUARANTEE FOR CLOSURE OR POST-CLOSURE CARE

Guarantee made this 25th day of March 2011 by Valero Energy Corporation, a business corporation organized under the laws of the State of Delaware, herein referred to as guarantor. This guarantee is made on behalf of MRP Properties Company, LLC (f.k.a. Michigan Reutilization, LLC) of P.O. Box 696000, San Antonio, Texas 78269-6000, which is our subsidiary, to the Kansas Department of Health & Environment (KDHE).

Recitals

1. Guarantor meets or exceeds the financial test criteria and agrees to comply with the reporting requirements for guarantors as specified in 40 CFR 264.143(f), 264.145(f), 265.143(e), and 265.145(e).

2. MRP Properties Company, LLC owns or operates the following hazardous waste management facility covered by this guarantee:

EPA ID No. KSD087418695
Arkansas City Refinery
1400 South M Street
Arkansas City, KS 67005-3760

Guarantee is for both closure and post-closure care.

3. "Closure plans" and "post-closure plans" as used below refer to the plans maintained as required by subpart G of 40 CFR parts 264 and 265 for the closure and post-closure care of facilities as identified above.

4. For value received from MRP Properties Company, LLC, guarantor guarantees to KDHE that in the event that MRP Properties Company, LLC fails to perform closure and post-closure care of the above facility in accordance with the closure or post-closure plans and other permit or interim status requirements whenever required to do so, the guarantor shall do so or establish a trust fund as specified in subpart H of 40 CFR part 264 or 265, as applicable, in the name of MRP Properties Company, LLC in the amount of the current closure or post-closure cost estimates as specified in subpart H of 40 CFR parts 264 and 265.

5. Guarantor agrees that if, at the end of any fiscal year before termination of this guarantee, the guarantor fails to meet the financial test criteria, guarantor shall send within 90 days, by certified mail, notice to the KDHE Secretary and to MRP Properties Company, LLC that he intends to provide alternate financial assurance as specified in subpart H of 40 CFR part 264 or 265, as applicable, in the name of MRP Properties Company, LLC. Within 120 days after the end of such fiscal year, the guarantor shall establish such financial assurance unless MRP Properties Company, LLC has done so.

6. The guarantor agrees to notify the KDHE Secretary by certified mail, of a voluntary or involuntary proceeding under Title 11 (Bankruptcy), U.S. Code, naming guarantor as debtor, within 10 days after commencement of the proceeding.

7. Guarantor agrees that within 30 days after being notified by the KDHE Secretary of a determination that guarantor no longer meets the financial test criteria or that he is disallowed from continuing as a guarantor of closure or post-closure care, he shall establish alternate

financial assurance as specified in subpart H of 40 CFR part 264 or 265, as applicable, in the name of MRP Properties Company, LLC unless MRP Properties Company, LLC has done so.

8. Guarantor agrees to remain bound under this guarantee notwithstanding any or all of the following: amendment or modification of the closure or post-closure plan, amendment or modification of the permit, the extension or reduction of the time of performance of closure or post-closure, or any other modification or alteration of an obligation of the owner or operator pursuant to 40 CFR part 264 or 265.

9. Guarantor agrees to remain bound under this guarantee for so long as MRP Properties Company, LLC must comply with the applicable financial assurance requirements of subpart H of 40 CFR parts 264 and 265 for the above-listed facilities, except as provided in paragraph 10 of this agreement.

10. Guarantor may terminate this guarantee by sending notice by certified mail to KDHE Secretary and to MRP Properties Company, LLC, provided that this guarantee may not be terminated unless and until MRP Properties Company, LLC obtains, and the KDHE Secretary approves, alternate closure and/or post-closure care coverage complying with 40 CFR 264.143, 264.145, 265.143, and/or 265.145.

11. Guarantor agrees that if MRP Properties Company, LLC fails to provide alternate financial assurance as specified in subpart H of 40 CFR part 264 or 265, as applicable, and obtain written approval of such assurance from the KDHE Secretary within 90 days after a notice of cancellation by the guarantor is received by KDHE Secretary from guarantor, guarantor shall provide such alternate financial assurance in the name of MRP Properties Company, LLC.

12. Guarantor expressly waives notice of acceptance of this guarantee by KDHE or by MRP Properties Company, LLC. Guarantor also expressly waives notice of amendments or modifications of the closure and/or post-closure plan and of amendments or modifications of the facility permit(s).

I hereby certify that the wording of this guarantee is identical to the wording specified in 40 CFR 264.151(h) as such regulations were constituted on the date first above written.

Effective date: March 25, 2011

Valero Energy Corporation

Michael S. Ciskowski
Executive Vice President
and Chief Financial Officer

Signature of witness or notary: 3/25/11

KATHERINE DORR
Notary Public
STATE OF TEXAS
My Comm. Exp. 10-20-2012

Added 8/29/11

KPMG LLP
Suite 1200
300 Convent
San Antonio, TX 78205

Independent Accountants' Report
on Applying Agreed-Upon Procedures

The Management of Valero Energy Corporation and subsidiaries:

We have audited, in accordance with standards of the Public Company Accounting Oversight Board, the consolidated balance sheet of Valero Energy Corporation and subsidiaries (the Company) as of December 31, 2010, and the related statements of income, stockholders' equity, cash flows and comprehensive income for the year then ended, and have issued our report thereon dated February 25, 2011.

We have performed the procedures enumerated below, which were agreed to by management of the Company, solely to assist you with respect to the use of the financial test to demonstrate financial responsibility for liability coverage and closure, post-closure or corrective action as specified in Subpart H of 40 CFR Parts 264 and 265 of the Code of Federal Regulations, Title 40 Protection of Environment and K.A.R. 28-29-2108 for the year ended December 31, 2010. The Company's management is responsible for determining the compliance with the financial test that is presented on the basis specified by the Kansas Department of Health and Environment, Division of Environment, Bureau of Waste Management. This agreed-upon procedures engagement was conducted in accordance with attestation standards established by the American Institute of Certified Public Accountants. The sufficiency of these procedures is solely the responsibility of those parties specified in this report. Consequently, we make no representation regarding the sufficiency of the procedures described below either for the purpose for which this report has been requested or for any other purpose.

We have performed the following procedures with respect to page 6 of the accompanying letter dated March 25, 2011 from the Company to the Kansas Department of Health and Environment, Division of Environment, Bureau of Waste Management.

1. We recomputed the amount included on line 7, which is derived from the Company's December 31, 2010 audited consolidated financial statements, by deducting Intangible Assets, net of related accumulated amortization, from Total Stockholders' Equity, and, after rounding, found it to be in agreement.

2. We recomputed the amount included on line 8, by deducting Valero LUX Company I S.à r.l.'s, Valero LUX Company II S.à r.l.'s, Valero Aruba Holdings International Ltd.'s, Valero UK Ltd.'s, and Canadian Ultramar Company's Total Assets and adding back the Company's investment in a United States subsidiary of Canadian Ultramar Company, which are derived from a Company-prepared consolidating balance sheet, from/to Total Assets, which are included in the Company's December 31, 2010 audited consolidated financial statements, and, after rounding, found it to be in agreement.

3. We recomputed the percent of Total Assets located in the U.S. by dividing the amount included on line 8 by Total Assets, which is included in the Company's December 31, 2010 audited consolidated financial statements, and found the recomputed percentage to be less than 90% (line 11).

KPMG LLP, a U.S. limited liability partnership, is the U.S. member firm of KPMG International, a Swiss cooperative.

We have performed the following procedures with respect to page 3 of the accompanying letter dated March 25, 2011 from the Company to the Kansas Department of Health and Environment, Bureau of Waste Management, Solid Waste Form 1275.

1. We compared the amount included on line 7 to Total Stockholders' Equity, which is derived from the Company's December 31, 2010 audited consolidated financial statements, and, after rounding, found it to be in agreement.

2. We compared the amount included on line 8 to Intangible Assets, net of related accumulated amortization, which is derived from the Company's December 31, 2010 audited consolidated financial statements, and, after rounding, found it to be in agreement.

3. We recomputed the amount included on line 9, by deducting Intangible Assets, net of related accumulated amortization, from Total Stockholders' Equity, which are derived from the Company's December 31, 2010 audited consolidated financial statements, and, after rounding, found it to be in agreement.

4. We compared the amount included on line 10, to Total Liabilities, which is derived from the Company's December 31, 2010 audited consolidated financial statements, and, after rounding, found it to be in agreement.

5. We recomputed the amount included on line 11, by adding depreciation and amortization from continuing operations and depreciation and amortization from discontinued operations, which are derived from a Company-prepared consolidating income statement, to Net income, which is included in the Company's December 31, 2010 audited consolidated financial statements, and, after rounding, found it to be in agreement.

6. We recomputed the amount included on line 12, by deducting Valero LUX Company I S.à r.l.'s, Valero LUX Company II S.à r.l.'s, Valero Aruba Holdings International Ltd.'s Valero UK Ltd.'s, and Canadian Ultramar Company's Total Assets and adding back the Company's investment in a United States subsidiary of Canadian Ultramar Company, which are derived from a Company-prepared consolidating balance sheet, from/to Total Assets, which are included in the Company's December 31, 2010 audited consolidated financial statements, and, after rounding, found it to be in agreement.

We were not engaged to, and did not, conduct an examination, the objective of which would be the expression of an opinion on the subject matter described above. Accordingly, we do not express such an opinion. Had we performed additional procedures, other matters might have come to our attention that would have been reported to you.

This report is intended solely for the information and use of the Company and the Kansas Department of Health and Environment, Division of Environment, Bureau of Waste Management, and is not intended to be and should not be used by anyone other than these specified parties.

KPMG LLP

San Antonio, Texas
March 25, 2011

Added 8/29/11

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
BUREAU OF WASTE MANAGEMENT
Solid Waste Form 1275

CHIEF FINANCIAL OFFICER'S LETTER FROM CORPORATE GUARANTOR

To: Kansas Department of Health and Environment
Attn: Bureau of Waste Management

Date March 25, 2011

I am the Chief Financial Officer of Valero Energy Corporation, a corporation organized and existing under the laws of the state of Delaware. This letter is in support of the use of financial test to demonstrate financial responsibility through the corporate guarantee procedure for closure, post-closure care, corrective action costs, third-party liability, or any combination of these, for the solid waste disposal area(s) or processing facility(ies) owned or operated by our majority owned subsidiary company(ies) identified in the numbered paragraphs following.

1. This firm has provided its guarantee of financial responsibility for the costs of closure, post-closure care, or corrective action, by use of the financial test specified in K.A.R. 28-29-2108, for the solid waste disposal area or processing facility owned or operated by our subsidiary company:

   MRP Properties Company, LLC
   EPA ID No. KSD087418695
   Arkansas City Refinery
   1400 South M Street
   Arkansas City, KS 67005-3760 Permit No. 0523

   Closure $217,245.00 Post-Closure $ n/a Corrective Action $ n/a

   [List additional sites, estimates and companies on a separate sheet identified as "Attachment A"]

2. This firm also provides financial assurance for its own environmental obligations, or provides environmental guarantees to another entity, through a financial test procedure at the following site and jurisdiction (if none, enter "None"):

   See attachment B.

   Permit No.

   Closure $ Post-Closure $ Corrective Action $

   Jurisdiction

   [List additional sites, estimates and jurisdictions on a separate sheet identified as "Attachment B"]

Added 8/29/11

3. This firm guarantees ___X___ (X) does not guarantee _____ (X) assurance for third-party liability through the financial test procedure at the Kansas solid waste disposal area(s) or processing facility(ies) listed herein. If such assurance is provided, this firm warrants that its guaranteed subsidiary company has met the requirements of K.A.R. 28-29-2201(e)(1) through (4) permitting self-insurance, is eligible to receive a variance under K.A.R. 28-29-2(a), and relies upon such variance, issued or not issued. The self-insurance coverages listed below are provided in compliance with the coverage requirements of K.A.R. 28-29-2201, with commercial general liability limits not less than $1,000,000 for each occurrence and $1,000,000 for the annual aggregate.

Each Occurrence $ 1,000,000 Annual Aggregate $ 1,000,000

This firm also guarantees assurance for liability coverage in the amount of $4,000,000 per occurrence and $8,000,000 annual aggregate related to RCRA and UIC requirements, $1,000,000 Louisiana solid waste liability requirement, $6,000,000 Delaware AST liability requirement, and $1,000,000 per occurrence and $2,000,000 annual aggregate related to underground storage tank requirements.

This firm is ___X___ (X) is not _____ (X) required to file a Form 10-K with the Securities and Exchange Commission (SEC) for the latest fiscal year. The amounts for the items marked with an asterisk on the attached financial test are derived from the firm's independently audited, year-end financial statements for the latest completed fiscal year, ended on December 31, 2010.

In support of the amounts presented on the attached financial test, I submit herewith the firm's annual, independently audited, comparative financial statements including report of certified public accountants, Auditor's Special Report, and (if required to be filed with the SEC) Form 10-K, for the latest completed fiscal year.

SIGNED FOR THE CORPORATE GUARANTOR

/S/ _____

Name Michael S. Ciskowski

Title Executive Vice President and Chief Financial Officer

Date March 25, 2011

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
BUREAU OF WASTE MANAGEMENT

CORPORATE FINANCIAL TEST

Costs to be Assured by the Financial Test

1.	Solid Waste Facilities Owned or Operated in Kansas (Sum of Para. 1)	$ 5,593,320
2.	Other Sites Assured or Guaranteed in any Jurisdiction (Sum of Para. 2)	$ 41,971,753
3.	Total of Third-Party Liability Coverages (Sum of Para. 3)	$ 12,000,000
4.	Sum of all Costs Assured by Financial Test	$ 53,971,753
5.*	Less Cost Estimates Recorded as Liabilities in the Balance sheet	$ (See Note)
6.	Net Costs Assured by Financial Test	$ 53,971,753

Financial Test Factors

7.*	Total Net Worth	$ 15,025,000,000
8.*	Less Intangible Assets	$ 224,000,000
9.*	Tangible Net Worth	$ 14,801,000,000
10*	Total Liabilities	$ 22,596,000,000
11*	Sum of Net Income (NI), Depletion, Depreciation and Amortization (DDA)	$ 1,797,000,000
12.*	Assets Located within the United States	$ 31,385,000,000
13.	Standard Factor ($10MM)	$ 10,000,000

Financial Test Calculations

A. Enter Three; Pass One

1. Senior Unsubordinated Debt Rating A+/A-1
   Rating Agency Standard & Poor's
   (Attach written evidence showing the current rating from the rating agency)
2. Total Liabilities / Total Net Worth — 1.50
   (Line 10 divided by Line 7 = < 1.50)
3. NI and DDA minus $10MM / Total Liabilities — 0.08
   (Line 11 minus $10MM divided by Line 10 = > 0.10)

B. Enter Two; Pass One

1. Sum of Costs Assured plus $10MM / Tangible Net Worth — 0.004
   (Line 4 plus $10MM divided by Line 9 = < 1.00)
2. Net Costs Assured plus $10MM / Tangible Net Worth — 0.004
   (Line 6 plus $10MM divided by Line 9 = < 1.00)

C. Enter and Pass One

1. Sum of Costs Assured / Assets Located in the U. S. — 0.002
   (Line 4 divided by Line 12 = < 1.00)

Note: *Although liabilities are recorded, we are not claiming the credit for this test.*

Added 8/29/11

Attachment A

This is a list of other facilities in Kansas for which this firm has provided its guarantee of financial responsibility for the costs of closure, post-closure care, or corrective action, by use of the financial test specified in K.A.R. 28-29-2108, for the solid waste disposal area or processing facility:

Facility	Closure Cost	Post-Closure Cost
MRP Properties Company, LLC EPA I.D. No. KSD087418695 Arkansas City Refinery 1400 South M Street Arkansas City, KS 67005-3760 Hazardous Waste Management	$146,757	$5,229,318

Attachment B

This a list of facilities outside of Kansas for which this firm also provides financial assurance for its own environmental obligations, or provides environmental guarantees to another entity, through a financial test procedure.

	Facility	Closure Cost	Post-Closure Cost	Other Cost
1a)	Valero Refining Company - Oklahoma EPA I.D. No. OKD057705972 Valero Ardmore Refinery P.O. Box 188 Ardmore, OK 73402-0188	N/A	$6,999,385	
1b)	Valero Refining Company - Oklahoma Solid Waste Permit No. 3510014 Valero Ardmore Refinery P.O. Box 188 Ardmore, OK 73402-0188 (Required by 27A OK Stat. Supp. 1997, Section 2-10-701(c)(4))	N/A	$221,269	
2a)	Diamond Shamrock Refining Company, L.P. EPA I.D. No. TXD059685339 Valero McKee Refinery HCR-1, (P.O. Box 36) Sunray, Texas 79086 TCEQ No. 30871	$4,147,788	$962,232	
2b)	Corrective Action Required by Compliance Plan No. 50229			$563,652
2c)	Diamond Shamrock Refining Company, L.P. EPA I.D. No. TXD990709966 Valero Three Rivers Refinery 301 Leroy Street, (P.O. Box 490) Three Rivers, Texas 78701 TCEQ No. 31553	N/A	$219,334	
2d)	Corrective Action Required by Compliance Plan No. 50100			$6,706,637
3a)	Valero Refining - Texas, L.P. EPA I.D. No. TXD008132268 Valero Corpus Christi Refinery 1300 Cantwell Lane Corpus Christi, TX 78407 Permit No. 50261 Hazardous Waste Management (per 30 TAC 335 §37.100)	N/A	$123,451	

Added 8/29/11

	Facility	Closure Cost	Post-Closure Cost	Other Cost
3b)	Corrective Action Required by Compliance Plan No. 50261			$441,119
3c)	Valero Refining - Texas, L.P. EPA I.D. No. TXD074604166 Valero Corpus Christi Refinery West Plant 5900 Up River Road Corpus Christi, TX 78407 GW Response Action Plan (Agreed Order 97-0358-IH-E)			$547,045
5a)	The Premcor Refining Group, Inc. EPA I.D. No. TXD008090409 Valero Port Arthur Refinery 1801 South Gulfway Drive Port Arthur, TX 77640 Hazardous Industrial Solid Waste Facility - Corrective Action Management Unit (CAMU) (per 30 TAC 335 §37.100)	N/A	$2,853,148	
6a)	Valero Refining - New Orleans, L.L.C. Permit No. P-0214R1 Valero St. Charles Refinery 14902 River Road Norco, LA 70079 Solid Waste Management Unit New Sarpy Pond	$1,362,999	$1,283,700	
6b)	Valero Refining - New Orleans, L.L.C. P-0415 Valero St. Charles Refinery 14902 River Road Norco, LA 70079 GATX Pond	$1,684,345	$1,486,100	
6c)	Valero Refining - New Orleans, L.L.C. Permit No. P-0214R1 Valero St. Charles Refinery 14902 River Road Norco, LA 70079 Solid Waste Management Unit East Plant Ponds	$3,680,300	$1,281,500	

Facility	Well I.D.	Plugging and Abandonment Cost
Diamond Shamrock Refining Company, L.P.	WDW-020	$179,198
EPA I.D. No TXD059685339	WDW-102	$238,709
Valero McKee Refinery	WDW-192	$240,359
HCR-1, (P.O. Box 36)	WDW-225	$176,420
Sunray, Texas 79086	WDW-226	$176,421
	WDW-332	$221,751
Diamond Shamrock Refining Company, L.P.	WDW-404	$193,857
EPA I.D. No. TXD990709966	WDW-405	$193,857
Valero Three Rivers Refinery	WDW-406	$193,857
301 Leroy Street, (P.O. Box 490)		
Three Rivers, Texas 78701		

Added 8/29/11

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
BUREAU OF WASTE MANAGEMENT
Solid Waste Form 1280

CORPORATE GUARANTEE FOR CLOSURE, POST-CLOSURE OR CORRECTIVE ACTION

Guarantee ("Guarantee"), made this 25th day of March, 2011, by Valero Energy Corporation, a corporation organized and existing under the laws of the state of Delaware, herein referred to as the "Guarantor", made on behalf of MRP Properties Company, LLC, a subsidiary corporation of Guarantor organized and existing under the laws of the state of Michigan, herein referred to as the "Guaranteed Subsidiary", to and for the benefit of Kansas Department of Health and Environment ("KDHE").

RECITALS

1. Guarantor meets or exceeds the financial test criteria specified in K.A.R. 28-29-2108 and agrees to comply with the reporting requirements for guarantors specified in K.A.R. 28-29-2109, as either regulation may be amended.

2. Guaranteed Subsidiary owns or operates the following solid waste disposal area or processing facility for which closure cost, post-closure cost, corrective action cost, or any combination of these as indicated following, are covered by this Guarantee: _____

   MRP Properties Company, LLC

   EPA I.D. No. KSD087418695

   Arkansas City Refinery

   1400 South M Street

   Arkansas City, KS 67005-3760 Permit No. 0523

   Closure Cost **Yes** (Yes/No) Post-Closure Cost **No** (Yes/No) Corrective Action Cost **No** (Yes/No)

3. The terms "closure plan", "post-closure plan", "corrective action plan", and "corrective action remedy" as used herein refer to the plans and remedy prepared for the disposal area or processing facility identified in Recital 2, and which are required to be filed with and approved by KDHE according to K.S.A. 65-3401 *et. seq.* and applicable rules and regulations.

4. For value received from Guaranteed Subsidiary, Guarantor guarantees to KDHE that in the event that Guaranteed Subsidiary fails to perform closure, post-closure care, corrective action, or any combination of these as indicated in Recital 2, at the guaranteed disposal area or processing facility according to the closure, post-closure, or corrective action plans, whenever required to do so, Guarantor shall do so or shall establish a funded trust fund as specified in K.A.R. 28-29-2103 in the amount of the current cost estimates for the plans, which cost estimates shall be accepted and approved by KDHE, in the name of Guaranteed Subsidiary.

5. Guarantor agrees that if, at the end of any fiscal year before termination of this Guarantee, Guarantor fails to meet the financial test criteria specified in K.A.R. 28-29-2108, Guarantor shall send within 90 days after the end of such fiscal year, notice to KDHE by certified mail that he intends to provide alternate financial assurance as allowed by law and regulations, in the name of Guaranteed Subsidiary. Within 120 days after the end of the said fiscal year, Guarantor shall provide such alternate financial assurance to KDHE, unless Guaranteed Subsidiary has done so.

6. Guarantor agrees to notify KDHE by certified mail of a voluntary or involuntary proceeding in bankruptcy, naming Guarantor as a debtor, within 10 days after commencement of the proceeding.

7. Guarantor agrees that within 30 days after being notified by KDHE that Guarantor no longer meets the financial test criteria specified in K.A.R. 28-29-2108, or that Guarantor is disapproved from continuing as a guarantor of closure, post-closure, or corrective action costs, Guarantor shall establish alternate financial assurance as allowed by law and regulations in the name of Guaranteed Subsidiary, unless Guaranteed Subsidiary has done so.

8. Guarantor agrees to remain bound under this Guarantee notwithstanding any or all of the following: amendment or modification of the closure, post-closure, or corrective action plans, or of the corrective action remedy, including any increases or decreases in the estimated costs; amendment or modification of the permit, including any increases or decreases in the time for performing post-closure care; and, amendment or modification of any law, rule or regulation applicable to the environmental obligations of Guaranteed Subsidiary at the guaranteed disposal area or processing facility.

9. Guarantor agrees to remain bound under this Guarantee for as long as Guaranteed Subsidiary must comply with the financial assurance requirements of law and regulations, except as provided in Recital 10.

10. Guarantor may terminate this Guarantee 120 days after the receipt, by certified mail, of a notice of cancellation by both Guaranteed Subsidiary and KDHE, as evidenced by the return receipts, provided however, that this Guarantee shall not be terminated unless and until Guaranteed Subsidiary establishes alternate financial assurance as allowed by law and regulations, and its use has been accepted by KDHE.

11. Guarantor agrees that if Guaranteed Subsidiary fails to provide alternate financial assurance within 90 days following receipt of a notice of cancellation of this Guarantee, Guarantor shall provide the alternate financial assurance during the next 30 days, in the name of Guaranteed Subsidiary.

12. Guarantor expressly waives notice of acceptance of this Guarantee by Guaranteed Subsidiary or by KDHE. Guarantor also expressly waives notice of amendments or modifications to the closure, post-closure, or corrective action plans, or to the corrective action remedy, or to the terms and conditions of the permit, or to any law, rule or regulation applicable to the environmental obligations of Guaranteed Subsidiary at the guaranteed disposal area or processing facility.

Guarantor has caused this Guarantee to by executed by its officer duly authorized, and its seal affixed and the signature attested, on the date appearing by the signature below.

SIGNED FOR THE GUARANTOR

/S/ _____

Name Michael S. Ciskowski

Title Executive Vice President and Chief Financial Officer

Date March 25, 2011

Seal

Signature Attested by the Notary Katherine Dorr 3/30/11

KATHERINE DORR
Notary Public
STATE OF TEXAS
My Comm. Exp. 10-20-2012

Added 8/29/11

APPENDIX L

Guarantee for Liability Coverage

GUARANTEE FOR LIABILITY COVERAGE

Guarantee made this 25th day of March 2011 by Valero Energy Corporation, a business corporation organized under the laws of the State of Delaware, herein referred to as guarantor. This guarantee is made on behalf of MRP Properties Company, LLC (f.k.a. Michigan Reutilization, LLC) of P.O. Box 696000, San Antonio, Texas 78269-6000, which is our subsidiary, to any and all third parties who have sustained or may sustain bodily injury or property damage caused by sudden and/or nonsudden accidental occurrences arising from operation of the facility covered by this guarantee.

Recitals

1. Guarantor meets or exceeds the financial test criteria and agrees to comply with the reporting requirements for guarantors as specified in 40 CFR 264.147(g) and 265.147(g).

2. MRP Properties Company, LLC owns or operates the following hazardous waste management facility covered by this guarantee:

EPA ID No. KSD087418695
Arkansas City Refinery
1400 South M Street
Arkansas City, KS 67005-3760

This corporate guarantee satisfies RCRA third-party liability requirements for both sudden and nonsudden accidental occurrences in above-named owner or operator facilities for coverage in the amount of $1 million per sudden accidental occurrence and $3 million per nonsudden accidental occurrence, and $2 million annual aggregate for sudden accidental occurrences and $6 million annual aggregate for nonsudden accidental occurrences.

3. For value received from MRP Properties Company, LLC, guarantor guarantees to any and all third parties who have sustained or may sustain bodily injury or property damage caused by sudden and/or nonsudden accidental occurrences arising from operations of the facility covered by this guarantee that in the event that MRP Properties Company, LLC fails to satisfy a judgment or award based on a determination of liability for bodily injury or property damage to third parties caused by sudden and/or nonsudden accidental occurrences, arising from the operation of the above-named facilities, or fails to pay an amount agreed to in settlement of a claim arising from or alleged to arise from such injury or damage, the guarantor will satisfy such judgment(s), award(s) or settlement agreement(s) up to the limits of coverage identified above.

4. Such obligation does not apply to any of the following:

(a) Bodily injury or property damage for which MRP Properties Company, LLC is obligated to pay damages by reason of the assumption of liability in a contract or agreement. This exclusion does not apply to liability for damages that MRP Properties Company, LLC would be obligated to pay in the absence of the contract or agreement.

(b) Any obligation of MRP Properties Company, LLC under a workers' compensation, disability benefits, or unemployment compensation law or any similar law.

(c) Bodily injury to:

(1) An employee of MRP Properties Company, LLC arising from, and in the course of, employment by MRP Properties Company, LLC; or

Added 8/29/11

(2) The spouse, child, parent, brother, or sister of that employee as a consequence of, or arising from, and in the course of employment by MRP Properties Company, LLC. This exclusion applies:

(A) Whether MRP Properties Company, LLC may be liable as an employer or in any other capacity; and

(B) To any obligation to share damages with or repay another person who must pay damages because of the injury to persons identified in paragraphs (1) and (2).

(d) Bodily injury or property damage arising out of the ownership, maintenance, use, or entrustment to others of any aircraft, motor vehicle or watercraft.

(e) Property damage to:

(1) Any property owned, rented, or occupied by MRP Properties Company, LLC;

(2) Premises that are sold, given away or abandoned by MRP Properties Company, LLC if the property damage arises out of any part of those premises;

(3) Property loaned to MRP Properties Company, LLC;

(4) Personal property in the care, custody or control of MRP Properties Company, LLC;

(5) That particular part of real property on which MRP Properties Company, LLC or any contractors or subcontractors working directly or indirectly on behalf of MRP Properties Company, LLC are performing operations, if the property damage arises out of these operations.

5. Guarantor agrees that if, at the end of any fiscal year before termination of this guarantee, the guarantor fails to meet the financial test criteria, guarantor shall send within 90 days, by certified mail, notice to the KDHE Secretary and to MRP Properties Company, LLC that he intends to provide alternate liability coverage as specified in 40 CFR 264.147 and 265.147, as applicable, in the name of MRP Properties Company, LLC. Within 120 days after the end of such fiscal year, the guarantor shall establish such liability coverage unless MRP Properties Company, LLC has done so.

6. The guarantor agrees to notify the KDHE Secretary by certified mail of a voluntary or involuntary proceeding under title 11 (Bankruptcy), U.S. Code, naming guarantor as debtor, within 10 days after commencement of the proceeding.

7. Guarantor agrees that within 30 days after being notified by the KDHE Secretary of a determination that guarantor no longer meets the financial test criteria or that he is disallowedfrom continuing as a guarantor, he shall establish alternate liability coverage as specified in 40 CFR 264.147 or 265.147 in the name of MRP Properties Company, LLC, unless MRP Properties Company, LLC has done so.

8. Guarantor reserves the right to modify this agreement to take into account amendment or modification of the liability requirements set by 40 CFR 264.147 and 265.147, provided that such modification shall become effective only if the KDHE Secretary does not disapprove the modification within 30 days of receipt of notification of the modification.

9. Guarantor agrees to remain bound under this guarantee for so long as MRP Properties Company, LLC must comply with the applicable requirements of 40 CFR 264.147 and 265.147 for the above-listed facility, except as provided in paragraph 10 of this agreement.

10. Guarantor may terminate this guarantee by sending notice by certified mail to the KDHE Secretary and to MRP Properties Company, LLC, provided that this guarantee may not be terminated unless and until MRP Properties Company, LLC obtains, and the KDHE Secretary approves, alternate liability coverage complying with 40 CFR 264.147 and/or 265.147.

11. Guarantor hereby expressly waives notice of acceptance of this guarantee by any party.

12. Guarantor agrees that this guarantee is in addition to and does not affect any other responsibility or liability of the guarantor with respect to the covered facilities.

13. The Guarantor shall satisfy a third-party liability claim only on receipt of one of the following documents:

(a) Certification from the Principal and the third-party claimant(s) that the liability claim should be paid. The certification must be worded as follows, except that instructions in brackets are to be replaced with the relevant information and the brackets deleted:

Certification of Valid Claim

The undersigned, as parties [insert Principal] and [insert name and address of third-party claimant(s)], hereby certify that the claim of bodily injury and/or property damage caused by a [sudden or nonsudden] accidental occurrence arising from operating [Principal's] hazardous waste treatment, storage, or disposal facility should be paid in the amount of $_____.

[Signatures] _____
Principal _____
(Notary) Date _____
[Signatures] _____
Claimant(s) _____
(Notary) Date _____

(b) A valid final court order establishing a judgment against the Principal for bodily injury or property damage caused by sudden or nonsudden accidental occurrences arising from the operation of the Principal's facility or group of facilities.

14. In the event of combination of this guarantee with another mechanism to meet liability requirements, this guarantee will be considered primary coverage.

I hereby certify that the wording of the guarantee is identical to the wording specified in 40 CFR 264.151(h)(2) as such regulations were constituted on the date shown immediately below.

Effective date: March 25, 2011

Valero Energy Corporation

Michael S. Ciskowski
Executive Vice President
and Chief Financial Officer

Signature of witness or notary: _____ 3/[illegible]/11

KATHERINE DORR
Notary Public
STATE OF TEXAS
My Comm. Exp. 10-20-2012

Added 8/29/11

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
BUREAU OF WASTE MANAGEMENT
Solid Waste Form 1285

CORPORATE GUARANTEE FOR THIRD PARTY LIABILITY

Guarantee ("Guarantee"), made this 25th day of March, 2011, by Valero Energy Corporation, a corporation organized and existing under the laws of the state of Delaware, herein referred to as the "Guarantor", made on behalf of MRP Properties Company, LLC, a subsidiary corporation of Guarantor organized and existing under the laws of the state of Michigan, herein referred to as the "Guaranteed Subsidiary", to and for the benefit of third parties who have sustained or may sustain damages or injuries caused by Guaranteed Subsidiary's operation of the Kansas solid waste disposal area or processing facility identified in Recital 2.

RECITALS

1. Guarantor meets or exceeds the financial test criteria specified in K.A.R. 28-29-2108 and agrees to comply with the reporting requirements for guarantors specified in K.A.R. 28-29-2109, as either regulation may be amended.

2. Guaranteed Subsidiary owns or operates the following Kansas solid waste disposal area or processing facility for which the third party liability coverages identified following in compliance with K.S.A. 65-3407(h), as it may be amended, are provided by this Guarantee:

   MRP Properties Company, LLC
   EPA I.D. No. KSD087418695
   Arkansas City Refinery
   1400 South M Street
   Arkansas City, KS 67005-3760 Permit No. 0523

   Commercial General Liability:

   Each Occurrence (minimum $1,000,000) $ 1,000,000

   Annual Aggregate (minimum $1,000,000) $ 1,000,000

3. For value received from Guaranteed Subsidiary, Guarantor guarantees to any and all third parties who have sustained or may sustain damages or injuries with respect to the coverages afforded the disposal area or processing facility identified in Recital 2, caused by accidental occurrences arising from the operation of the disposal area or processing facility identified herein, that in the event Guaranteed Subsidiary fails to satisfy a judgement or award based on a determination of liability for the coverages afforded in Recital 2, or fails to pay an amount agreed to in settlement of a claim arising from or alleged to arise from such damage or injury, Guarantor will pay the amount of such judgement, award or settlement of claim, up to the limits of coverage stated in Recital 2.

4. The obligation of Guarantor does not apply to any of the following:

   (a) Bodily injury or property damage for which Guaranteed Subsidiary is obligated to pay damages by reason of the assumption of liability in a contract agreement. This exclusion does not apply to liability for damages that Guaranteed Subsidiary would be obligated to pay in the absence of the contract agreement.

   (b) Any obligation of Guaranteed Subsidiary under a worker's compensation, disability benefits or unemployment compensation law or any similar law.

   (c) Bodily injury to:

      (1) An employee of Guaranteed Subsidiary arising from, and in the course of, employment by Guaranteed Subsidiary; or

      (2) The spouse, child, parent, brother or sister of that employee as a consequence of, or arising from, and in the course of employment by Guaranteed Subsidiary. This exclusion applies:

         (A) Whether Guaranteed Subsidiary may be liable as an employer or in any other capacity; and

         (B) To any other obligation to share damages with or repay another person who must pay damages because of the injury to persons identified in paragraphs (5)(c)(1) and (5)(c)(2).

   (c) Bodily injury or property damage arising out of the ownership, maintenance, use, or entrustment to others of any aircraft, motor vehicle or watercraft.

   (d) Property damage to:

      (1) Any property owned, rented, or occupied by Guaranteed Subsidiary;

      (2) Premises that are sold, given away or abandoned by Guaranteed Subsidiary if the property damage arises out of any part of those premises, unless non-sudden pollution damage coverage is afforded in Recital 2, in which case this exclusion shall be null and void;

      (3) Property that is loaned to Guaranteed Subsidiary;

      (4) Personal property in the care, custody or control of Guaranteed Subsidiary; and

      (5) That particular part of real property on which Guaranteed Subsidiary or any contractors working directly or indirectly on behalf of Guaranteed Subsidiary are performing operations, if the property damage arises out of those operations.

5. Guarantor agrees that if, at the end of any fiscal year before termination of this Guarantee, Guarantor fails to meet the financial test criteria specified in K.A.R. 28-29-2108, Guarantor shall send within 90 days after the end of such fiscal year, notice to the Kansas Department of Health and Environment ("KDHE") by certified mail that he intends to provide alternate financial assurance as allowed by law and regulations, in the name of Guaranteed Subsidiary. Within 120 days after the end of the said fiscal year, Guarantor shall provide such alternate financial assurance to KDHE, unless Guaranteed Subsidiary has done so.

6. Guarantor agrees that within 30 days after being notified by KDHE that Guarantor no longer meets the financial test criteria specified in K.A.R. 28-29-2108, or that Guarantor is disapproved from continuing as a guarantor of third party liability coverages, Guarantor shall establish alternate third party liability coverages as required by law and regulations in the name of Guaranteed Subsidiary, unless Guaranteed Subsidiary has done so.

7. Guarantor agrees to notify KDHE by certified mail of a voluntary or involuntary proceeding in bankruptcy, naming Guarantor as a debtor, within 10 days after commencement of the proceeding.

8. Guarantor reserves the right to modify this Guarantee to take into account amendments or modifications of third party liability coverage required by applicable law and regulations, provided however, that any such modification of this Guarantee shall not become effective unless and until Guarantor receives the written approval of KDHE for the modification.

9. Guarantor agrees to remain bound under this Guarantee for as long as Guaranteed Subsidiary must comply with the third party liability requirements of law and regulations, except as provided in Recital 10.

10. Guarantor may terminate this Guarantee 120 days after the receipt, by certified mail, of a notice of cancellation by both Guaranteed Subsidiary and KDHE, as evidenced by the return receipts, provided however, that this Guarantee shall not be terminated unless and until Guaranteed Subsidiary establishes alternate third party liability coverage as allowed by law and regulations, and its use has been accepted by KDHE.

11. Guarantor expressly waives notice of acceptance of this Guarantee by any party.

12. Guarantor agrees that this Guarantee is in addition to and does not affect any other responsibility or liability of the Guarantor with respect to the guaranteed disposal area or processing facility.

13. In the event of a combination of this Guarantee with another instrument or method to meet third party liability requirements, this Guarantee shall be considered primary coverage.

14. Guarantor shall satisfy a third party liability claim only on receipt of one of the following documents:

    (a) Certification from Guaranteed Subsidiary and the third party claimant that the liability claim should be paid. The certification must be worded as follows except that instructions in brackets are to be replaced with the relevant information and the brackets eliminated:

Certification of Valid Claim

The undersigned, as parties [insert Guaranteed Subsidiary's name] and [insert name and address of the third party claimant] hereby certify that the claim of bodily injury and/or property damage caused by a [insert "sudden" or "non-sudden"] accidental occurrence arising from operating [name of Principal's Kansas solid waste disposal area or processing facility] should be paid in the amount of $_____

Name of Guaranteed Subsidiary	Name of the Third Party Claimant
Signature and Seal of Guaranteed Subsidiary	Signature of the Third Party Claimant
Date Signed	Date Signed
Signature and Seal of the Notary	Signature and Seal of the Notary

(b) A valid court order establishing a judgement against Guaranteed Subsidiary for bodily injury and/or property damage caused by accidental occurrences arising from Guaranteed Subsidiary's operation of the guaranteed solid waste disposal area or processing facility.

Guarantor has caused this Guarantee to be executed by its officer duly authorized, and its seal affixed and the signature attested, on the date appearing by the signature below.

SIGNED FOR THE GUARANTOR

/S/ _____

Name Michael S. Ciskowski

Title Executive Vice President and Chief Financial Officer

Date March 25th, 2011

Seal

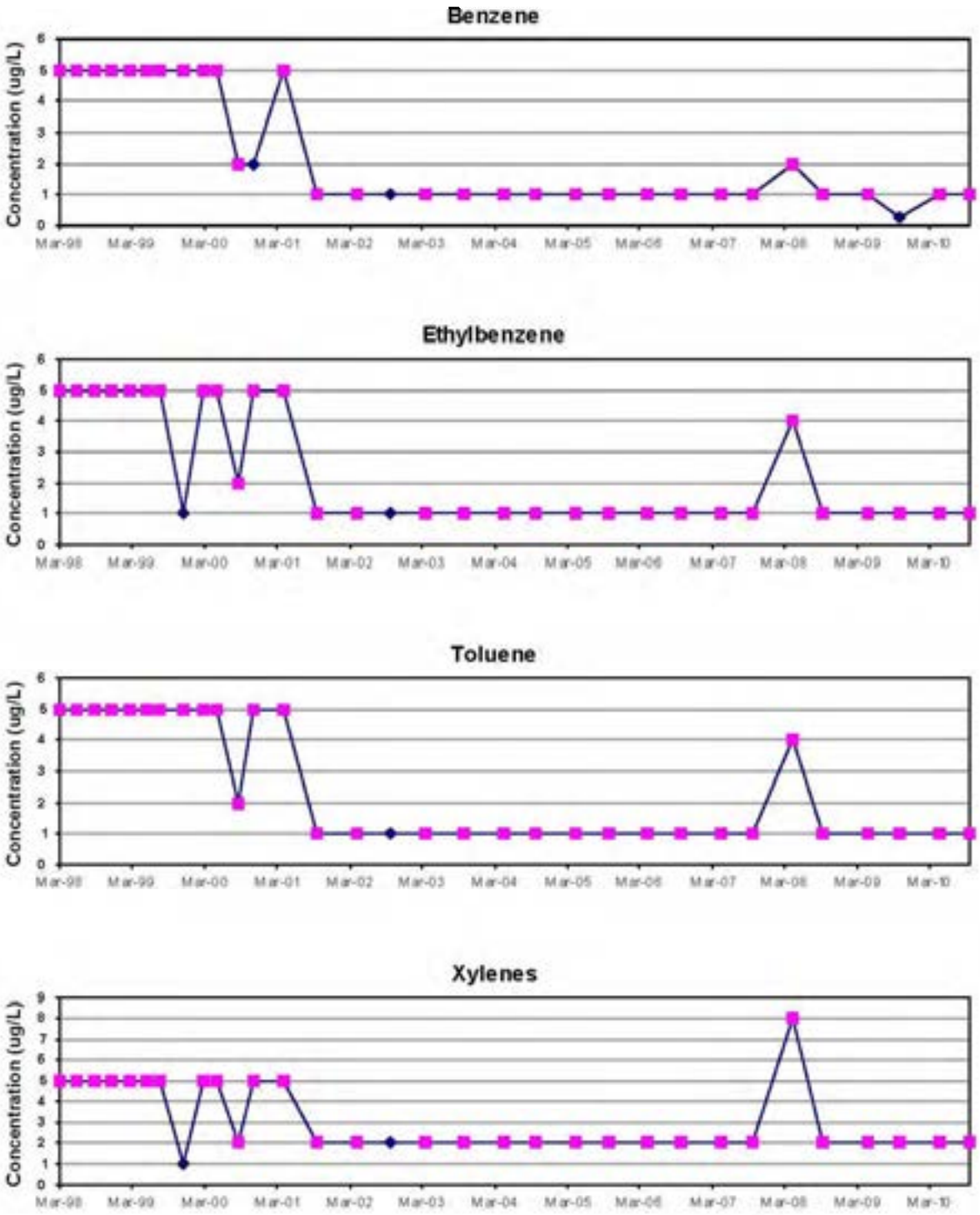
Signature Attested by the Notary _____ 3/25/11

KATHERINE DORR
Notary Public
STATE OF TEXAS
My Comm. Exp. 10-26-2012

Added 8/29/11

APPENDIX M

Groundwater Analytical Data



EXPLANATION

Concentration

Non-Detect (value = reporting level)

TITLE:

WN-1A Groundwater Quality

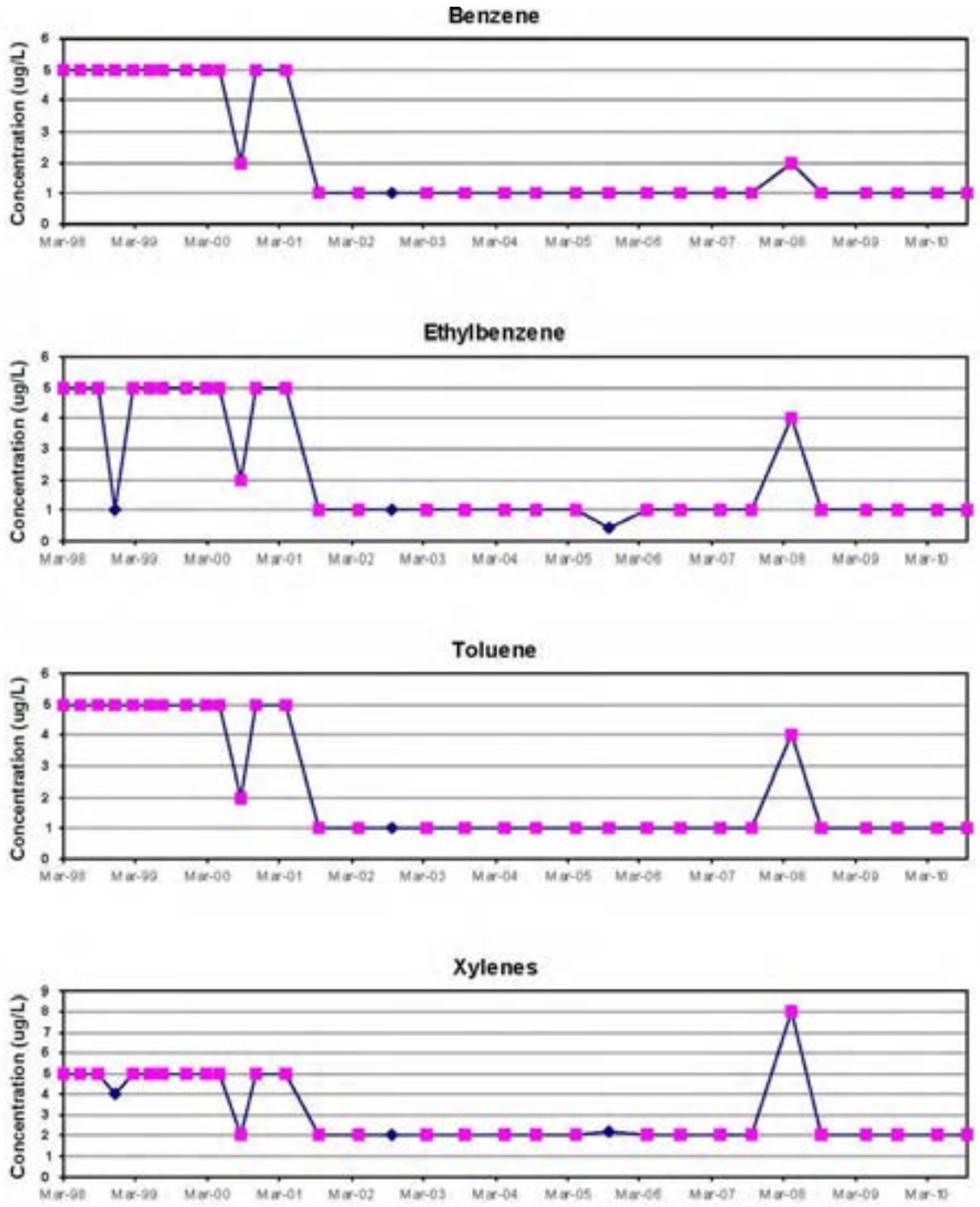
PROJECT:

MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:

M-1



EXPLANATION

Concentration

Non-Detect (value = reporting level)

TITLE:

WN-1B Groundwater Quality

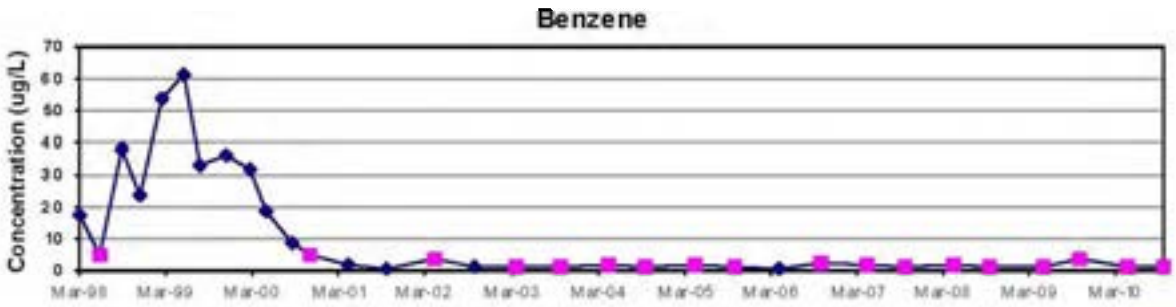
PROJECT:

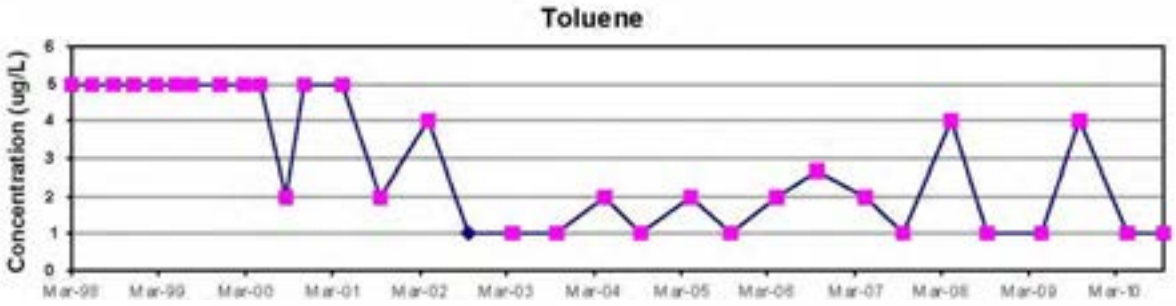
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

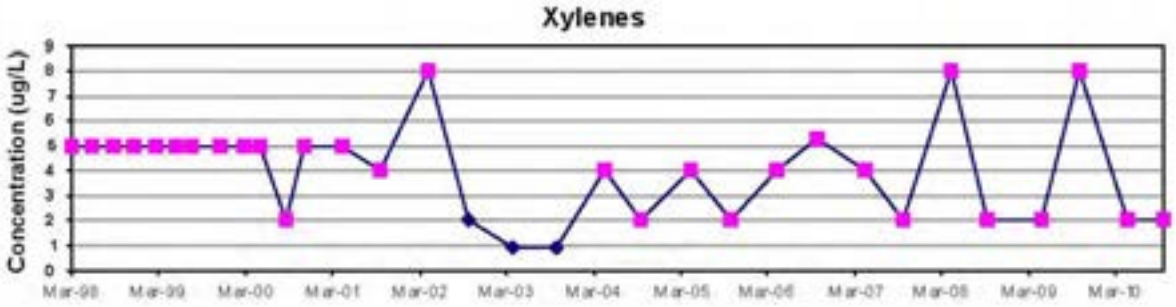
MWH

Figure No.:

M-2







EXPLANATION

Concentration

Non-Detect (value = reporting level)

TITLE:

WN-5B Groundwater Quality

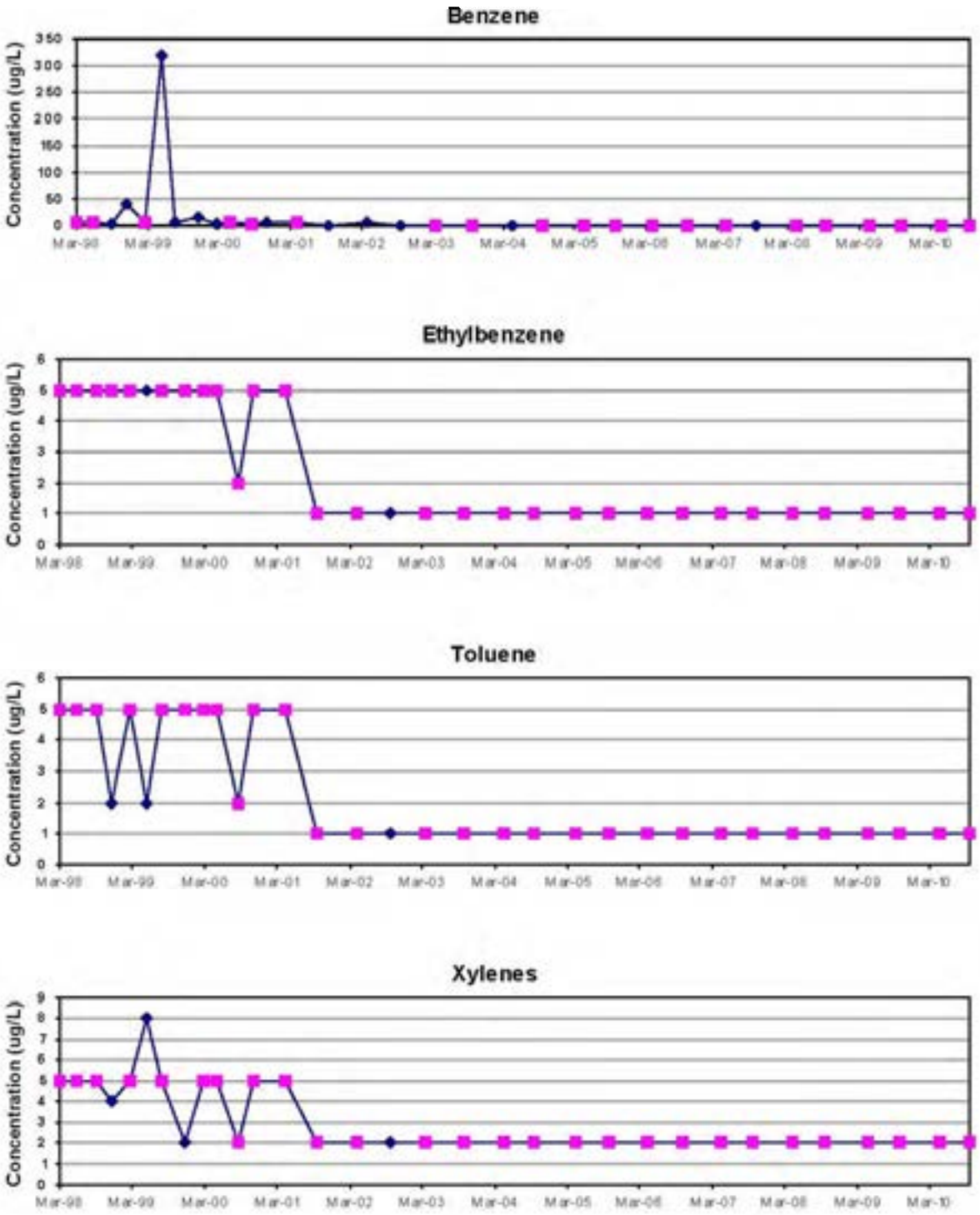
PROJECT:

MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:

M-3



EXPLANATION

Concentration

Non-Detect (value = reporting level)

TITLE:

WN-6A Groundwater Quality

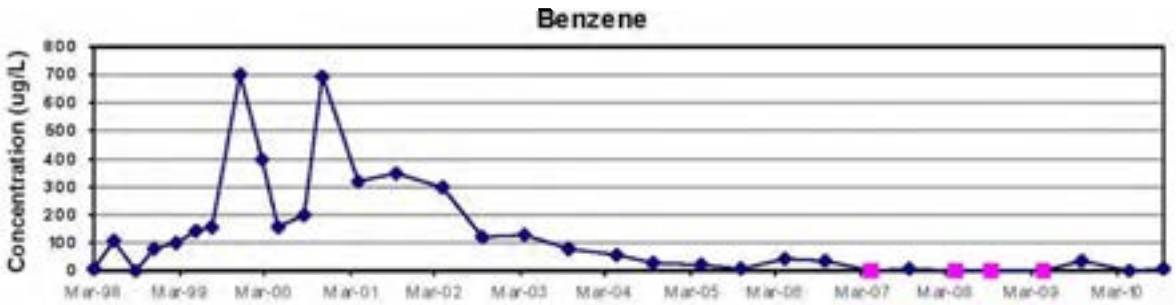
PROJECT:

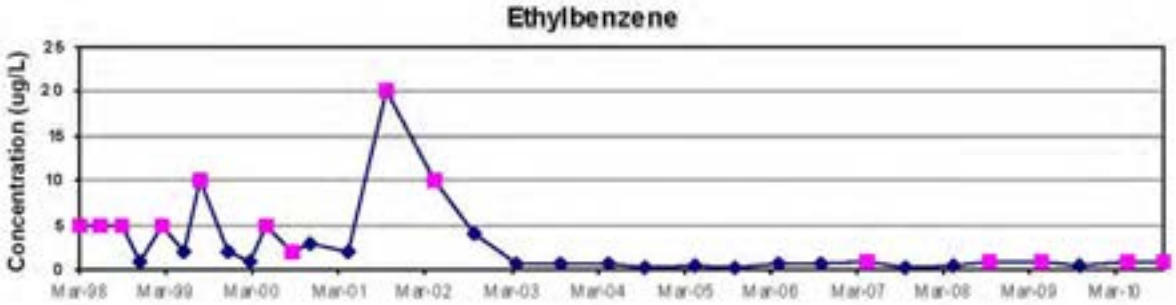
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

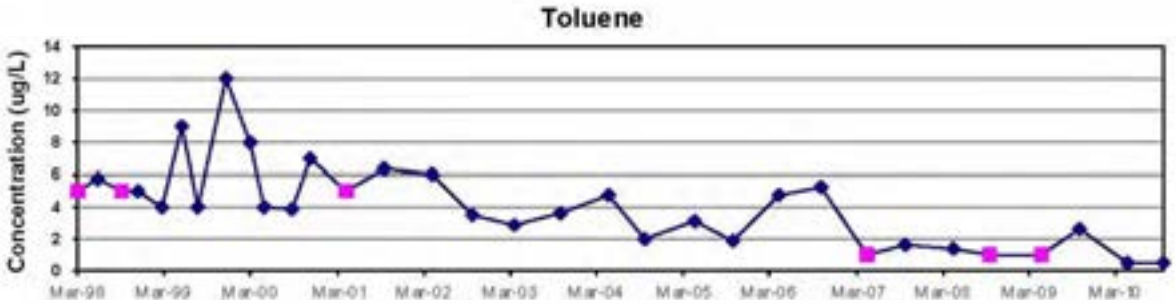
MWH

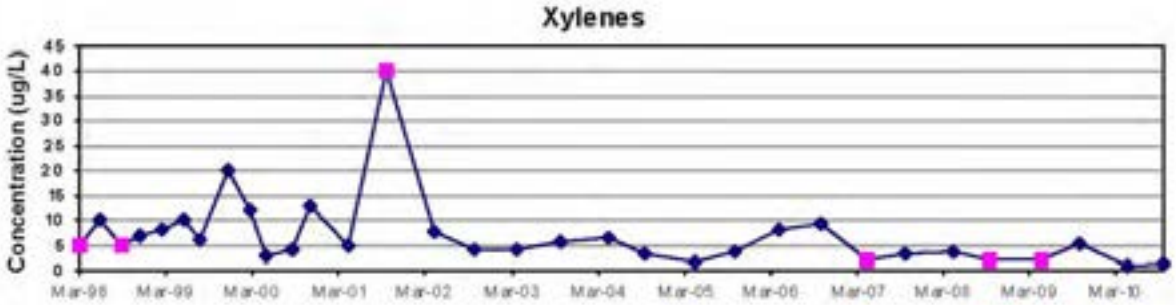
Figure No.:

M-4









EXPLANATION

Concentration

Non-Detect (value = reporting level)

TITLE:

WN-6B Groundwater Quality

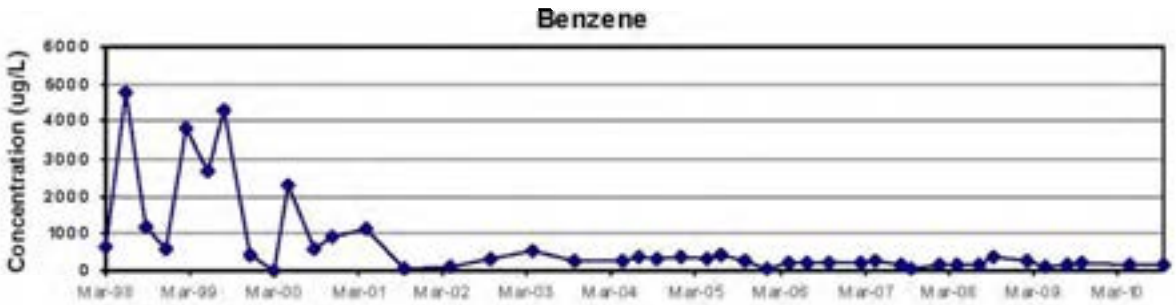
PROJECT:

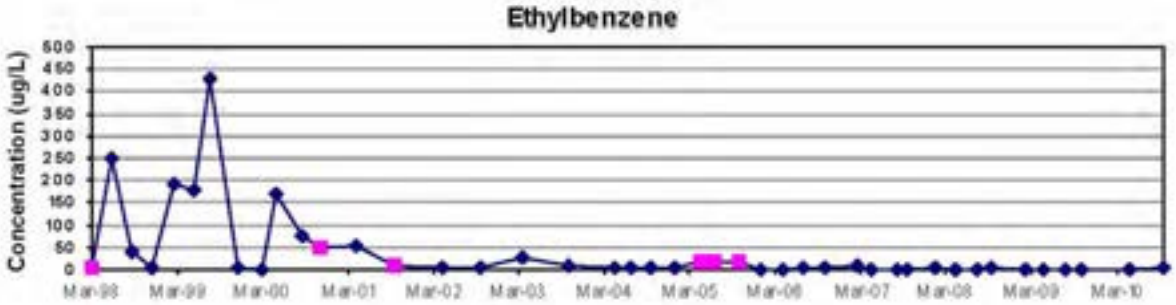
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

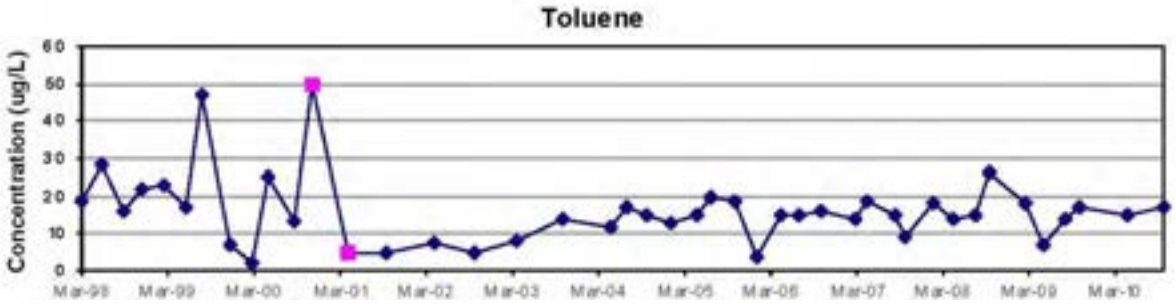
MWH

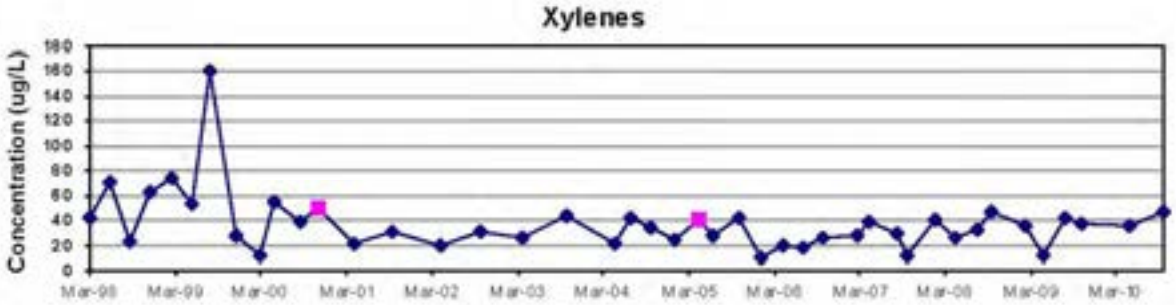
Figure No.:

M-5









EXPLANATION

Concentration

Non-Detect (value = reporting level)

TITLE:

WN-7B Groundwater Quality

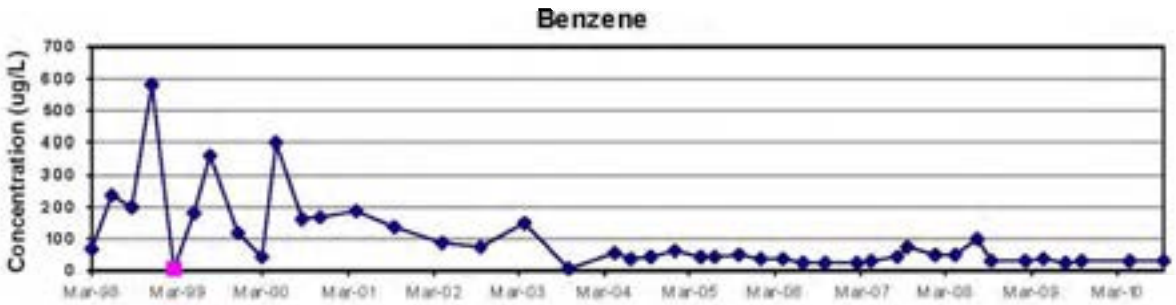
PROJECT:

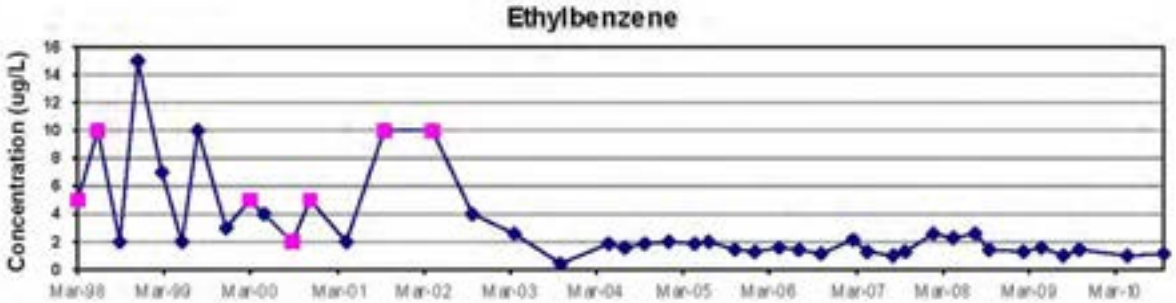
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

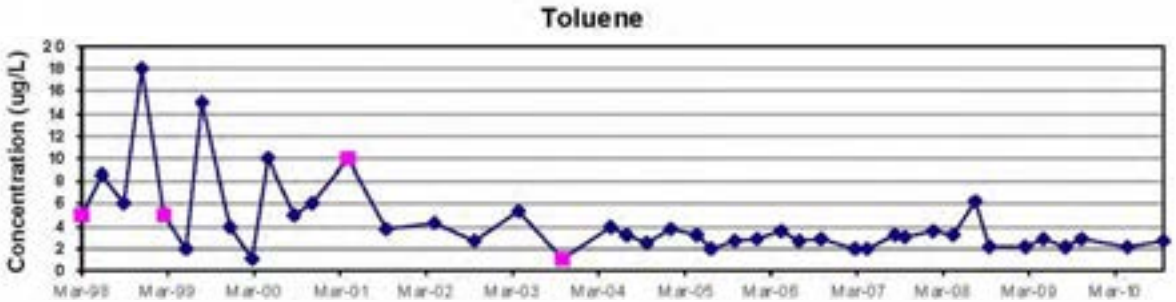
MWH

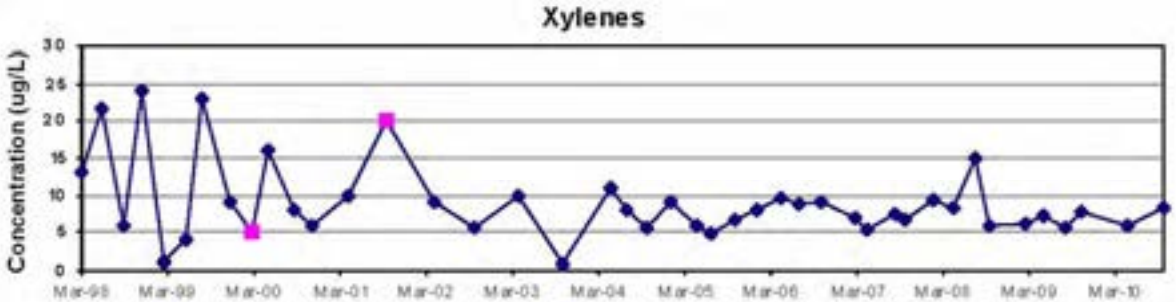
Figure No.:

M-6









EXPLANATION

Concentration

Non-Detect (value = reporting level)

TITLE:

WN-8B Groundwater Quality

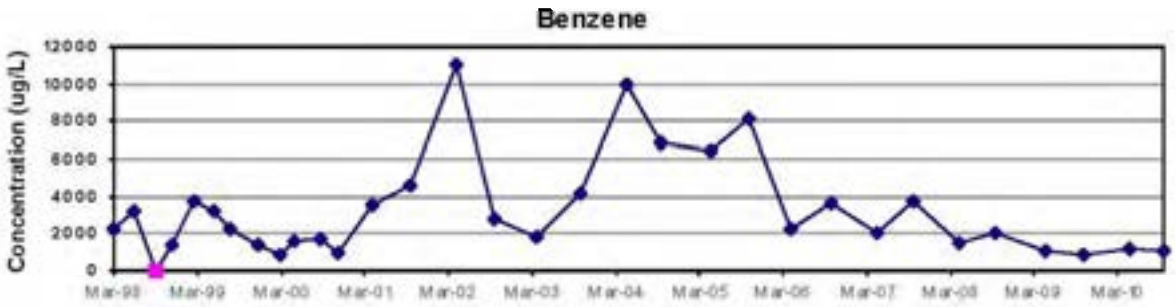
PROJECT:

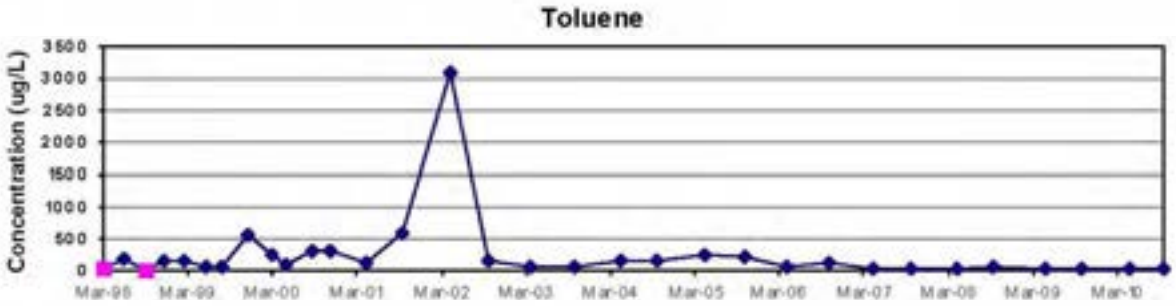
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

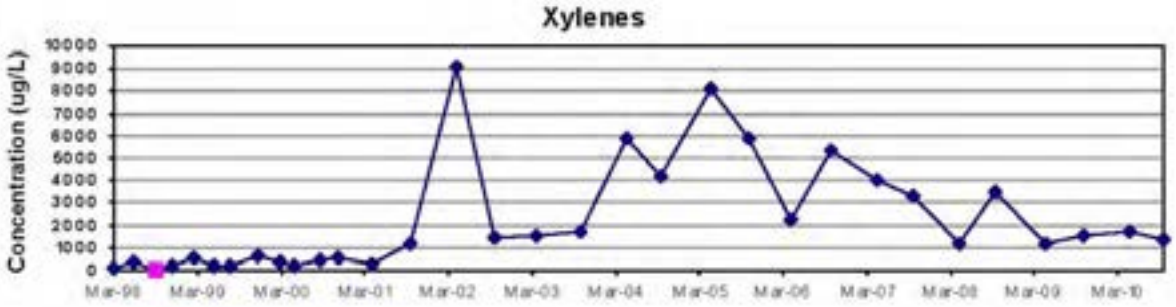
MWH

Figure No.:

M-7







EXPLANATION

Concentration

Non-Detect (value = reporting level)

TITLE:

MW-6 Groundwater Quality

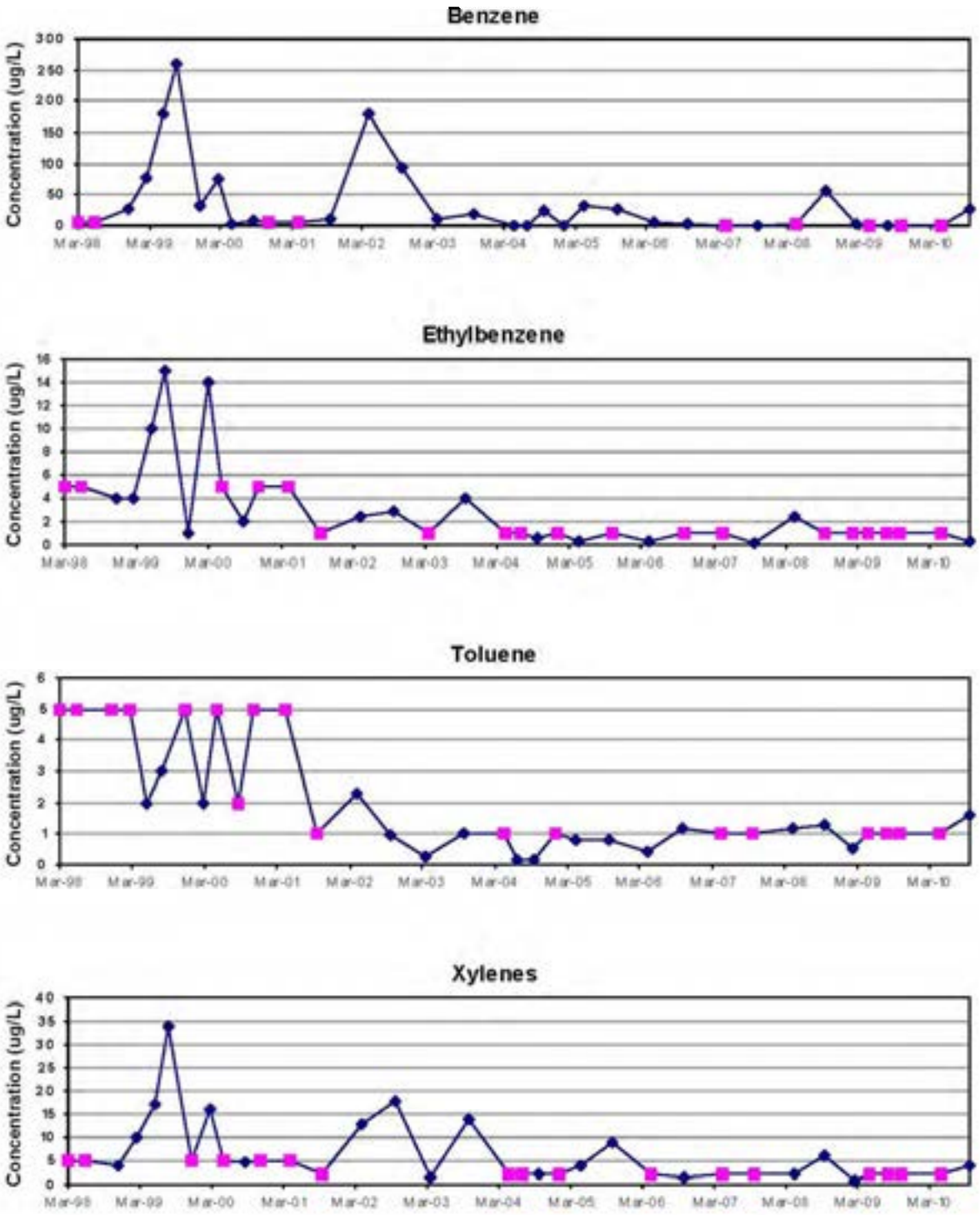
PROJECT:

MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:

M-8



EXPLANATION

Concentration

Non-Detect (value = reporting level)

TITLE:

MW-12 Groundwater Quality

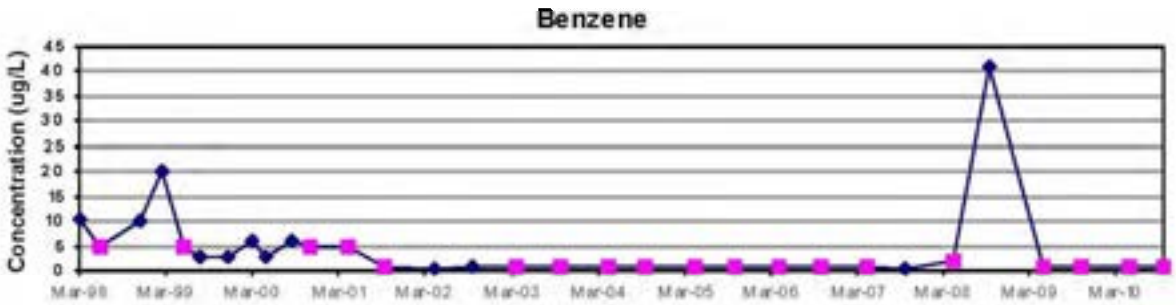
PROJECT:

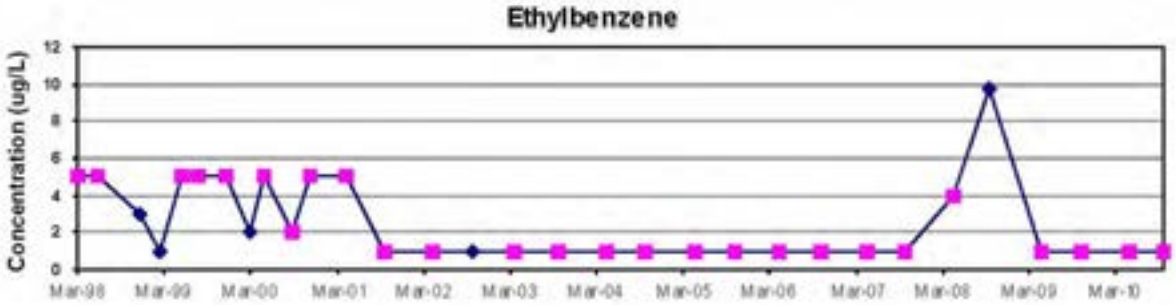
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

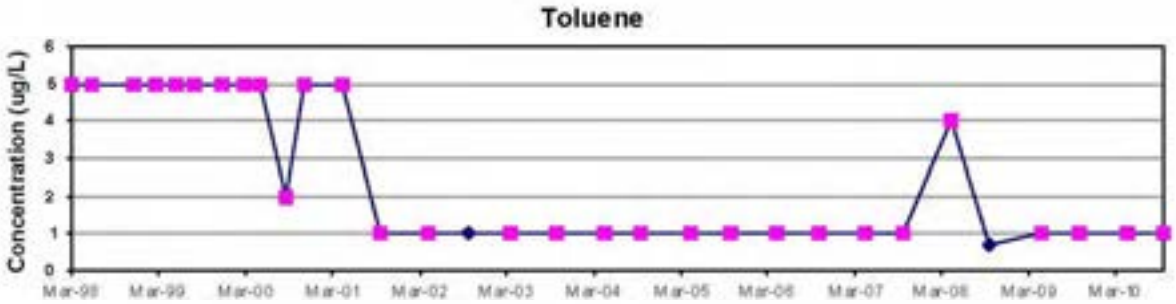
MWH

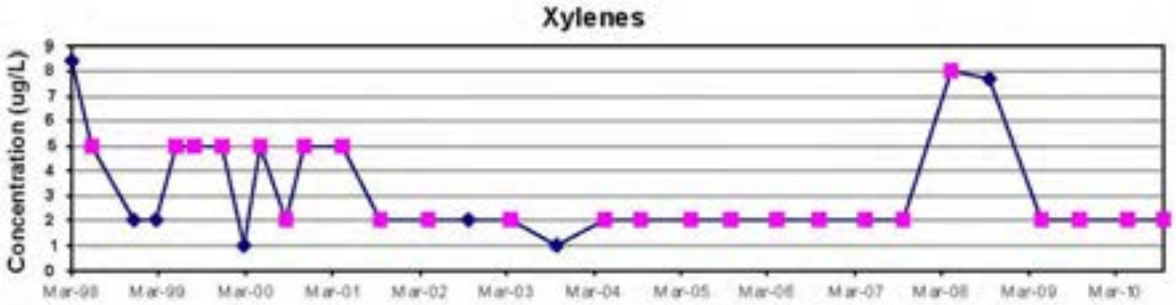
Figure No.:

M-9









EXPLANATION

Concentration

Non-Detect (value = reporting level)

TITLE:

MW-13 Groundwater Quality

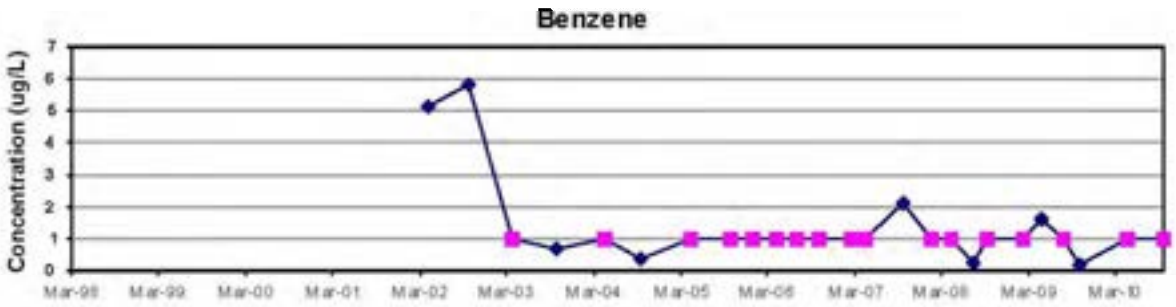
PROJECT:

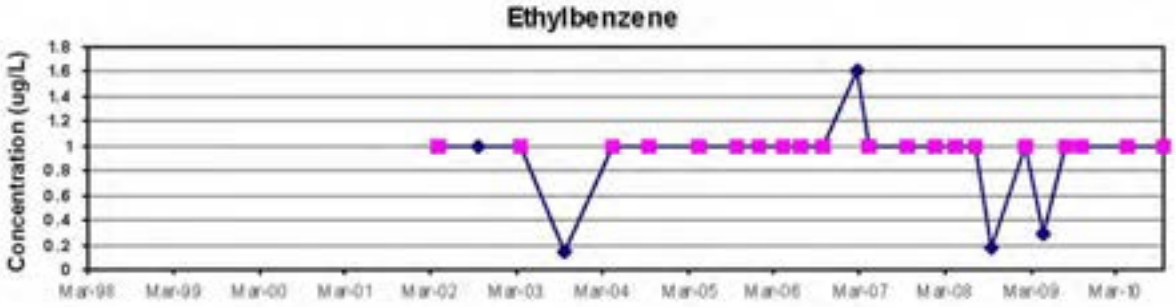
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

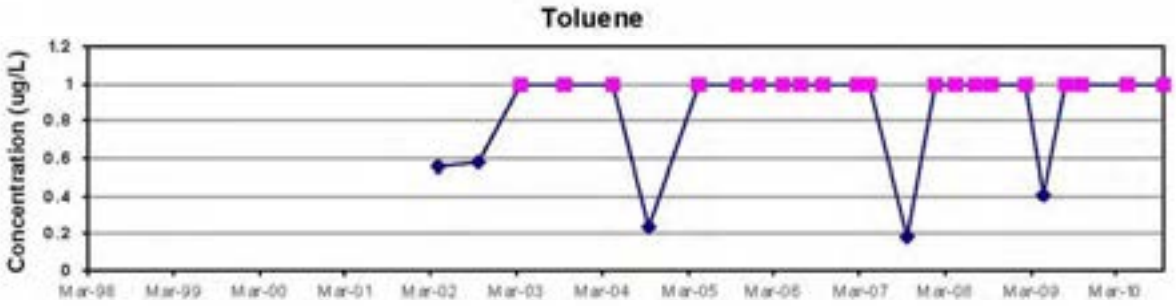
MWH

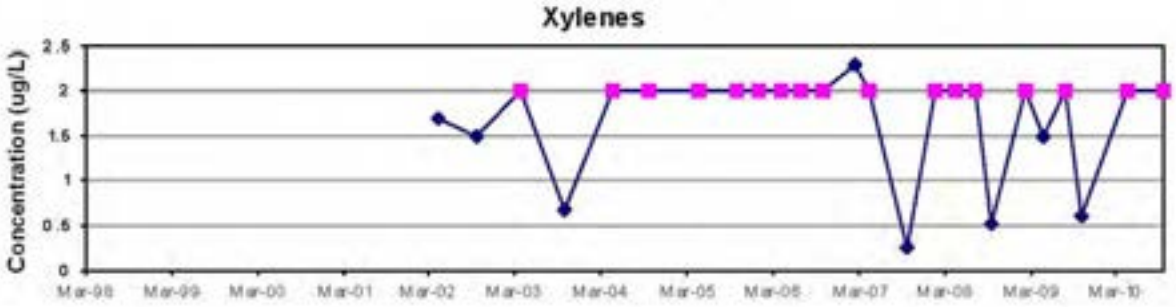
Figure No.:

M-10









EXPLANATION

Concentration

Non-Detect (value = reporting level)

TITLE:

MW-17 Groundwater Quality

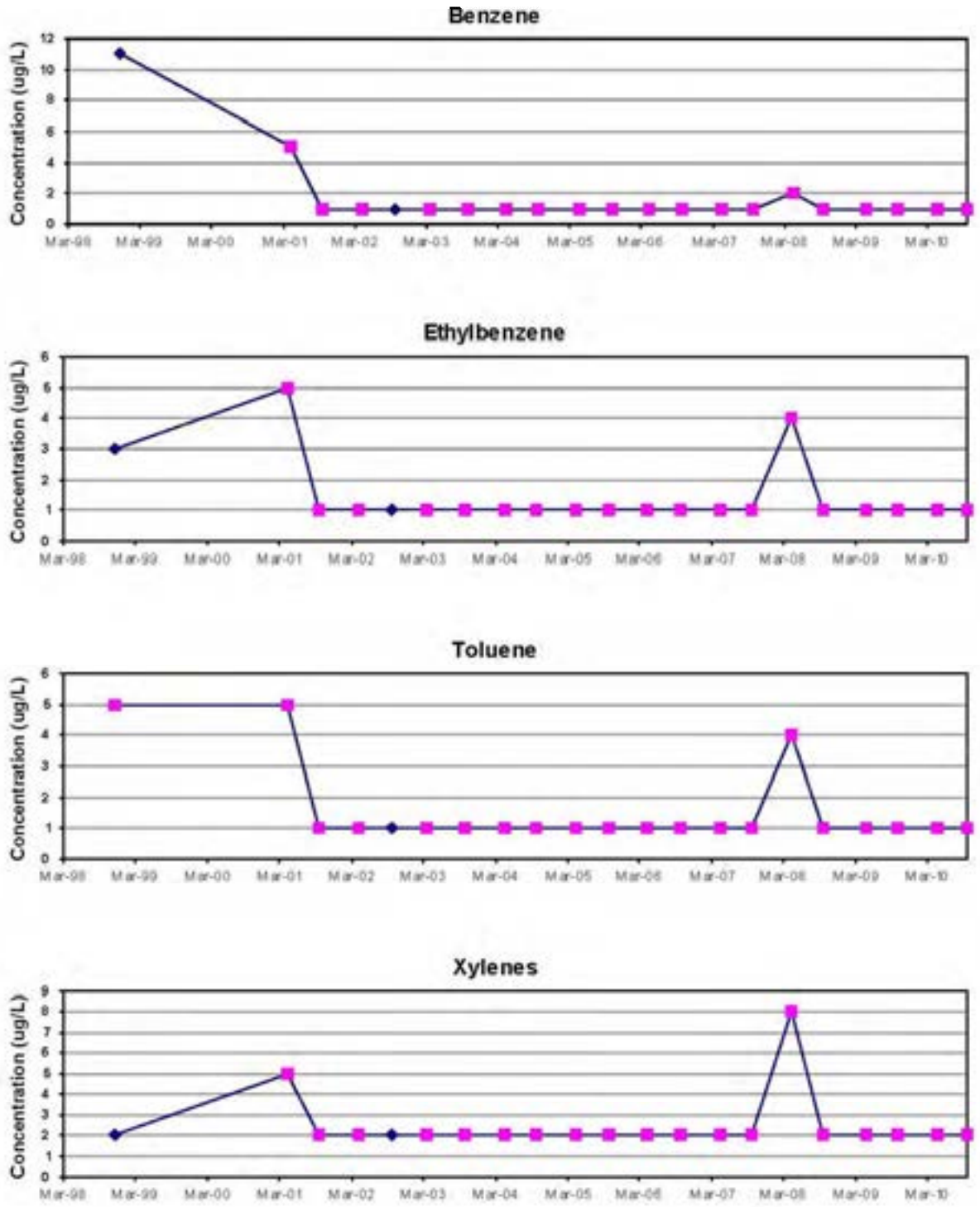
PROJECT:

MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:

M-11



EXPLANATION

Concentration

Non-Detect (value = reporting level)

TITLE:

RCRA-4 Groundwater Quality

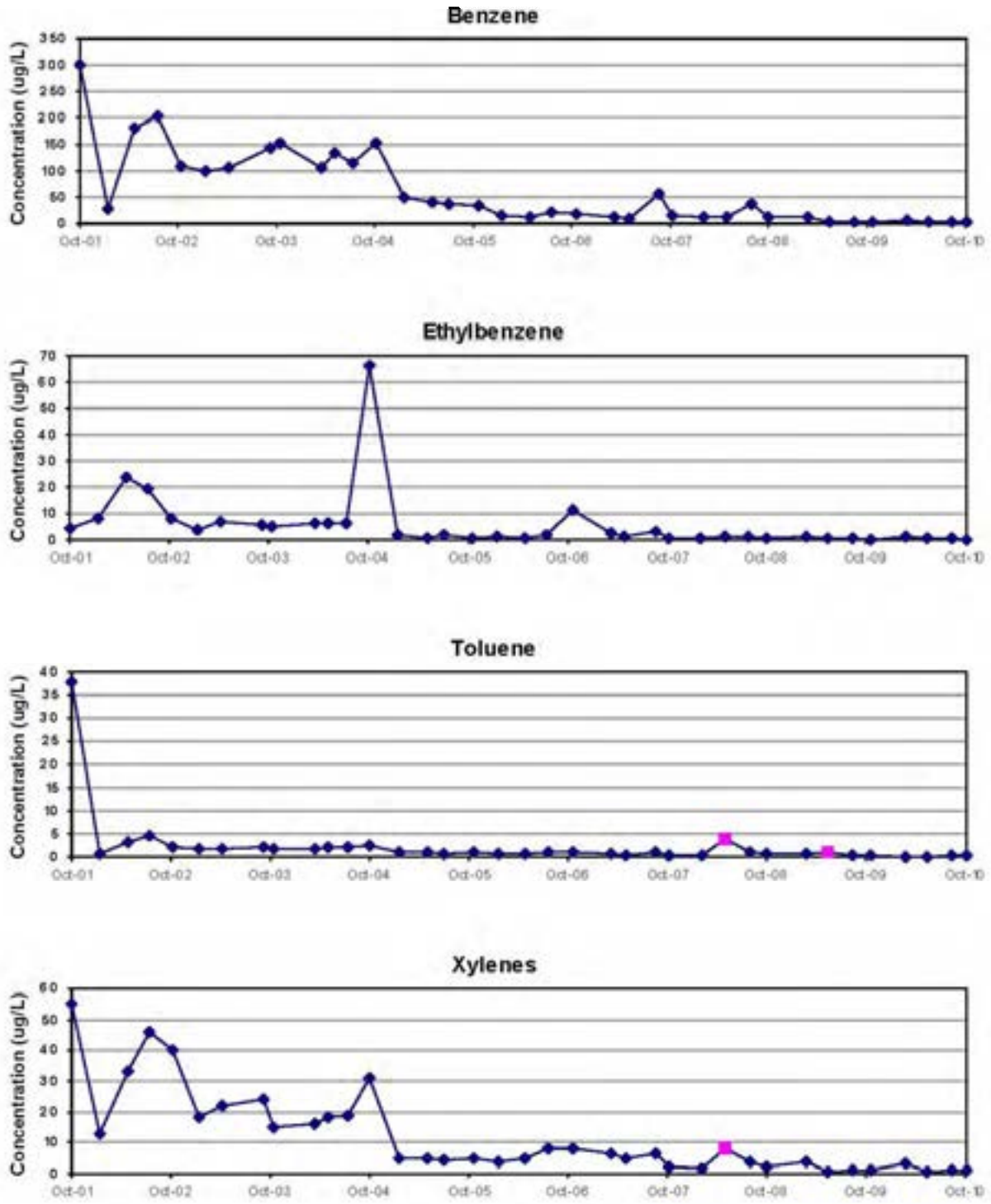
PROJECT:

MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:

M-12



EXPLANATION

Concentration

Non-Detect (value = reporting level)

TITLE:

Bioreactor Influent Water Quality

PROJECT:

MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:

M-13

Appendix M Summary of BTEX Compounds in Groundwater Samples
MRP Properties Company, LLC - Arkansas City, Kansas

Monitoring Location	Sample Date	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
WN-1A	3/29/1998	5U	5U	5U	5U
WN-1A	6/18/1998	5U	5U	5U	5U
WN-1A	9/17/1998	5U	5U	5U	5U
WN-1A	12/9/1998	5U	5U	5U	5U
WN-1A	3/13/1999	5U	5U	5U	5U
WN-1A	6/9/1999	5U	5U	5U	5U
WN-1A	8/17/1999	5U	5U	5U	5U
WN-1A	12/6/1999	5U	5U	1J	1J
WN-1A	3/20/2000	5U	5U	5U	5U
WN-1A	5/24/2000	5U	5U	5U	5U
WN-1A	9/12/2000	2U	2U	2U	2U
WN-1A	11/30/2000	2J	5U	5U	5U
WN-1A	5/1/2001	5U	5U	5U	5U
WN-1A	10/9/2001	1U	1U	1U	2U
WN-1A	4/30/2002	1U	1U	1U	2U
WN-1A	10/16/2002	1U	1U	1U	2U
WN-1A	4/15/2003	1U	1U	1U	2U
WN-1A	10/21/2003	1U	1U	1U	2U
WN-1A	5/11/2004	1U	1U	1U	2U
WN-1A	10/14/2004	1U	1U	1U	2U
WN-1A	5/10/2005	1U	1U	1U	2U
WN-1A	10/25/2005	1U	1U	1U	2U
WN-1A	5/2/2006	1U	1U	1U	2U
WN-1A	10/24/2006	1U	1U	1U	2U
WN-1A	5/7/2007	1U	1U	1U	2U
WN-1A	10/16/2007	1U	1U	1U	2U
WN-1A	5/6/2008	2U	4U	4U	8U
WN-1A	10/8/2008	1U	1U	1U	2U
WN-1A	5/19/2009	1U	1U	1U	2U
WN-1A	10/26/2009	0.26J	1U	1U	2U
WN-1A	5/17/2010	1U	1U	1U	2U
WN-1A	10/12/2010	1U	1U	1U	2U
WN-1B	3/29/1998	5U	5U	5U	5U
WN-1B	6/18/1998	5U	5U	5U	5U
WN-1B	9/17/1998	5U	5U	5U	5U
WN-1B	12/9/1998	5U	5U	1J	4J
WN-1B	3/13/1999	5U	5U	5U	5U
WN-1B	6/9/1999	5U	5U	5U	5U
WN-1B	8/17/1999	5U	5U	5U	5U
WN-1B	12/6/1999	5U	5U	5U	5U
WN-1B	3/20/2000	5U	5U	5U	5U
WN-1B	5/24/2000	5U	5U	5U	5U
WN-1B	9/12/2000	2U	2U	2U	2U
WN-1B	11/30/2000	5U	5U	5U	5U
WN-1B	5/1/2001	5U	5U	5U	5U
WN-1B	10/9/2001	1U	1U	1U	2U
WN-1B	4/30/2002	1U	1U	1U	2U
WN-1B	10/16/2002	1U	1U	1U	2U
WN-1B	4/15/2003	1U	1U	1U	2U
WN-1B	10/21/2003	1U	1U	1U	2U
WN-1B	5/11/2004	1U	1U	1U	2U

Appendix M Summary of BTEX Compounds in Groundwater Samples
MRP Properties Company, LLC - Arkansas City, Kansas

Monitoring Location	Sample Date	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
WN-1B	10/14/2004	1U	1U	1U	2U
WN-1B	5/11/2005	1U	1U	1U	2U
WN-1B	10/25/2005	1U	1U	0.45J	2.2
WN-1B	5/2/2006	1U	1U	1U	2U
WN-1B	10/24/2006	1U	1U	1U	2U
WN-1B	5/8/2007	1U	1U	1U	2U
WN-1B	10/18/2007	1U	1U	1U	2U
WN-1B	5/6/2008	2U	4U	4U	8U
WN-1B	10/8/2008	1U	1U	1U	2U
WN-1B	5/19/2009	1U	1U	1U	2U
WN-1B	10/27/2009	1U	1U	1U	2U
WN-1B	5/17/2010	1U	1U	1U	2U
WN-1B	10/12/2010	1U	1U	1U	2U
WN-5B	3/29/1998	17.6	5U	5U	5U
WN-5B	6/18/1998	5U	5U	5U	5U
WN-5B	9/17/1998	38	5U	5U	5U
WN-5B	12/9/1998	24	5U	5U	5U
WN-5B	3/13/1999	54	5U	5U	5U
WN-5B	6/9/1999	61	5U	5U	5U
WN-5B	8/17/1999	33	5U	5U	5U
WN-5B	12/6/1999	36	5U	5U	5U
WN-5B	3/20/2000	32	5U	5U	5U
WN-5B	5/24/2000	19	5U	5U	5U
WN-5B	9/12/2000	8.5	2U	2U	2U
WN-5B	11/28/2000	5U	5U	5U	5U
WN-5B	5/2/2001	2J	5U	5U	5U
WN-5B	10/10/2001	0.73J	2U	2U	4U
WN-5B	5/1/2002	4U	4U	4U	8U
WN-5B	10/17/2002	1U	1U	1U	2U
WN-5B	4/17/2003	1U	1U	0.37	0.91
WN-5B	10/22/2003	1U	1U	0.41J	0.89J
WN-5B	5/12/2004	2U	2U	0.32J	4U
WN-5B	10/13/2004	1U	1U	0.25J	2U
WN-5B	5/12/2005	2U	2U	0.32J	4U
WN-5B	10/25/2005	1U	1U	0.30J	2U
WN-5B	5/2/2006	0.36J	2U	0.37J	4U
WN-5B	10/24/2006	2.7U	2.7U	2.7U	5.3U
WN-5B	5/10/2007	2U	2U	2U	4U
WN-5B	10/18/2007	1U	1U	0.33J	2U
WN-5B	5/6/2008	2U	4U	4U	8U
WN-5B	10/8/2008	1U	1U	1U	2U
WN-5B	5/21/2009	1U	1U	1U	2U
WN-5B	10/27/2009	4U	4U	4U	8U
WN-5B	5/18/2010	1U	1U	1U	2U
WN-5B	10/12/2010	1U	1U	1U	2U
WN-6A	3/29/1998	5U	5U	5U	5U
WN-6A	6/17/1998	5U	5U	5U	5U
WN-6A	9/25/1998	2J	5U	5U	5U
WN-6A	12/9/1998	42	2J	5U	4J
WN-6A	3/13/1999	5U	5U	5U	5U
WN-6A	6/9/1999	320	2J	5J	8J

Appendix M Summary of BTEX Compounds in Groundwater Samples
MRP Properties Company, LLC - Arkansas City, Kansas

Monitoring Location	Sample Date	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
WN-6A	8/18/1999	7	5U	5U	5U
WN-6A	12/14/1999	17	5U	5U	2J
WN-6A	3/20/2000	3J	5U	5U	5U
WN-6A	5/24/2000	5U	5U	5U	5U
WN-6A	11/28/2000	6	5U	5U	5U
WN-6A	5/2/2001	5U	5U	5U	5U
WN-6A	10/10/2001	1.2	1U	1U	2U
WN-6A	4/30/2002	5	1U	1U	2U
WN-6A	10/16/2002	1U	1U	1U	2U
WN-6A	4/16/2003	1U	1U	1U	2U
WN-6A	10/21/2003	1U	1U	1U	2U
WN-6A	5/11/2004	0.3J	1U	1U	2U
WN-6A	10/12/2004	1U	1U	1U	2U
WN-6A	5/12/2005	1U	1U	1U	2U
WN-6A	10/25/2005	1U	1U	1U	2U
WN-6A	5/2/2006	1U	1U	1U	2U
WN-6A	10/25/2006	1U	1U	1U	2U
WN-6A	5/8/2007	1U	1U	1U	2U
WN-6A	10/16/2007	0.35J	1U	1U	2U
WN-6A	5/7/2008	1U	1U	1U	2U
WN-6A	10/9/2008	1U	1U	1U	2U
WN-6A	5/20/2009	1U	1U	1U	2U
WN-6A	10/27/2009	1U	1U	1U	2U
WN-6A	5/18/2010	1U	1U	1U	2U
WN-6A	10/13/2010	1U	1U	1U	2U
WN-6B	3/29/1998	8.9	5U	5U	5U
WN-6B	6/17/1998	108	5.8	5U	10.1
WN-6B	9/25/1998	2J	5U	5U	5U
WN-6B	12/9/1998	75	5J	1J	7
WN-6B	3/13/1999	99	4J	5U	8
WN-6B	6/9/1999	140D	9	2J	10
WN-6B	8/18/1999	160	4J	10U	6J
WN-6B	12/14/1999	700D	12	2J	20
WN-6B	3/20/2000	400D	8	1J	12
WN-6B	5/24/2000	160D	4J	5U	3J
WN-6B	9/14/2000	203	3.93	2RU	4.01
WN-6B	11/28/2000	690D	7	3J	13
WN-6B	5/2/2001	320D	5U	2J	5
WN-6B	10/10/2001	350D	6.4J	20U	40U
WN-6B	5/2/2002	300D	6J	10U	7.8J
WN-6B	10/17/2002	120	3.5J	4U	4.1J
WN-6B	4/16/2003	130	2.9	0.61	4
WN-6B	10/22/2003	80	3.6	0.73J	5.6
WN-6B	5/12/2004	56	4.8	0.73J	6.4
WN-6B	10/12/2004	28	2	0.27J	3.4
WN-6B	5/12/2005	22	3.1J	0.42J	1.6J
WN-6B	10/25/2005	6.8	1.9	0.28J	3.5
WN-6B	5/2/2006	41	4.7	0.60J	7.9
WN-6B	10/25/2006	35	5.3	0.67J	9.1
WN-6B	5/9/2007	1U	1U	1U	2U
WN-6B	10/16/2007	7.3	1.6	0.23J	3.2

Appendix M Summary of BTEX Compounds in Groundwater Samples
MRP Properties Company, LLC - Arkansas City, Kansas

Monitoring Location	Sample Date	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
WN-6B	5/7/2008	1U	1.4	0.37J	3.7
WN-6B	10/9/2008	1U	1U	1U	2U
WN-6B	5/19/2009	1U	1U	1U	2U
WN-6B	10/27/2009	35	2.6	0.47J	5.2
WN-6B	5/18/2010	1.1	0.48J	1U	0.72J
WN-6B	10/12/2010	5.2	0.51J	1U	1.3J
WN-7B	3/29/1998	629	18.7	5U	41.9
WN-7B	6/18/1998	4780	28.6	248	70.2
WN-7B	9/18/1998	1200D	16	40	22J
WN-7B	12/9/1998	570D	22	6	62
WN-7B	3/13/1999	3800D	23	190	74
WN-7B	6/9/1999	2700D	17	180	53
WN-7B	8/18/1999	4300	47J	430	160
WN-7B	12/14/1999	430D	7	3J	27
WN-7B	3/21/2000	17	2J	2J	12
WN-7B	5/25/2000	2300D	25J	170	55
WN-7B	9/13/2000	607	13.5	76.5	38.5
WN-7B	11/30/2000	920	50U	50U	50U
WN-7B	5/2/2001	1100D	5U	55	21
WN-7B	10/10/2001	77D	4.7J	10U	31D
WN-7B	5/2/2002	100D	7.6	3.1J	19D
WN-7B	10/17/2002	310	4.9J	4.9J	30
WN-7B	4/16/2003	520	7.9	25	25
WN-7B	10/22/2003	260	14	8.3	44
WN-7B	5/12/2004	260	12	2.7J	21
WN-7B	7/19/2004	390	17	3.1J	42
WN-7B	10/12/2004	340	15	5.2	33
WN-7B	1/25/2005	400	13	5.7J	24
WN-7B	5/12/2005	320	15J	20U	40U
WN-7B	7/12/2005	440	20	20U	28J
WN-7B	10/26/2005	260	19J	20U	42
WN-7B	1/25/2006	59	3.7	0.91J	9.2
WN-7B	5/3/2006	190	15	2.0J	20
WN-7B	7/25/2006	240	15	2.5J	17
WN-7B	10/25/2006	210	16	2.5J	26
WN-7B	3/15/2007	200	14	11	27
WN-7B	5/9/2007	250	19	2	39
WN-7B	8/30/2007	170	15	1.6	29
WN-7B	10/17/2007	58	9	1.4	12
WN-7B	2/12/2008	180	18	3.7J	40
WN-7B	5/7/2008	160	14	1.5	26
WN-7B	8/6/2008	160	15	1.7	32
WN-7B	10/8/2008	370	26	2.6	46
WN-7B	3/5/2009	270	18	2	35
WN-7B	5/21/2009	110	6.7	1	11
WN-7B	8/20/2009	170	14	2.1	42
WN-7B	10/26/2009	220	17	2J	37
WN-7B	5/18/2010	140	15	2	36
WN-7B	10/13/2010	180	17	2.3	46
WN-8B	3/29/1998	66.8	5U	5U	13.1
WN-8B	6/18/1998	236	8.5	10U	21.6

Appendix M Summary of BTEX Compounds in Groundwater Samples
MRP Properties Company, LLC - Arkansas City, Kansas

Monitoring Location	Sample Date	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
WN-8B	9/18/1998	200	6	2J	6
WN-8B	12/9/1998	580D	18	15	24
WN-8B	3/13/1999	5U	5U	7	1J
WN-8B	6/10/1999	180	2J	2J	4J
WN-8B	8/18/1999	360D	15	10	23
WN-8B	12/14/1999	120	4J	3J	9
WN-8B	3/21/2000	44	1J	5U	5U
WN-8B	5/25/2000	400E	10J	4J	16
WN-8B	9/13/2000	162	5.01	2U	7.94
WN-8B	11/30/2000	170	6	5U	6
WN-8B	5/2/2001	190	10U	2J	10
WN-8B	10/10/2001	140D	3.7J	10U	20U
WN-8B	5/2/2002	86D	4.2J	10U	9.1J
WN-8B	10/17/2002	72	2.6J	4U	5.6J
WN-8B	4/17/2003	150D	5.3	2.6	9.8
WN-8B	10/22/2003	4.5	1U	0.47J	0.78J
WN-8B	5/12/2004	55	3.9J	1.9J	11
WN-8B	7/19/2004	38	3.2	1.6	8
WN-8B	10/12/2004	46	2.5	1.9	5.6
WN-8B	1/25/2005	64	3.7	2	9
WN-8B	5/12/2005	46	3.2	1.9	5.9
WN-8B	7/12/2005	41	2	2	4.9
WN-8B	10/26/2005	53	2.7	1.4	6.8
WN-8B	1/25/2006	40	2.9	1.3	8.1
WN-8B	5/3/2006	40	3.5	1.6J	9.7
WN-8B	7/25/2006	25	2.7	1.4	8.9
WN-8B	10/25/2006	26	2.8	1.1J	9
WN-8B	3/15/2007	25	1.9	2.1	6.9
WN-8B	5/9/2007	30J	1.9	1.3	5.3
WN-8B	8/30/2007	46	3.3	0.96J	7.4
WN-8B	10/17/2007	72	3	1.3	6.7
WN-8B	2/12/2008	47	3.5	2.6	9.3
WN-8B	5/7/2008	52	3.2	2.3	8.4
WN-8B	8/6/2008	97	6.2	2.6	15
WN-8B	10/8/2008	32	2.2	1.5	6
WN-8B	3/5/2009	32	2.2	1.3	6.2
WN-8B	5/19/2009	36	2.8	1.6	7.3
WN-8B	8/20/2009	27	2.1	0.97J	5.5
WN-8B	10/27/2009	33J	2.9	1.4	7.9
WN-8B	5/18/2010	33	2.1	1	6
WN-8B	10/13/2010	32	2.7	1.1	8.4
MW-6	3/29/1998	2220	25U	25U	93
MW-6	6/19/1998	3230	196	125U	347
MW-6	9/25/1998	5U	5U	5U	5U
MW-6	12/10/1998	1400D	150	27	170
MW-6	3/12/1999	3800D	160D	120	560
MW-6	6/10/1999	3200D	65	52	220
MW-6	8/18/1999	2200	67J	26J	140
MW-6	12/15/1999	1400	560	46	590
MW-6	3/21/2000	870	240	11	350
MW-6	5/25/2000	1600	87	12J	150

Appendix M Summary of BTEX Compounds in Groundwater Samples
MRP Properties Company, LLC - Arkansas City, Kansas

Monitoring Location	Sample Date	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
MW-6	9/14/2000	1760	322	32.8	426
MW-6	11/29/2000	930	310	28	550
MW-6	5/2/2001	3500	140	17	260
MW-6	10/9/2001	4600D	590D	150J	1200D
MW-6	5/1/2002	11000D	3100D	1600D	9100D
MW-6	10/16/2002	2800	170	250	1400
MW-6	4/16/2003	1800D	60D	160D	1500D
MW-6	10/21/2003	4200	77	200	1700
MW-6	5/11/2004	10000	150J	790	5900
MW-6	10/12/2004	6900	160	790	4200
MW-6	5/12/2005	6400	240	920	8100
MW-6	10/27/2005	8100	230	880	5900
MW-6	5/3/2006	2300	56J	300	2200
MW-6	10/27/2006	3600J	110J	820J	5400J
MW-6	5/9/2007	2000	33	240	4000
MW-6	10/18/2007	3800	40	390	3300
MW-6	5/8/2008	1500	28	170	1200
MW-6	10/10/2008	2000	50	180	3500
MW-6	5/20/2009	1100	27	160	1200
MW-6	10/28/2009	810	29	110	1500
MW-6	5/19/2010	1200	39	190	1700
MW-6	10/14/2010	1100	36	150	1300
MW-12	3/30/1998	5U	5U	5U	5U
MW-12	6/19/1998	5U	5U	5U	5U
MW-12	12/10/1998	26	5U	4J	4J
MW-12	3/12/1999	78	5U	4J	10
MW-12	6/10/1999	180D	2J	10	17
MW-12	8/18/1999	260D	3J	15	34
MW-12	12/15/1999	32	5U	1J	5U
MW-12	3/21/2000	74	2J	14	16
MW-12	5/26/2000	4J	5U	5U	5U
MW-12	9/14/2000	9.27	2RU	1.96J	4.51
MW-12	11/29/2000	5U	5U	5U	5U
MW-12	5/2/2001	5U	5U	5U	5U
MW-12	10/9/2001	9.8	1U	1U	2U
MW-12	5/1/2002	180D	2.3J	2.5J	13D
MW-12	10/16/2002	93	0.95J	2.8	18
MW-12	4/16/2003	9.5	0.26J	1U	1.5J
MW-12	10/21/2003	19	1	4	14
MW-12	5/11/2004	1.2	1U	1U	2U
MW-12	7/19/2004	0.24J	0.16J	1U	2U
MW-12	10/13/2004	24	0.16J	0.59J	2.2
MW-12	1/25/2005	0.51J	1U	1U	2U
MW-12	5/11/2005	33	0.78J	0.25J	3.8
MW-12	10/26/2005	26	0.83J	1U	8.8
MW-12	5/3/2006	4.3	0.44J	0.22J	2U
MW-12	10/27/2006	2.1	1.2	1U	1.5J
MW-12	5/8/2007	1U	1U	1U	2U
MW-12	10/18/2007	1.2	1U	0.21J	2U
MW-12	5/6/2008	2U	1.2J	2.5J	2.1J
MW-12	10/9/2008	57	1.3	1U	6.1

Appendix M Summary of BTEX Compounds in Groundwater Samples
MRP Properties Company, LLC - Arkansas City, Kansas

Monitoring Location	Sample Date	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
MW-12	3/5/2009	3.2	0.54J	1U	0.78J
MW-12	5/20/2009	1U	1U	1U	2U
MW-12	8/20/2009	0.72J	1U	1U	2U
MW-12	10/28/2009	1U	1U	1U	2U
MW-12	5/19/2010	1U	1U	1U	2U
MW-12	10/13/2010	28	1.6	0.33J	3.9
MW-13	3/29/1998	10.5	5U	5U	8.4
MW-13	6/19/1998	5U	5U	5U	5U
MW-13	12/10/1998	10	5U	3J	2J
MW-13	3/12/1999	20	5U	1J	2J
MW-13	6/10/1999	5U	5U	5U	5U
MW-13	8/18/1999	3J	5U	5U	5U
MW-13	12/15/1999	3J	5U	5U	5U
MW-13	3/21/2000	6	5U	2J	1J
MW-13	5/25/2000	3J	5U	5U	5U
MW-13	11/29/2000	5U	5U	5U	5U
MW-13	5/2/2001	5U	5U	5U	5U
MW-13	10/9/2001	1U	1U	1U	2U
MW-13	5/1/2002	0.59J	1U	1U	2U
MW-13	10/16/2002	1U	1U	1U	2U
MW-13	4/16/2003	1U	1U	1U	2U
MW-13	10/21/2003	1U	1U	1U	1J
MW-13	5/11/2004	1U	1U	1U	2U
MW-13	10/12/2004	1U	1U	1U	2U
MW-13	5/11/2005	1U	1U	1U	2U
MW-13	10/27/2005	1U	1U	1U	2U
MW-13	5/3/2006	1U	1U	1U	2U
MW-13	10/27/2006	1U	1U	1U	2U
MW-13	5/9/2007	1U	1U	1U	2U
MW-13	10/18/2007	0.35J	1U	1U	2U
MW-13	5/8/2008	2U	4U	4U	8U
MW-13	10/10/2008	41	0.70J	9.7	7.7
MW-13	5/20/2009	1U	1U	1U	2U
MW-13	10/29/2009	1U	1U	1U	2U
MW-13	5/19/2010	1U	1U	1U	2U
MW-13	10/13/2010	1U	1U	1U	2U
MW-17	5/2/2002	5.1	0.56J	1U	1.7J
MW-17	10/17/2002	5.8	0.58J	1U	1.5J
MW-17	4/17/2003	1U	1U	1U	2U
MW-17	10/22/2003	0.69J	1U	0.14J	0.68J
MW-17	5/12/2004	1U	1U	1U	2U
MW-17	10/12/2004	0.37J	0.24J	1U	2U
MW-17	5/12/2005	1U	1U	1U	2U
MW-17	10/25/2005	1U	1U	1U	2U
MW-17	1/25/2006	1U	1U	1U	2U
MW-17	5/3/2006	1U	1U	1U	2U
MW-17	7/25/2006	1U	1U	1U	2U
MW-17	10/25/2006	1U	1U	1U	2U
MW-17	3/16/2007	1U	1U	1.6	2.3
MW-17	5/10/2007	1U	1U	1U	2U
MW-17	10/17/2007	2.1	0.18J	1U	0.24J

Appendix M Summary of BTEX Compounds in Groundwater Samples
MRP Properties Company, LLC - Arkansas City, Kansas

Monitoring Location	Sample Date	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
MW-17	2/12/2008	1U	1U	1U	2U
MW-17	5/7/2008	1U	1U	1U	2U
MW-17	8/6/2008	0.26J	1U	1U	2U
MW-17	10/8/2008	1U	1U	0.18J	0.51J
MW-17	3/5/2009	1U	1U	1U	2U
MW-17	5/21/2009	1.6	0.41J	0.29J	1.5J
MW-17	8/20/2009	1U	1U	1U	2U
MW-17	10/26/2009	0.19J	1U	1U	0.6J
MW-17	5/17/2010	1U	1U	1U	2U
MW-17	10/12/2010	1U	1U	1U	2U
RCRA-4	12/11/1998	11	5U	3J	2J
RCRA-4	5/2/2001	5U	5U	5U	5U
RCRA-4	10/9/2001	1U	1U	1U	2U
RCRA-4	5/1/2002	1U	1U	1U	2U
RCRA-4	10/17/2002	1U	1U	1U	2U
RCRA-4	4/15/2003	1U	1U	1U	2U
RCRA-4	10/22/2003	1U	1U	1U	2U
RCRA-4	5/11/2004	1U	1U	1U	2U
RCRA-4	10/14/2004	1U	1U	1U	2U
RCRA-4	5/11/2005	1U	1U	1U	2U
RCRA-4	10/26/2005	1U	1U	1U	2U
RCRA-4	5/2/2006	1U	1U	1U	2U
RCRA-4	10/24/2006	1U	1U	1U	2U
RCRA-4	5/10/2007	1U	1U	1U	2U
RCRA-4	10/18/2007	1U	1U	1U	2U
RCRA-4	5/6/2008	2U	4U	4U	8U
RCRA-4	10/9/2008	1U	1U	1U	2U
RCRA-4	5/20/2009	1U	1U	1U	2U
RCRA-4	10/28/2009	1U	1U	1U	2U
RCRA-4	5/17/2010	1U	1U	1U	2U
RCRA-4	10/13/2010	1U	1U	1U	2U
BIOREACTOR-INF	10/10/2001	300	38	4.5	55
BIOREACTOR-INF	1/23/2002	27	0.73	8	13
BIOREACTOR-INF	5/2/2002	180.6	3.1	24	33
BIOREACTOR-INF	7/25/2002	204	4.8	19.4	46
BIOREACTOR-INF	10/17/2002	108	2.1	8.2	40
BIOREACTOR-INF	1/21/2003	101	1.9	3.9	18
BIOREACTOR-INF	4/16/2003	105	1.7	6.8	22
BIOREACTOR-INF	9/17/2003	143	2.3	5.7	24
BIOREACTOR-INF	10/23/2003	154	1.7	5.1	15
BIOREACTOR-INF	3/24/2004	106	1.9	6.4	16
BIOREACTOR-INF	5/12/2004	134	2	6.4	18
BIOREACTOR-INF	7/19/2004	116	2.2	6.3	19
BIOREACTOR-INF	10/12/2004	154	2.6	66.3	31
BIOREACTOR-INF	1/25/2005	50	1.1	1.8	5
BIOREACTOR-INF	5/11/2005	42	1.1	0.9	4.6
BIOREACTOR-INF	7/11/2005	36	0.8	1.6	4.1
BIOREACTOR-INF	10/26/2005	35	1	0.9	5
BIOREACTOR-INF	1/24/2006	16.9	0.66	0.95	4
BIOREACTOR-INF	5/4/2006	14	0.61J	0.88J	4.6
BIOREACTOR-INF	7/26/2006	21	1.1	1.7	7.8

Appendix M Summary of BTEX Compounds in Groundwater Samples
MRP Properties Company, LLC - Arkansas City, Kansas

Monitoring Location	Sample Date	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)
BIOREACTOR-INF	10/27/2006	19	1.1	11	8.3
BIOREACTOR-INF	3/16/2007	13	0.66J	2.4J	6.3
BIOREACTOR-INF	5/9/2007	8.3	0.44J	0.99J	4.7
BIOREACTOR-INF	8/27/2007	57	1.2	3.3	6.5
BIOREACTOR-INF	10/17/2007	16	0.51J	0.70J	1.9J
BIOREACTOR-INF	2/12/2008	13	0.46J	0.37J	1.7J
BIOREACTOR-INF	5/8/2008	11	4.0U	1.3J	8U
BIOREACTOR-INF	8/6/2008	36	0.91J	1.3	3.8
BIOREACTOR-INF	10/10/2008	12	0.57J	0.83J	2.2
BIOREACTOR-INF	3/4/2009	12	0.63J	1.2	3.9
BIOREACTOR-INF	5/21/2009	1.6	1U	0.45J	0.51J
BIOREACTOR-INF	8/20/2009	2.4	0.19J	0.37J	0.81J
BIOREACTOR-INF	10/29/2009	3.8	0.25J	0.18J	1J
BIOREACTOR-INF	3/4/2010	4.7	0.04	1.3	3
BIOREACTOR-INF	5/24/2010	2.9	0.11J	0.5J	0.8J
BIOREACTOR-INF	8/19/2010	3	0.36J	0.5	1
BIOREACTOR-INF	10/14/2010	2.2	0.28J	0.21J	0.94J

Notes:

U - Not detected above the method reporting level shown.

J - Estimated value. Used primarily when the compound was detected between the method detection level

D - Indicates that the compound was identified in an analysis at a secondary dilution factor.

E - Estimated results. Results concentration exceeds the calibration range.

ug/L - micrograms per liter

BIOREACTOR-INF = Bioreactor Influent sample

APPENDIX N

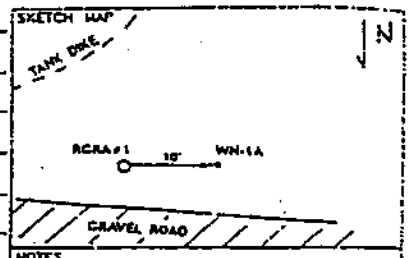
Monitoring Well Construction Logs

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

WELL NUMBER WN-1 A

T Total RCRA		OWNER Total Petroleum, Inc.	
CATION Ark City, KS		PROJECT NUMBER 422-875-9023	
TE DRILLED 8-1-88	TOTAL DEPTH OF HOLE 45.0	DIAMETER 8.0"	
RFACE ELEVATION 1066.17	WATER LEVEL INITIAL 18.0'	24-HRS. 18.0'	
REEN DIA. 2.0"	LENGTH 15.0'	SLOT SIZE 0.02"	
SING DIA. 2.0"	LENGTH 31.0'	TYP. Stainless Steel	
LLING COMPANY GTI		DRILLING METHOD 8.0" Hollow Stem	
LLER Frank Baker		LOG BY Barry McFarland	

SKETCH MAP



NOTES
10' W of RCRA #1

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		Concrete	SC		Clayey Sand: Dark Brown; 20-30% fines, dry, fine grained, medium dense.
		5' continuous sampler used from 0-20'	SP		Sand: Yellowish Brown-Light Brown; 0-10% fines, fine to medium grained, medium dense (with some clay seams to 2")
5		Volclay Grout			
10			SP		A.A. but medium grained and wet to very wet at 16.0'.
15					
20			SP		Sand- Light Grey; 0-10% fines, saturated medium and coarse grained, medium dense (slight fuel odor)
		Bentonite Chips			
25					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

WELL NUMBER WN-1-A

PROJECT Total/RCRA OWNER Total Petroleum, Inc.

LOCATION Ark City, KS PROJECT NUMBER 422-875-9023

DATE DRILLED 8-1-88 TOTAL DEPTH OF HOLE 45.0 DIAMETER 8.0"

SURFACE ELEVATION _____ WATER LEVEL INITIAL _____ 24-HRS. _____

SCREEN DIA. _____ LENGTH _____ SLOT SIZE _____

CASING DIA. _____ LENGTH _____ TYP. _____

DRILLING COMPANY _____ DRILLING METHOD _____

DRILLER _____ LOG BY _____

SKETCH MAP

NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
26			SP		A.A.
30					
35					
			SP		Gravelly Sand: Light Grey; 0-10% fines, saturated medium dense; coarse grained, (with limestone gravels to 3")
40					
45					Shale: Light Greyish Brown; medium hard

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

WELL NUMBER WN-1-B

OJECT Total/RCRA OWNER Total Petroleum, Inc.
CATION Arkansas City, KS PROJECT NUMBER 422-875-9023
TE DRILLED 8-10-88 TOTAL DEPTH OF HOLE 28.0' DIAMETER 8.0'
RFACE ELEVATION 1065.12 WATER LEVEL INITIAL 18.0' 24-HRS. 18.0'
REEN DIA. 2.0" LENGTH 15.0' SLOT SIZE 0.02"
SING DIA. 2.0" LENGTH 16.0' TYP. Stainless Steel
RILLING COMPANY GTI DRILLING METHOD Hollow Stem
RILLER Frank Baker LOG BY Barry McFarland

SKETCH MAP

NOTES
7' NE of WN-1-A

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
0		Concrete			Same as WN-1-A
		Volclay Grout			
5					
		Bentonite			
10					
		Screen 13'-28'			
15					
20					
25					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

WELL NUMBER WN-1-B

PROJECT Total/RCRA OWNER Total Petroleum, Inc.

LOCATION Arkansas City, KS PROJECT NUMBER 422-875-9023

DATE DRILLED 8-10-88 TOTAL DEPTH OF HOLE 28.0' DIAMETER 8.0"

SURFACE ELEVATION _____ WATER LEVEL INITIAL _____ 24-HRS. _____

SCREEN DIA. _____ LENGTH _____ SLOT SIZE _____

CASING DIA. _____ LENGTH _____ TYP. _____

DRILLING COMPANY _____ DRILLING METHOD _____

DRILLER _____ LOG BY _____

SKETCH MAP

NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
26					Same as WN-1-A

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

WELL NUMBER WN-5-B

PROJECT Total/RCRA
OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS
PROJECT NUMBER 422-875-9023
DATE DRILLED 8-9-88
TOTAL DEPTH OF HOLE 26.0'
DIAMETER 8.0"
SURFACE ELEVATION 1062.86
WATER LEVEL INITIAL 17.0'
24-HRS 17.0'
SCREEN DIA. 2.0"
LENGTH 15.0'
SLOT SIZE 0.02"
CASING DIA. 2.0"
LENGTH 15.0'
TYP. Stainless Steel
DRILLING COMPANY GTI
DRILLING METHOD Hollow Stem
DRILLER Frank Baker
LOG BY Barry McFarland

SKETCH MAP

NOTES
7' S of WN-5-A

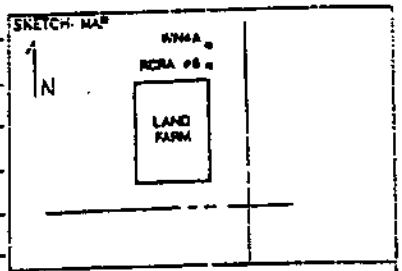
DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		Concrete			Same as WN-5-A
		Volclay Grout			
		Bentonite Chips			
10					
		Sand Pack			
20					
30					
40					
50					

TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

WELL NUMBER WN-6-A

OWNER	Total Refinery/RCRA
LOCATION	Arkansas City, KS
PROJECT NUMBER	422-875-9023
DATE DRILLED	8-4-88
TOTAL DEPTH OF HOLE	44.0'
DIAMETER	8.0"
SURFACE ELEVATION	1062.81
WATER LEVEL INITIAL	18.0'
24-HRS.	18.0'
SCREEN DIA.	2.0"
LENGTH	15.0'
SLOT SIZE	0.02"
CASING DIA.	2.0"
LENGTH	32.0'
TYP.	Stainless Steel
DRILLING COMPANY	GTI
DRILLING METHOD	Hollow Stem
DRILLER	Frank Baker
LOG BY	Barry McFarland

SKETCH MAP



NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		Concrete	CL		Sandy Clay: Dark Brown; 20-30% fine sand; moist; low plastic; medium dense (w/ roots upper 6")
		5' continuous sampler from 0-20'	SM		Silty Sand: Brown; 10-20% fines; moist to wet at 6'; fine & medium grains; medium dense
5		Volclay Grout			
			SP		A.A. but Yellowish Brown, 0-10% fines
10		Composite Jar Samples 10-15' and 15-20'			
		Bentonite Chips			
15		HNU 100-150 ppm @ sample	SP		Sand: Light Grey; 0-10% fines; very wet; medium grains; medium dense (w/ some fuel odor)
20			SP		A.A. but saturated with medium & coarse grains (some large gravels to 1")
25					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

WELL NUMBER WN-6-A

PROJECT Total/RCRA OWNER Total Petroleum, Inc.

LOCATION Ark City, KS PROJECT NUMBER 422-875-9023

DATE DRILLED 8-4-88 TOTAL DEPTH OF HOLE 44.0' DIAMETER 8.0"

SURFACE ELEVATION _____ WATER LEVEL INITIAL _____ 24-HRS _____

SCREEN DIA. _____ LENGTH _____ SLOT SIZE _____

CASING DIA. _____ LENGTH _____ TYP. _____

DRILLING COMPANY _____ DRILLING METHOD _____

DRILLER _____ LOG BY _____

SKETCH MAP

NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
26					As above
30		Screen 29-44'			
35					
40					A.A. but with limestone gravels to 3" diameter.
45					Shale: Very Light Brown - Light Grey; moist, medium hard rock.
50					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

WELL NUMBER WN-6-B

PROJECT Total/RCRA OWNER Total Petroleum, Inc.
LOCATION Arkansas, KS PROJECT NUMBER 422-875-9023
DATE DRILLED 8-9-88 TOTAL DEPTH OF HOLE 28.0' DIAMETER 8.0'
SURFACE ELEVATION 1062.79 WATER LEVEL INITIAL 18.0' 24-HRS 18.0'
SCREEN DIA. 2.0" LENGTH 15.0' SLOT SIZE 0.02"
CASING DIA. 2.0" LENGTH 15.0' TYP. Stainless Steel
DRILLING COMPANY GTI DRILLING METHOD Hollow Stem
DRILLER Frank Baker LOG BY Barry McFarland

SKETCH MAP

NOTES
8' E of WN-4A

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0	Concrete				Same as WN-4 A
	Volclay Grout				
	Bentonite Chips				
	Sand Pack				
20					
30					
40					
50					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

WELL NUMBER WN-7-B

PROJECT Total/RCRA OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS PROJECT NUMBER 422-875-9023
DATE DRILLED 8-10-88 TOTAL DEPTH OF HOLE 31.0' DIAMETER 8.0"
SURFACE ELEVATION 1062.27 WATER LEVEL INITIAL 19.5' 24-HRS 19.5'
SCREEN DIA. 2.0" LENGTH 15.0' SLOT SIZE
CASING DIA. 2.0" LENGTH 19.0' TYP. Stainless Steel
DRILLING COMPANY GTI DRILLING METHOD Hollow Stem
DRILLER Frank Baker LOG BY Barry McFarland

SKETCH MAP

NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		Concrete			Sand: Very pale brown; 0-10% fines, dry-moist, fine grained, medium dense (with some black staining in upper 2.0')
		Volclay Grout			
10		Bentonite Chips			Sand: Light grey and light greyish brown, 0-10% fines, wet, fine to medium grained, medium dense (with fuel odor and staining)
20		Sand Pack			As above but medium and coarse grained, saturated.
30					
40					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

WELL NUMBER WN 8-B

PROJECT: Total/RCRA
OWNER: Total Petroleum, Inc.
LOCATION: Ark City, KS
PROJECT NUMBER: 422-875-9023
DATE DRILLED: 8-10-88
TOTAL DEPTH OF HOLE: 30.0'
DIAMETER: 8.0"
SURFACE ELEVATION: 1062.07
WATER LEVEL INITIAL: 19.0'
24-HRS: 19.0'
SCREEN DIA.: 2.0"
LENGTH: 15.0'
SLOT SIZE: 0.02"
CASING DIA.: 2.0"
LENGTH: 20.0'
TYP.: Stainless Steel
DRILLING COMPANY: GTI
DRILLING METHOD: Hollow Stem
DRILLER: Frank Baker
LOG BY: Barry McFarland

SKETCH MAP

NOTES: 8' NE of WN-8-A

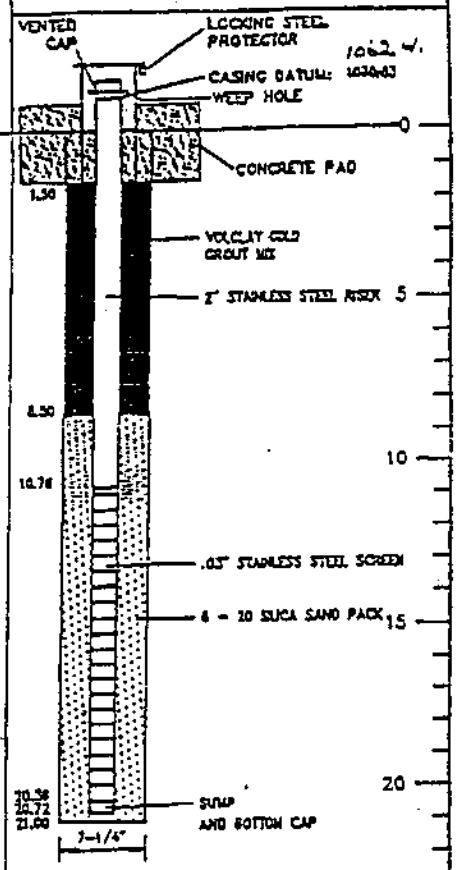
DEPTH (FEET)	WELL CONSTRUCTION	NOTES	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0	Concrete			Same as WN-8-A
	Volclay Grout			
10	Bentonite Chips			
	Sand Pack			
20				
30				
40				
50				

WELL COMPLETION RECORD

DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
	GROUND SURFACE: 1060.34				
0	CLAYEY SANDY SILT: 7.5 YR 6/4, LT. BROWN, MOIST, SOFT, 10% CLAY, 30% SAND, VF–F GRAIN, RND–SUBRND., 60% SILT, L–PLAST.	ML		NS	
1.0		CH			
2.0	CLAY: 7.5 YR BROWN, MOIST, FIRM IN DI N–PLAST.	ML			
3.0	CLAYEY SANDY SILT: 7.5 YR 6/4, LT. BROWN, MOIST, SOFT, 10% CLAY, 30% SAND, VF–F GRAIN, RND–SUBRND., 60% SILT, L–PLAST.	SM		1	
5	SILTY SAND: 7.5 YR 6/0, GRAY, MOIST, SOFT, ODOR, 10% SILT, 30% SAND, VF–C GRAIN, RND–SUBRND.	SP		NS	
	SAND: POORLY GRD., VF–F GRAIN, QRTZ, LT. GRAY, 10 YR 7/1 TO 7/2, STRONG HYDROCARBON ODOR, LOOSE, DRY				
10				2 / NS	
14.0	SILTY SANDY CLAY: VF GRAIN SD., 60% CLAY, 30% SD./SILT, L–PLAST., RED GRAYISH, 5 YR 5/2, VERY MOIST, FIRM	ML		3	1.5
15 / 15.5	SAND: POORLY GRD., FINE TO COARSE GRAIN, SUBRND, QTZ, CHERT, LT. GRAY 10 YR 7/1, SAT., LOOSE, STRONG HYDROCARBON ODOR	SP		NS / NS	
20				4	1.5
	T.D. 21.0'				
	NOTE: DEEP BORING LOGS USED FOR BOTH DEEP AND SHALLOW DETAILS FOR NESTED WELLS				
25					
30					
35					

13.1'

WELL COMPLETION DETAIL



CHE 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 *TOTAL/89035*

BORING NUMBER *MW-6 (BH-13)*

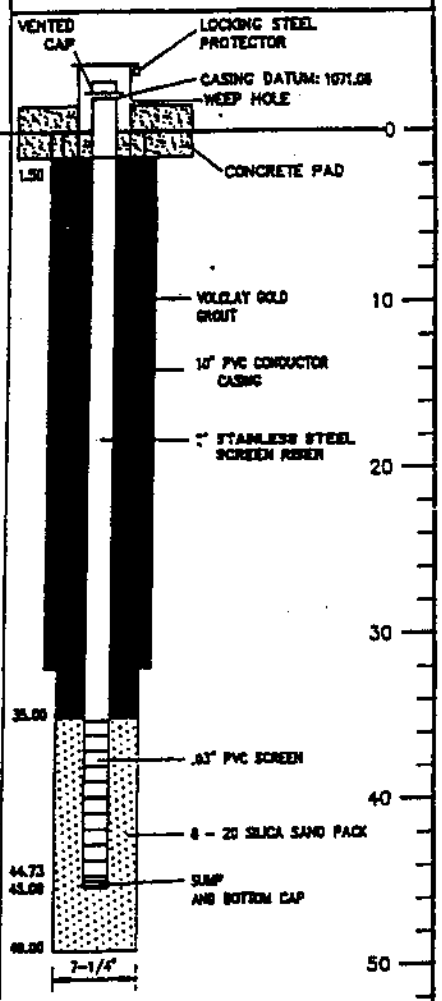
DATE DRILLED 3/12/90 – 3/15/90
DRILLING METHOD HA/HSA
DRILLED BY LATHE/WESTERN
LOGGED BY TPC/MCP
CHECKED BY BJS
DRAWN BY: CAP PAGE 1 OF 1

ROBERTS/SCHORNICK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALVE
		GROUND SURFACE: 1087.40				
	0 – 0.5	TOPSOIL: SILTY CLAY, GRASS ROOTS				
		SILTY CLAY: 10 YR 4/3, DARK BROWN, MOIST, SOFT–FIRM M–H PLAST., SLI–MOTTLED, 30% SILT, 70% CLAY	CH–CL		HAND AUGER	
	5.0	SILTY SAND: VF GRAIN, 80% SAND, 15% SILT, 5% CLAY, POORLY GRADED, DARK GRAYISH BROWN 10 YR 4/2, DRY, LOOSE	SM		1 NR NS 0.2"	
	7.0	SILTY CLAY: 70% CLAY, 30% SILT, MED PLAST., VERY DARK GRAY 7.5 YR 3/0, SOFT, MASSIVE, MOIST	CL		NS	
	10 – 10.5 – 11.1	SILTY SAND: POORLY GRADED, VF–F GRAIN, 80% SAND, 10% SILT, BLACK 10 YR 7/1, SLI MOIST, LOOSE	SM CL		2 NR NS 1.5"	
	15.8	SILTY CLAY: 90% CLAY, 10% SILT, MED. PLAST., BLACK 10 YR 2/1, SM, SOFT, MASSIVE	SP		3 NR NS 1.5"	
		SAND: POORLY GRD, F–M GRAIN, 100% SAND, SUBRND, QTZ., CHERT, PALE BROWN 10 YR 6/3, SLI MOIST, LOOSE				
	20 – 20.1 – 20.5	CLAYEY SAND: F–M GRAIN, 80% SAND, 20% CLAY SUBRND, BLACK 2.5 YR 4/0, QTZ., SLI MOIST	SC SP		4 NR NS 1.5"	
24.0'		SAND: POORLY GRD, F–M GRAIN, SUBRND, QTZ., PALE BROWN 10 YR 2/1, MOIST, LOOSE TO DARK GRAY 5 YR 4/1 AT 21.1' SATURATED–STRONG HYDROCARBON ODOR 25.0'			5 NR NS 1.5"	
	30				6 NR NS 1.5"	
	35.5	GRAVELLY SAND: F–VC SAND, WELL GRD., 80% SAND, 10% GRAVEL, MINOR ANGULAR LIMESTONE ROCKS TO 2", QTZ., SATURATED, LOOSE, STRONG HYDROCARBON ODOR, DARK GRAY 10 YR 4/1	SW		7 NR NS 1.5"	
	40	SAND: FINE–COARSE POORLY GRD., SUBRND, QTZ. DARK GRAY 10 YR 4/1, SAT., LOOSE, STRONG HYDROCARBON ODOR	SP		8 NR NS 1.5"	
		VF–FINE GRAIN SAND AT 45.8'			9 NR NS 1.5"	
	48.0 – 50	AUGER REFUSAL 48.0'				
		NOTE: DEEP BORING LOGS USED FOR BOTH DEEP AND SHALLOW DETAILS FOR NESTED WELLS				
	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.)

JOB NAME/NUMBER *TOTAL/89035*

BORING NUMBER *MW-12 (BH-18)*

DATE DRILLED 5/2/90 – 5/9/90
DRILLING METHOD HA/HSA
DRILLED BY LAYNE/WEST.
LOGGED BY TPG/WEP
CHECKED BY SJS
DRAWN BY: SAR PAGE 1 OF 1

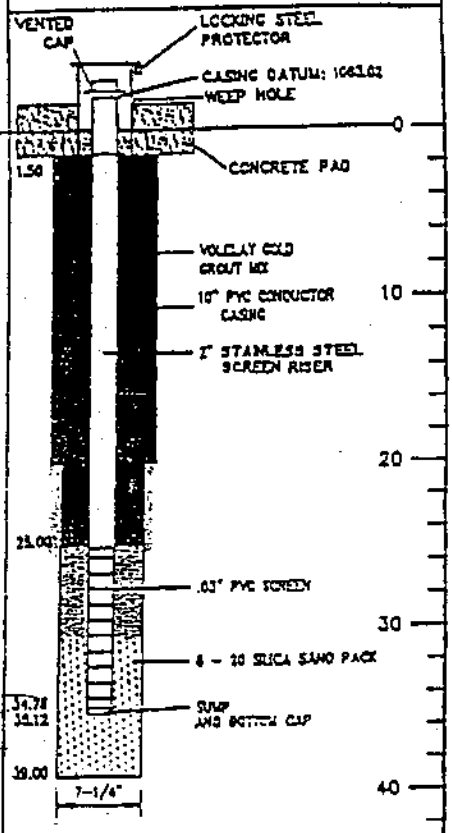
ROBERTS/SCHORNICK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3998

WELL COMPLETION RECORD

GEOLOG.	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE 1060.26				
	0 – 1.0	CLAYEY SANDY SILT 7.5 YR 6/4, LT. BROWN, MOIST, SOFT, 10% CLAY, 30% SAND, VF–F GRAIN, RND–SUBRND, 60% SILT, L–PLAST.	CL			
	1.0 – 2.0	CLAY 7.5 YR BROWN, MOIST, FIRM WITH H–PLAST.	CH		1	NS
	2.0 – 5.0	CLAYEY SANDY SILT 7.5 YR 6/4, LT. BROWN, MOIST, SOFT, 10% CLAY, 30% SAND, VF–F GRAIN, RND–SUBRND, 60% SILT, L–PLAST.	ML			
	5.0 – 10	SILTY SAND: 7.5 YR 6/2, GRAY, MOIST, SOFT, ODOR, 10% SILT, 90% SAND, VF–C GRAIN, RND–SUBRND.	SM		2	NS
	10 – 14.0	SAND: POORLY GRD., VF–F GRAIN, QTZ, LT. GRAY, 10 YR 7/1 TO 7/2, STRONG HYDROCARBON ODOR, LOOSE, DRY	SP			
▽ 15.5'	14.0 – 15.5	SILTY SANDY CLAY: VF GRAIN SD., 60% CLAY, 20% SD./SILT, L–PLAST., RED GRAYISH, 5 YR 5/2, VERY MOIST, FIRM	ML / SC		3 / 4	1.5 / NR / NS
	15.5 – 20	SAND: POORLY GRD., FINE TO COARSE GRAIN, SUBRND, QTZ., CHERT, LT. GRAY 10 YR 7/1, SAT., LOOSE, STRONG HYDROCARBON ODOR COARSENING WITH DEPTH	SP		4 / 5	1.5 / NR / NS / 1.5 / NR / NS
	20 – 30	GRAVELLY SAND: POORLY GRD., 20% GRAVEL, 80% SAND, M–VC GRAIN, GRAVEL TO 1/8" SUB–ANG., QTZ., CHERT, GRAYISH BROWN, 10 YR 5/2, SATURATED, LOOSE, HYDROCARBON ODOR	SP		6 / 7	1.5 / NR / NS / 1.5 / NR / NS
	30 – 39.0	ANGULAR LIMESTONE FRAGMENT, MICRO–CRYSTALLINE, V. HARD, LT. BROWNISH GRAY 10 YR 5/2	SP		7	1.5
	39.0	AUGER REFUSAL AT 39.0'				

NOTE: DEEP BORING LOGS USED FOR BOTH DEEP AND SHALLOW DETAILS FOR NESTED WELLS

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.)

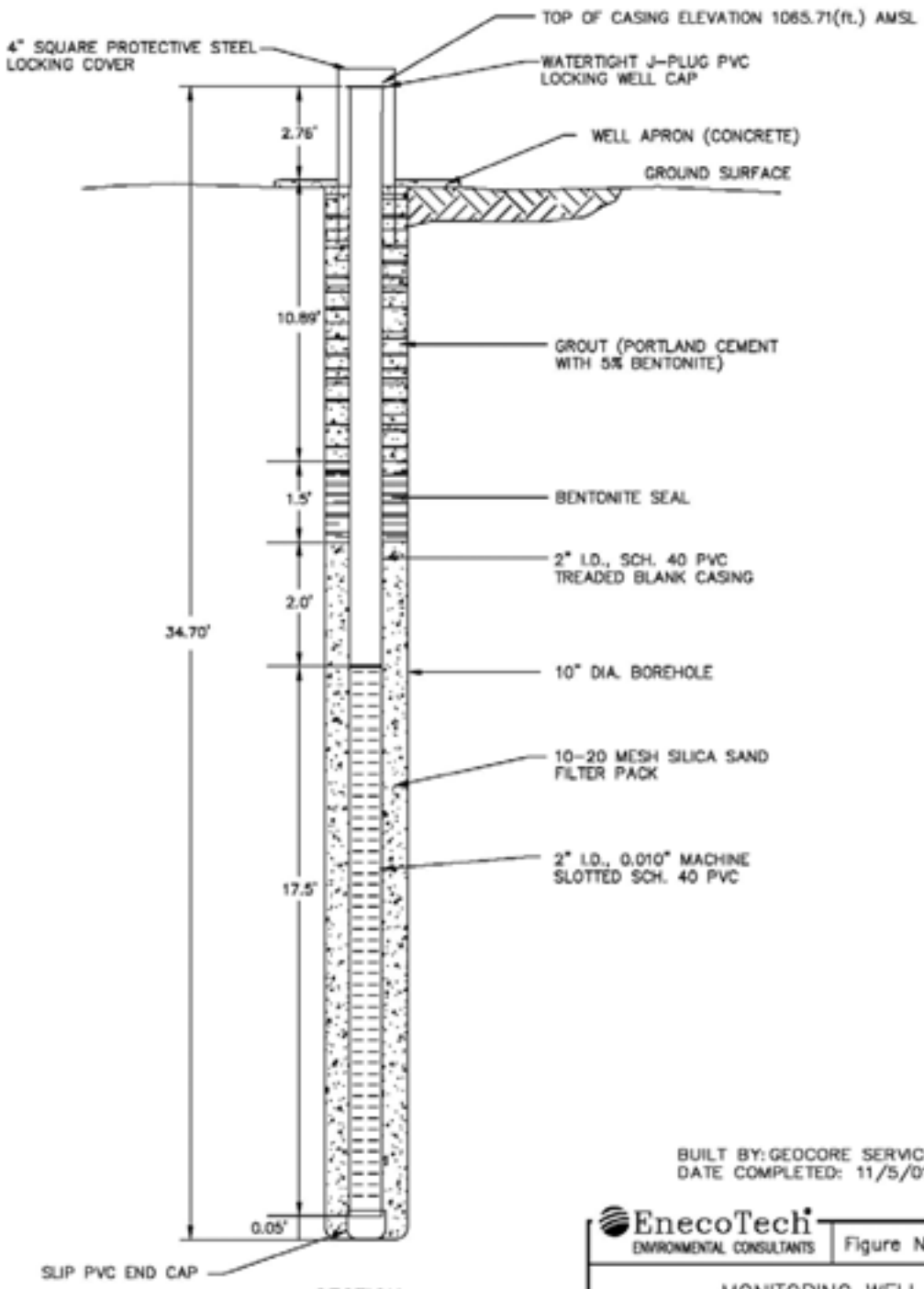
JOB NAME/NUMBER TOTAL/89035

BORING NUMBER MW-13 (BH-19)

DATE DRILLED 3/2/90 – 3/15/90
DRILLING METHOD HA/HSA
DRILLED BY LATHE/WESTERN
LOGGED BY TPC/WEP
CHECKED BY BJS
DRAWN BY SAR

PAGE 1 OF 1

ROBERTS/SCHORNICK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3098



SECTION
NOT TO SCALE

BUILT BY: GEOCORE SERVICES, INC.
DATE COMPLETED: 11/5/01

LOCATION (Plant Coordinates)

NORTHING -1872.404(ft.)
EASTING 1186.906(ft.)

ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (AMSL)

NOTE: PVC CASING CONNECTIONS ARE THREADED AND FLUSH JOINTED

EnecoTech
ENVIRONMENTAL CONSULTANTS

Figure No.:

MONITORING WELL
MW-17
CONSTRUCTION DIAGRAM

PROJECT: TPI PETROLEUM INC. - ARKANSAS CITY REFINERY

1001-014	DESIGNED BY: JFM	APPROVED BY: JFM	
18-MW_17	DRAWN BY: LKB	DATE: 1/15/02	REV.

ENGINEERING Enterprises, Inc.

RCRA MONITORING WELL No. 4

Date Completed: 9-1-81
7 5/8" Hole by mud rotary

Location: East side of refinery
See Location Map in Text

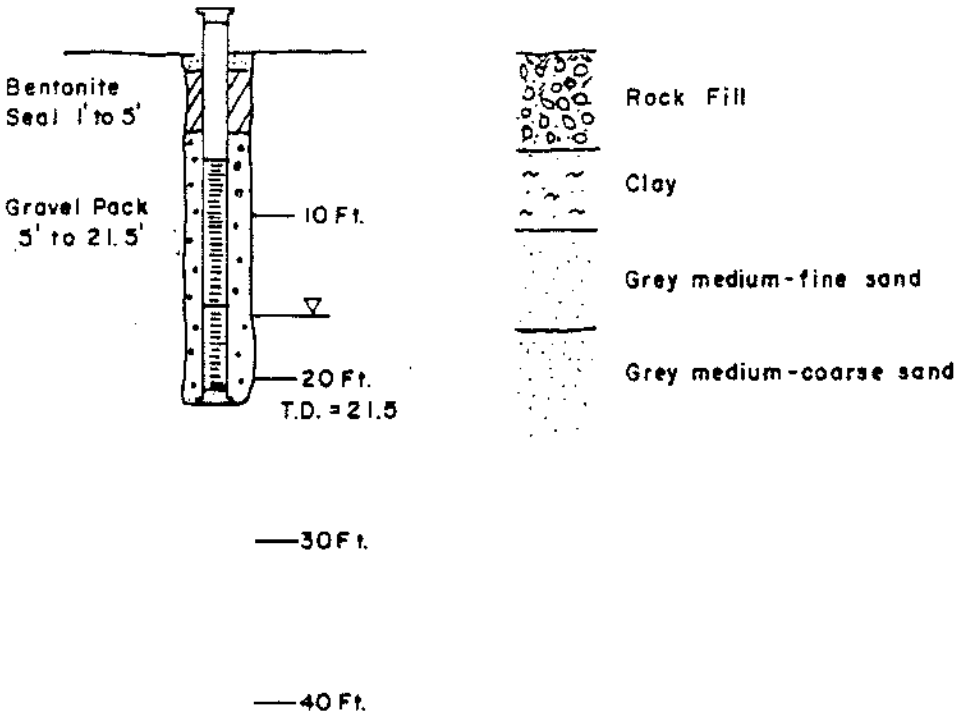
Ground Elevation: 1059.7

Casing: 4" PVC

Top of Casing Elevation: 1061.16

Screen: 4" Plastic (ABS), Continuous Wrap (0.045') Slot 6.7' to 16.5'
(0.050') Slot 16.5' to 21.5'

Static Water Level: 1045.00 (10-2-81)



PROJECT: [illegible]

LOCATION: Arkansas City, KS

BORING DATE: 11/[illegible]

DATUM: GROUND SURFACE

BOREHOLE RFI2-5C

LOGGED: Chuck Gay

DEPTH SCALE (METRES / FEET)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	DEPTH B.G.S. (ft)	Sampler: Sample ID	USCS Symbol	Recovery (%)	MEASUREMENTS: PID (PPM)	
0 / 0		GROUND SURFACE							
		Soil, dark brown, dry, organic.		0.0					
		Clay, brown, very firm, friable, dry, low plasticity, iron oxide mottles.		1.3		ML			
2 / 8		Clay, brown, friable, dry to moist at 6.5', sparse iron oxide mottles.		5.0		ML			
3 / 10		Sand, black to light brown, very fine to fine grained, subrounded, strong hydrocarbon odor and staining at 8.8-10.0', moist, 10% silt.		8.2		SM			
4 / 12–14		Sand, black turning to pale yellowish brown at 13.3-15.0', wet at 14.0', strong hydrocarbon odor and stain at 10.0-12.75', medium to coarse grain 11.5-13.0', turning very fine to fine grained, sub rounded.		10.0		SP			
5 / 16		Sand, pale yellowish brown, very fine to fine grained, faint hydrocarbon odor, wet.		15.0		SP			

Continued on next page

CEMENT APPROX 0.0ft TO 2.5ft

BENTONITE GROUT 2.5ft TO 19.5ft

DRAWN: JS

CHECKED: JWH

BOREHOLE/MONITORING WELL NAME: CMW-1 (RFI2-5C)

LOCATION & ELEVATIONS

NORTHING:

EASTING:

COORDINATE SYSTEM: Plant Coords.

TOP OF CASING ELEV.: XXXX.XX ft.

GROUND ELEV.: XXXX.XX ft.

DRILLING SUMMARY

TOTAL WELL DEPTH: 29.00 ft bgs

SURFACE MOUNT: X STICKUP:

DATE DRILLED: 11/19/99

LOGGED BY: Chuck Gay EnecoTech

DRILLING CONTRACTOR:
Geocore Services, Inc., Salina, KS.

DRILLING RIG: CME-75
DRILLING METHOD: Hollow stem auger

BOREHOLE DIAMETER: 10"

HOLLOW STEM AUGER ID: 6.25"

WATER LEVEL (btoc): NA

WELL DESIGN AND MATERIALS

CASING: 2" ID sch. 40 PVC

SCREEN: 2" ID sch. 40 PVC 0.020" machine slot
SCREENED INTERVAL: 23.00-28.00 ft bgs

FILTER PACK: 10-20 silica sand
FILTER PACK INTERVAL: 21.00-29.00 ft bgs

BENTONITE PELLETS: 2.50-19.50 ft bgs

GROUT INTERVAL 1: Benseal w/Aqua-Grout
GROUT INTERVAL 1: 19.50-21.00 ft bgs
GROUT INTERVAL 2: Cement
GROUT INTERVAL 2: 0.00-2.50 ft bgs

SAMPLING

WELL DEVELOPMENT

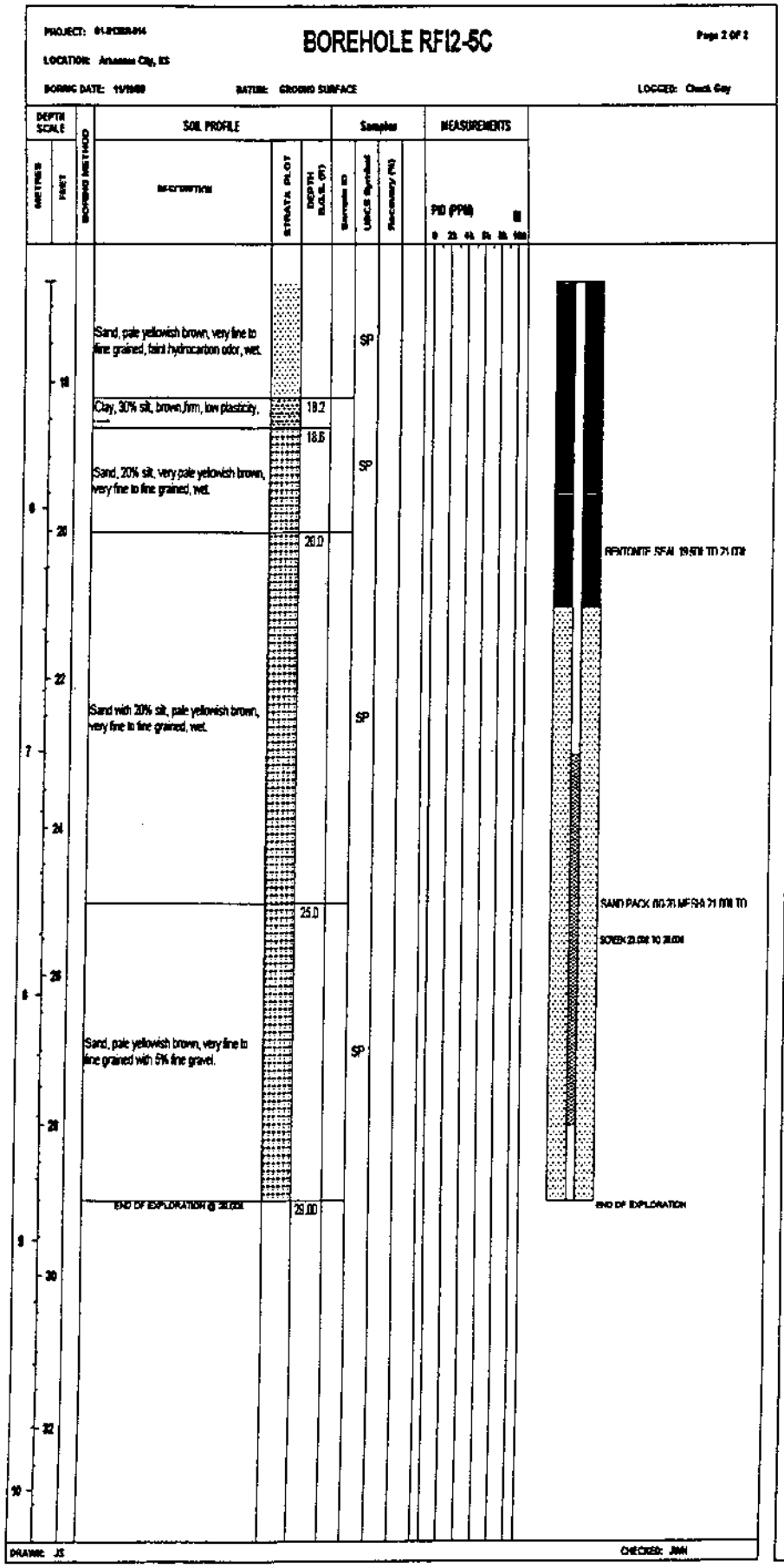
The wells were surged and pumped for approximately one hour until the water was sediment free.

COMMENTS

The stratification lines on the borehole log represent the approximate boundary between soil and rock types. The transition between these boundaries may be more gradual than depicted on this log.

Lithologic description from adjacent well RFI2-5A.

EnecoTech Inc.
1580 Lincoln Street, Suite 1000
Denver, Colorado 80203
(303) 861-2200



BOREHOLE/MONITORING WELL NAME: CMW-1 (RFI2-5C)

LOCATION & ELEVATIONS

NORTHING:

EASTING:

COORDINATE SYSTEM: Plant Coords.

TOP OF CASING ELEV.: XXXX.XX ft.

GROUND ELEV.: XXXX.XX ft.

DRILLING SUMMARY

TOTAL WELL DEPTH: 29.00 ft bgs

SURFACE MOUNT: X STICKUP:

DATE DRILLED: 11/19/99

LOGGED BY: Chuck Gay EnecoTech

DRILLING CONTRACTOR:
Geocore Services, Inc., Salina, KS.

DRILLING RIG: CME-75
DRILLING METHOD: Hollow stem auger

BOREHOLE DIAMETER: 10"

HOLLOW STEM AUGER ID: 6.25"

WATER LEVEL (btoc): NA

WELL DESIGN AND MATERIALS

CASING: 2" ID sch. 40 PVC

SCREEN: 2" ID sch. 40 PVC 0.020" machine slot
SCREENED INTERVAL: 23.00-28.00 ft bgs

FILTER PACK: 10-20 silica sand
FILTER PACK INTERVAL: 21.00-29.00 ft bgs

BENTONITE PELLETS: 2.50-19.50 ft bgs

GROUT INTERVAL 1: Benseal w/Aqua-Grout
GROUT INTERVAL 1: 19.50-21.00 ft bgs
GROUT INTERVAL 2: Cement
GROUT INTERVAL 2: 0.00-2.50 ft bgs

SAMPLING

WELL DEVELOPMENT

The wells were surged and pumped for approximately one hour until the water was sediment free.

COMMENTS

The stratification lines on the borehole log represent the approximate boundary between soil and rock types. The transition between these boundaries may be more gradual than depicted on this log.

Lithologic description from adjacent well RFI2-5A.

EnecoTech Inc.
1580 Lincoln Street, Suite 1000
Denver, Colorado 80203
(303) 861-2200

PROJECT: [illegible]

LOCATION: Arkansas City, KS

BORING DATE: 11/19/99

DATUM: GROUND SURFACE

BOREHOLE CMW-2

Page 1 OF 2

LOGGED: Chuck Gay

DEPTH SCALE METRES	DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	DEPTH BLOW (m)	Samples ID	USCS Symbol	Recovery (%)	MEASUREMENTS PID (PPM)
			CONCRETE SIDEWALK						
			Sand, yellowish orange, no odor or staining, well sorted, fine grained.		0.0		SP	100	
			Sand, light gray, strong hydrocarbon odor, heavy staining, well sorted, fine grained.		4.0		SP	100	
			Sand, olive gray, strong hydrocarbon odor, heavy staing, well sorted, fine grained.		4.0		SP	100	
			Sand, olive gray, strong hydrocarbon odor, heavy staining, well sorted, fine grained.		10.0		SP	50	
			Sand, olive gray, strong hydrocarbon odor, heavy staining, well sorted, medium		12.0		SP	50	
			Sand, olive gray, strong hydrocarbon odor, heavy staining, fine grained, well sorted.		14.00		SP	50	
			Sand, olive gray, strong hydrocarbon odor, heavy staining, fine grained, well sorted.		16.0		SP	80	
			Sand, olive gray, water at approximately 17.0', heavily stained, free product present, strong hydrocarbon odor, medium grained, poorly sorted.		18.0		SP	80	
			Sand, olive gray, strong hydrocarbon odor, free product present, fine grained, well sorted.		19.0		SW	80	
			Sand, olive gray, moderate hydrocarbon odor and staing, fine grained, well sorted.		20.0		SW	80	
			Sand, olive gray, slight odor and staining, fine grained, well sorted.		26.0		SW	50	
			Sand, olive gray, fine grained, well sorted, slight hydrocarbon odor and staining.		30.0		SW	40	

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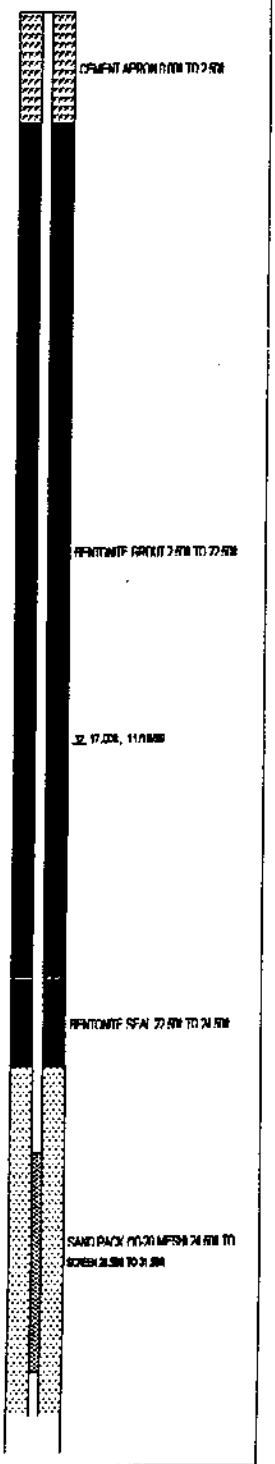


DRAWN: JS

CHECKED: JMH

BOREHOLE/MONITORING WELL NAME: CMW-2

LOCATION & ELEVATIONS

NORTHING:

EASTING:

COORDINATE SYSTEM: Plant Coords.

TOP OF CASING ELEV.: XXXX.XX ft.

GROUND ELEV.: XXXX.XX ft.

DRILLING SUMMARY

TOTAL WELL DEPTH: 32.50 ft bgs

SURFACE MOUNT: STICKUP:

DATE DRILLED: 11/19/99

LOGGED BY: Chuck Gay EnecoTech

DRILLING CONTRACTOR:
Geocore Services, Inc., Salina, KS.

DRILLING RIG: CME-75
DRILLING METHOD: Hollow stem auger

BOREHOLE DIAMETER: 10"

HOLLOW STEM AUGER ID:
PILOT BOREHOLE: 4.25"
REAMED BOREHOLE: 6.25"

WATER LEVEL (btoc): NA

WELL DESIGN AND MATERIALS

CASING: 2" ID sch. 40 PVC

SCREEN: 2" ID sch. 40 PVC 0.020" machine slot
SCREENED INTERVAL: 26.50-31.50 ft bg.

FILTER PACK: 10-20 silica sand
FILTER PACK INTERVAL: 24.50-32.50 ft bgs

BENTONITE PELLETS: 2.50-22.50 ft bgs

GROUT INTERVAL 1: Benseal w/Aqua-Grout
GROUT INTERVAL 1: 22.50-24.50 ft bgs
GROUT INTERVAL 2: Cement
GROUT INTERVAL 2: 0.00-2.50 ft bgs

SAMPLING

The borehole was sampled continuously with a 5-foot sampler. Percent recoveries and sample intervals are noted on the borehole log diagram.

WELL DEVELOPMENT

The wells were surged and pumped for approximately one hour until the water was sediment free.

COMMENTS

The stratification lines on the borehole log represent the approximate boundary between soil and rock types. The transition between these boundaries may be more gradual than depicted on this log.

Borehole below bottom of screen pugged with bentonite.

EnecoTech Inc.
1580 Lincoln Street, Suite 1000
Denver, Colorado 80203
(303) 861-2200

PROJECT: [illegible]

LOCATION: Arkansas City, KS

BORING DATE: [illegible]

BOREHOLE CMW-2

Page 1 of 2

DATUM: GROUND SURFACE

LOGGER: Chuck Gay

DEPTH SCALE METRES	DEPTH SCALE FEET	SOIL PROFILE DESCRIPTION	STRATA PLOT	DEPTH BLOW (m)	Sample ID	USCS Symbol	Recovery (%)	MEASUREMENTS PID (PPM) 0 200 400 600 800 1000
		Sand, olive gray, fine grained, well sorted, slight hydrocarbon odor and staining.				SW	40	
		Sand, olive gray, fine grained, well sorted, very slight hydrocarbon odor.		26 ft		SW	20	
		Sand, olive gray, medium grained, well sorted, very slight hydrocarbon odor.		30 ft		SW	20	
		Shale.		32 ft				
		END OF EXPLORATION @ 40.00ft		40 ft				

END OF EXPLORATION

DRAWN: JS

CHECKED: JMK

BOREHOLE/MONITORING WELL NAME: CMW-2

LOCATION & ELEVATIONS

NORTHING:

EASTING:

COORDINATE SYSTEM: Plant Coords.

TOP OF CASING ELEV.: XXXX.XX ft.

GROUND ELEV.: XXXX.XX ft.

DRILLING SUMMARY

TOTAL WELL DEPTH: 32.50 ft bgs

SURFACE MOUNT: STICKUP:

DATE DRILLED: 11/19/99

LOGGED BY: Chuck Gay EnecoTech

DRILLING CONTRACTOR:
Geocore Services, Inc., Salina, KS.

DRILLING RIG: CME-75
DRILLING METHOD: Hollow stem auger

BOREHOLE DIAMETER: 10"

HOLLOW STEM AUGER ID:
PILOT BOREHOLE: 4.25"
REAMED BOREHOLE: 6.25"

WATER LEVEL (btoc): NA

WELL DESIGN AND MATERIALS

CASING: 2" ID sch. 40 PVC

SCREEN: 2" ID sch. 40 PVC 0.020" machine slot
SCREENED INTERVAL: 26.50-31.50 ft bgs

FILTER PACK: 10-20 silica sand
FILTER PACK INTERVAL: 24.50-32.50 ft bgs

BENTONITE PELLETS: 2.50-22.50 ft bgs

GROUT INTERVAL 1: Bensesl w/Aqua-Grout
GROUT INTERVAL 1: 22.50-24.50 ft bgs
GROUT INTERVAL 2: Cement
GROUT INTERVAL 2: 0.00-2.50 ft bgs

SAMPLING

The borehole was sampled continuously with a 5-foot sampler. Percent recoveries and sample intervals are noted on the borehole log diagram.

WELL DEVELOPMENT

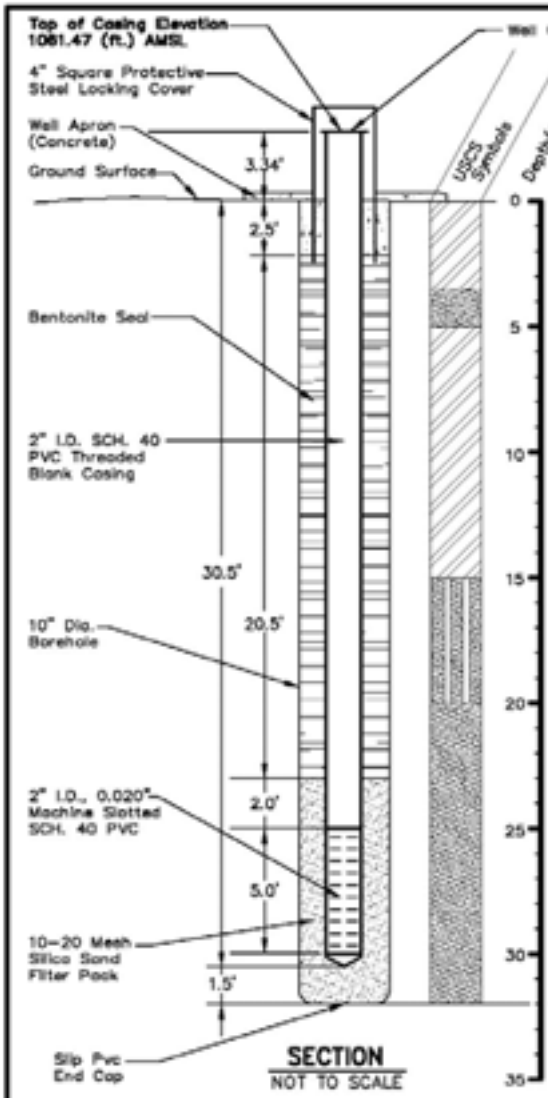
The wells were surged and pumped for approximately one hour until the water was sediment free.

COMMENTS

The stratification lines on the borehole log represent the approximate boundary between soil and rock types. The transition between these boundaries may be more gradual than depicted on this log.

Borehole below bottom of screen pugged with bentonite.

EnecoTech Inc.
1580 Lincoln Street, Suite 1000
Denver, Colorado 80203
(303) 861-2200



COMMENTS

The stratification lines on the borehole log represent the approximate boundary between soil and rock types. The transition between these boundaries may be more gradual than depicted on this log.

PID Reading (ppm)	Classification USCS	Depth (ft.)	Lithology/Remarks
0	CL	0–3.5ft.	Clayey Silt, Dark Brown, Moist, Slight Plasticity, Some Fine Sand, No Odor
	SP	3.5–5.0ft.	Sand, Brown, Very Fine to Fine Grained, Moist, No Odor
0	CL	5.0– 15.0ft.	Silty Clay, Brown, Moist, Medium to High Plasticity, No Odor
0	SM	15.0–20.0ft.	Silty Sand, Dark Grayish Brown, Moist, Cohesive, Fine to Very Coarse Grained, Slight Weathered Hydrocarbon Odor
0	SP	20.0–32.0ft.	Sand, Brown, Some Silt, Medium to Very Coarse Grained with Small Gravel, Wet, Well Graded, Poorly Sorted, Subrounded to Angular, Weathered Hydrocarbon Odor to No Odor

End of Boring @ 32.0 ft. BGS

BUILT BY: GEOCORE SERVICES, INC.
DATE COMPLETED: 4/13/08

DATE	DRAWN BY	CHECKED BY	REVISED BY
04/08	JTW	LKD	JTW

LOCATION (Plant Coordinates)

NORTHING -963.380 (ft.)
EASTING 2595.681 (ft.)

ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (AMSL)

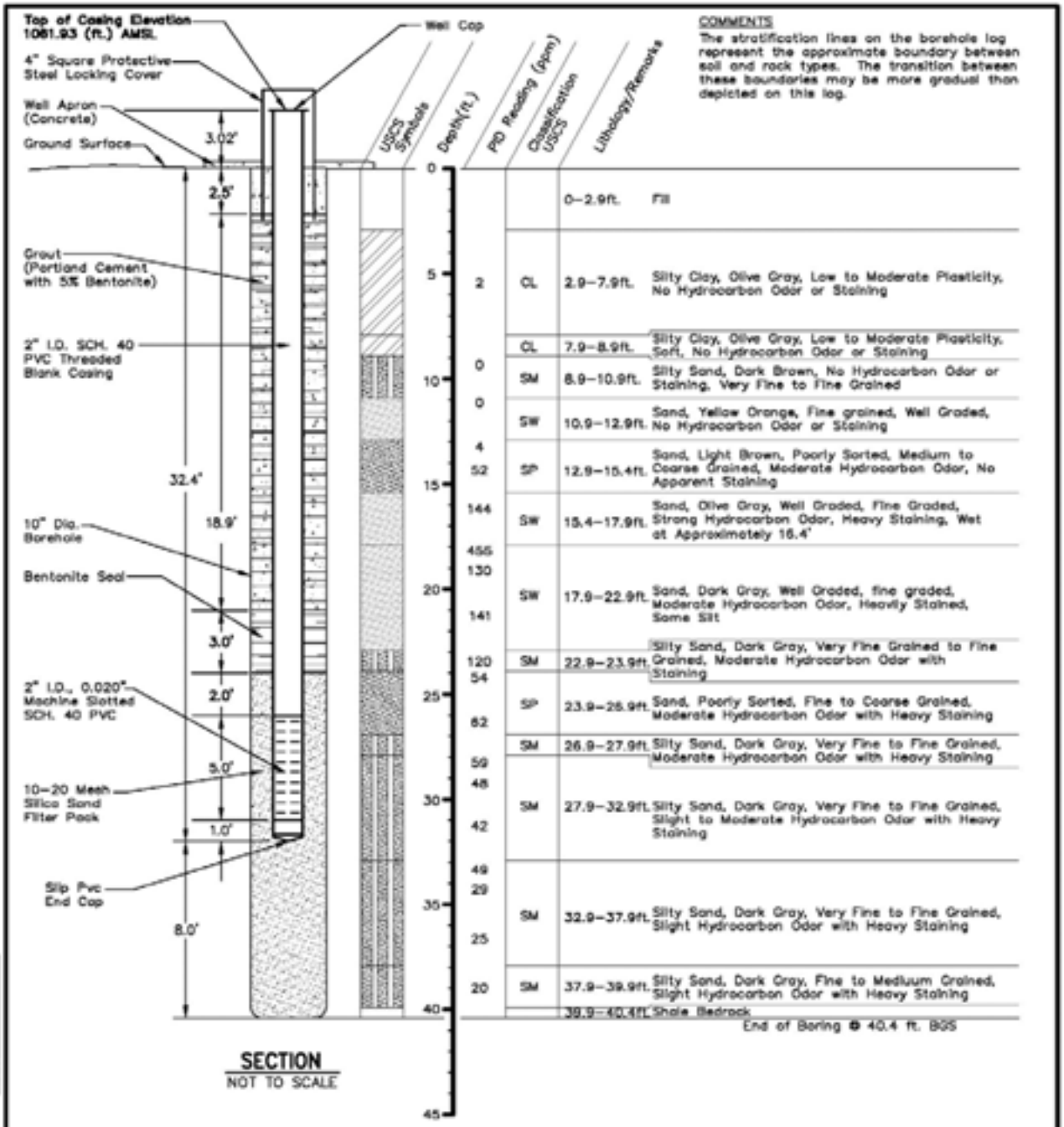
NOTE: PVC CASING CONNECTIONS ARE THREADED AND FLUSH JOINTED

MONITORING WELL
CMW-03
CONSTRUCTION DIAGRAM

PROJECT: ARKANSAS CITY, KANSAS
MICHIGAN REUTILIZATION, LLC.

MWH

Figure No.:



COMMENTS

The stratification lines on the borehole log represent the approximate boundary between soil and rock types. The transition between these boundaries may be more gradual than depicted on this log.

BUILT BY: GEOCORE SERVICES, INC.
DATE COMPLETED: 4/13/06

DATE	DRAWN BY	CHECKED BY	REVISED BY
06/06	JTW	LKD	JTW

LOCATION (Plant Coordinates)

NORTHING -1128.715 (ft.)
EASTING 2770.582 (ft.)

ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (AMSL)

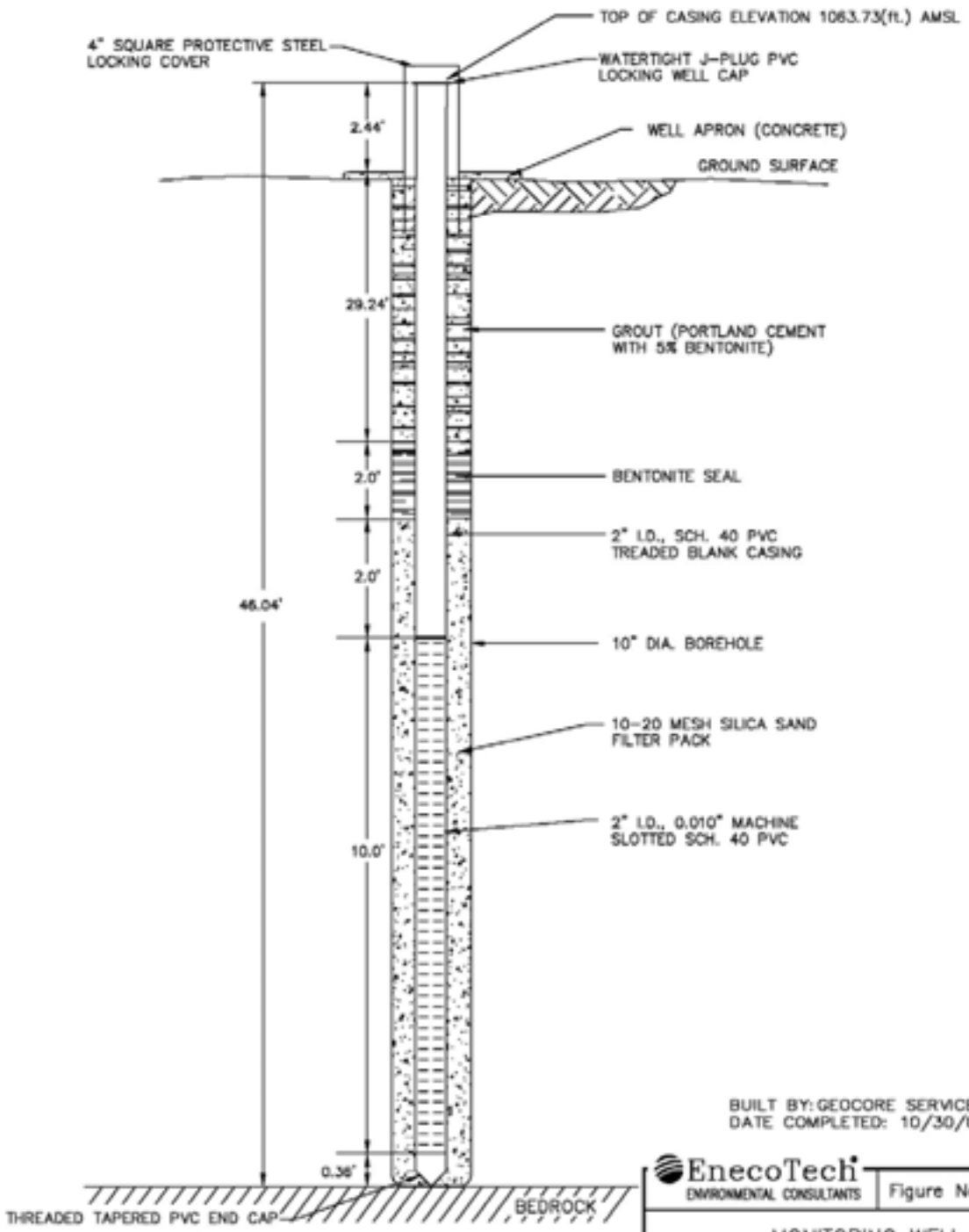
NOTE: PVC CASING CONNECTIONS ARE THREADED AND FLUSH JOINTED

MONITORING WELL
CMW-04
CONSTRUCTION DIAGRAM

PROJECT: ARKANSAS CITY, KANSAS
MICHIGAN REUTILIZATION, LLC.

MWH

Figure No.:



SECTION
NOT TO SCALE

BUILT BY: GEOCORE SERVICES, INC.
DATE COMPLETED: 10/30/01

LOCATION (Plant Coordinates)

NORTHING -647.635(ft.)
EASTING 2054.371(ft.)

ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (AMSL)

NOTE: PVC CASING CONNECTIONS ARE THREADED AND FLUSH JOINTED

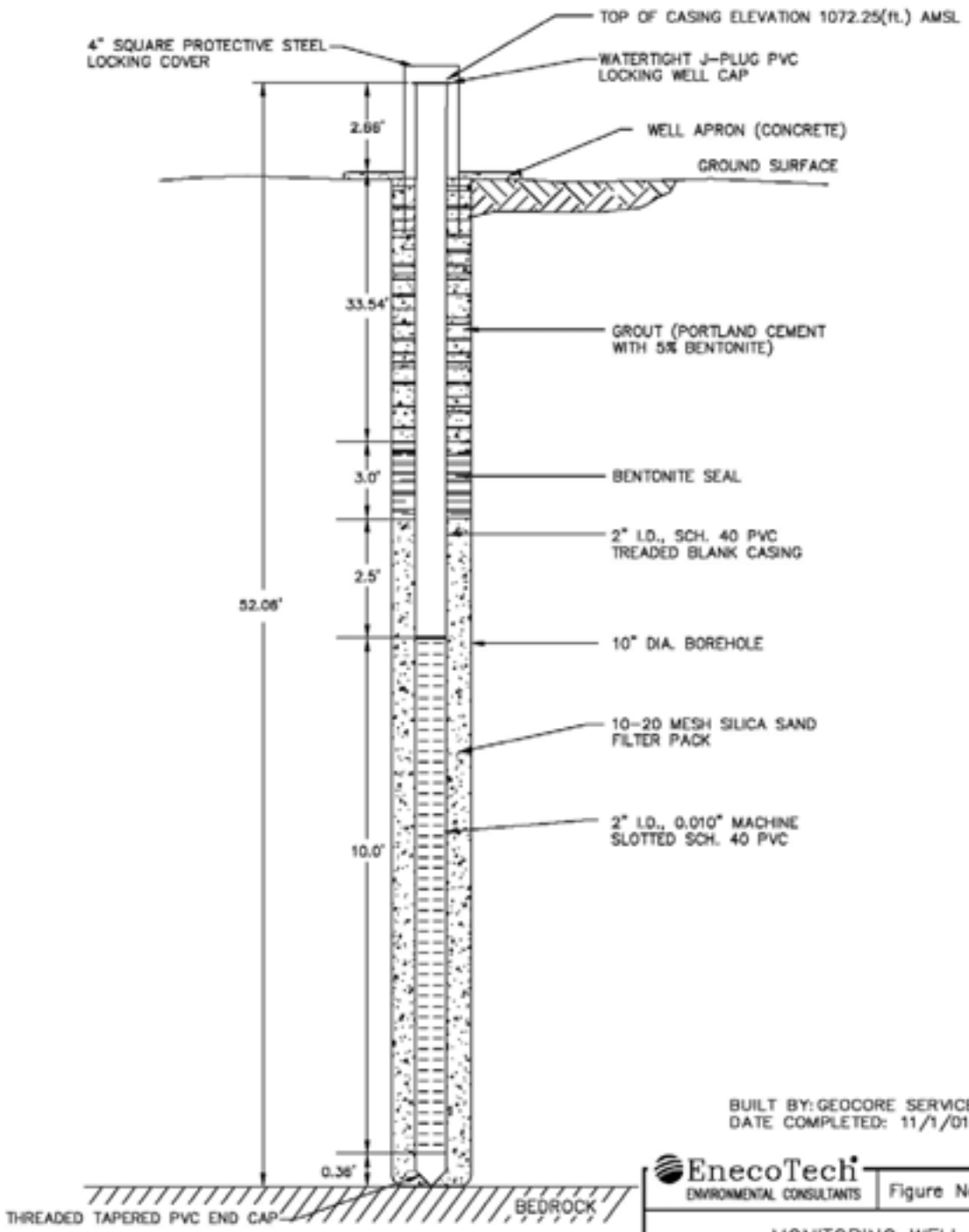
EnecoTech
ENVIRONMENTAL CONSULTANTS

Figure No.:

MONITORING WELL
RCRA-7
CONSTRUCTION DIAGRAM

PROJECT: TPI PETROLEUM INC. - ARKANSAS CITY REFINERY

1301-014	DESIGNED BY: JFW	APPROVED BY: JFW	
15-RCRA_7	DRAWN BY: LKB	DATE: 1/15/02	REV.



SECTION
NOT TO SCALE

BUILT BY: GEOCORE SERVICES, INC.
DATE COMPLETED: 11/1/01

LOCATION (Plant Coordinates)

NORTHING -770.862(ft.)
EASTING 2162.007(ft.)

ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (AMSL)

NOTE: PVC CASING CONNECTIONS ARE THREADED AND FLUSH JOINTED

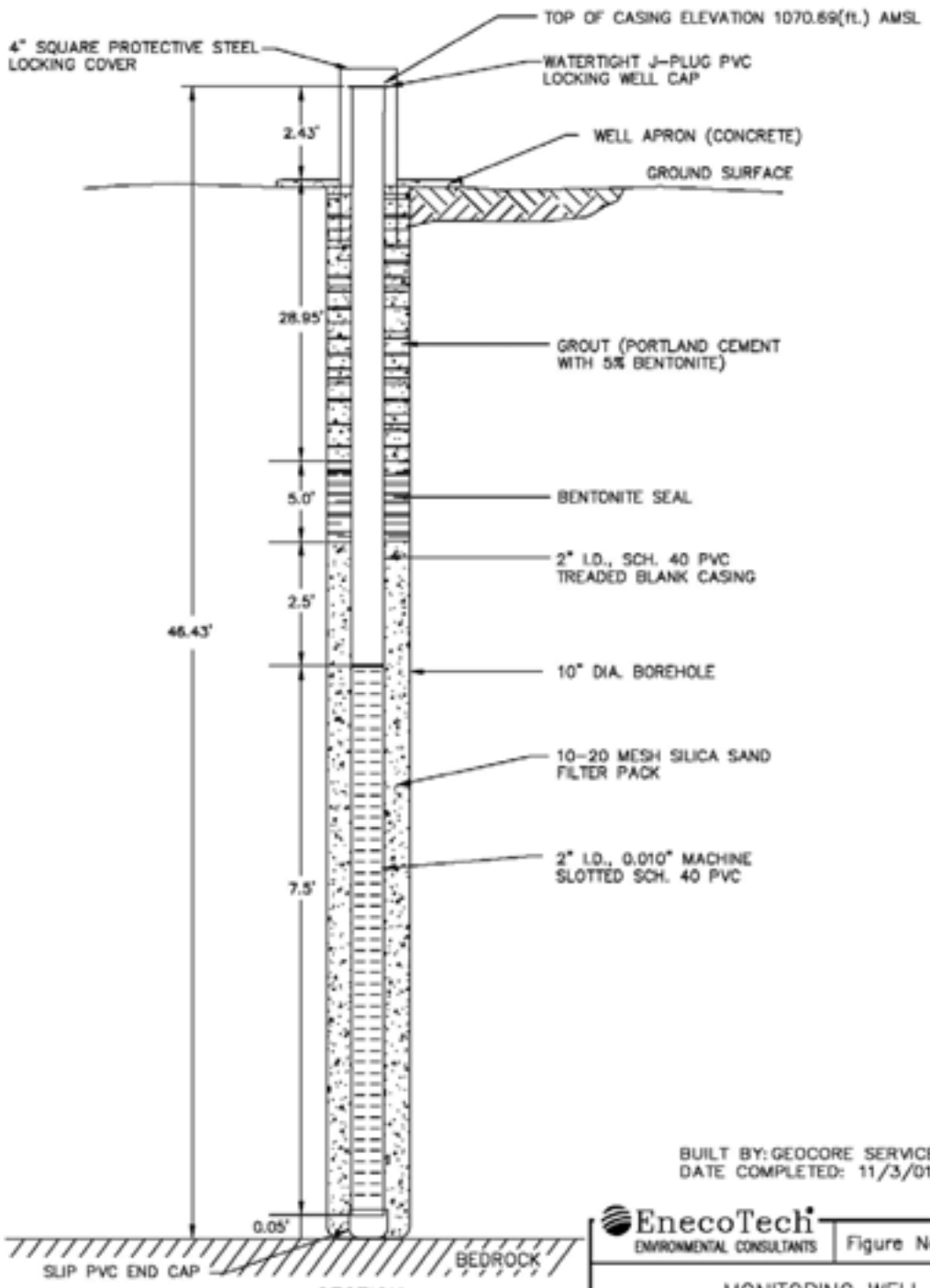
EnecoTech
ENVIRONMENTAL CONSULTANTS

Figure No.:

MONITORING WELL
113
CONSTRUCTION DIAGRAM

PROJECT: TPI PETROLEUM INC. - ARKANSAS CITY REFINERY

1301-014	DESIGNED BY: JFW	APPROVED BY: JFW	
18-113	DRAWN BY: LKB	DATE: 1/15/02	REV.



SECTION
NOT TO SCALE

BUILT BY: GEOCORE SERVICES, INC.
DATE COMPLETED: 11/3/01

LOCATION (Plant Coordinates)

NORTHING -1059.369(ft.)
EASTING 2453.611(ft.)

ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (AMSL)

NOTE: PVC CASING CONNECTIONS ARE THREADED AND FLUSH JOINTED

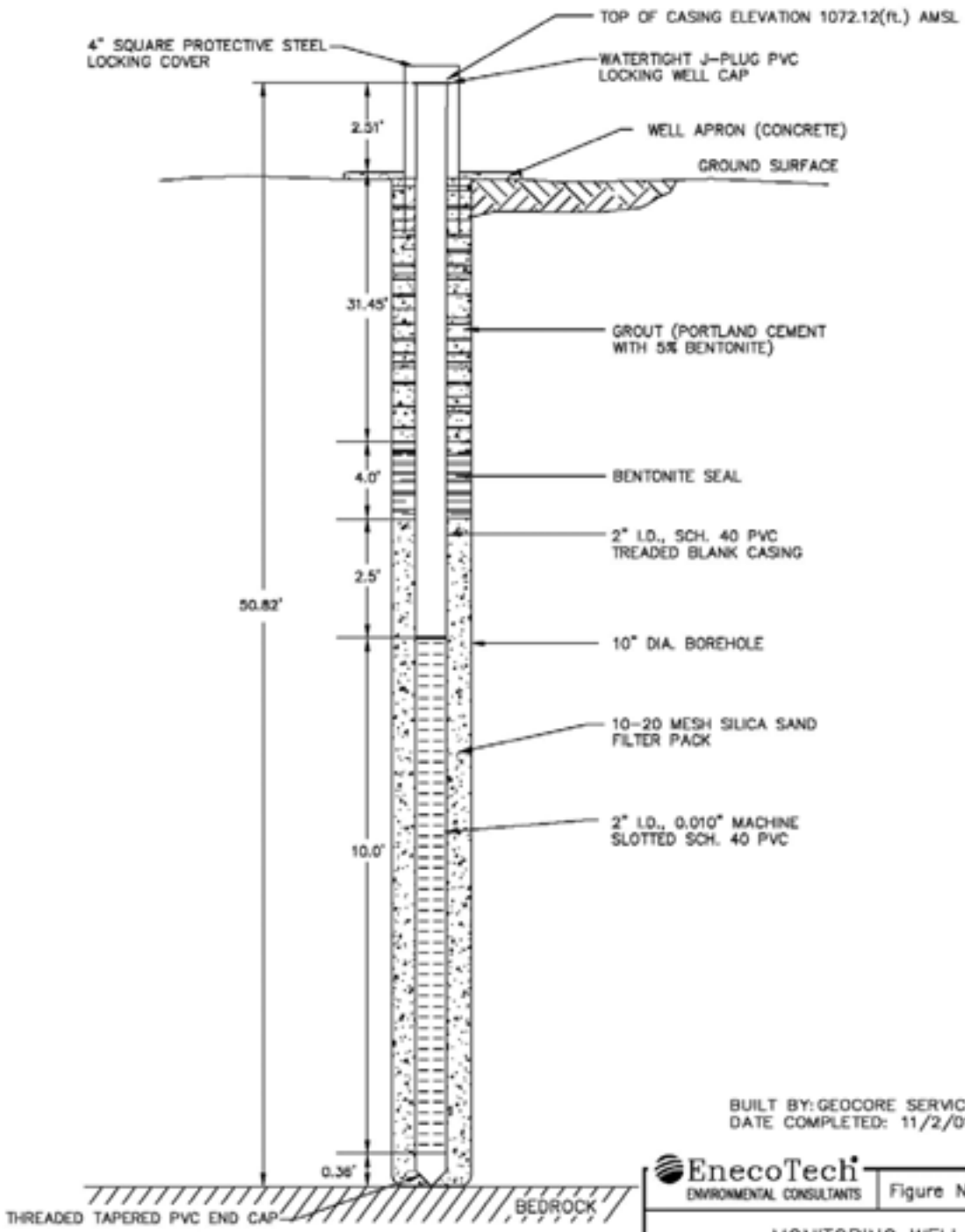
EnecoTech
ENVIRONMENTAL CONSULTANTS

Figure No.:

MONITORING WELL
118
CONSTRUCTION DIAGRAM

PROJECT: TPI PETROLEUM INC. - ARKANSAS CITY REFINERY

1001-016	DESIGNED BY: JFW	APPROVED BY: JFW	
18-118	DRAWN BY: LKB	DATE: 1/15/02	REV.



SECTION
NOT TO SCALE

BUILT BY: GEOCORE SERVICES, INC.
DATE COMPLETED: 11/2/01

LOCATION (Plant Coordinates)

NORTHING -1169.513(ft.)
EASTING 2699.092(ft.)

ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (AMSL)

NOTE: PVC CASING CONNECTIONS ARE THREADED AND FLUSH JOINTED

EnecoTech
ENVIRONMENTAL CONSULTANTS

Figure No.:

MONITORING WELL
MW-1002
CONSTRUCTION DIAGRAM

PROJECT: TPI PETROLEUM INC. - ARKANSAS CITY REFINERY

1301-014	DESIGNED BY: JFW	APPROVED BY: JFW	
15-MW_1002	DRAWN BY: LKB	DATE: 1/15/02	REV.

APPENDIX O

Threatened and Endangered Species

Updated: 2/10/10

Cowley County

Cowley County

THREATENED & ENDANGERED SPECIES

American Burying Beetle: ***Nicrophorus americanus*** **State:** END **Federal:** END **Critical Habitat:** NO

Arkansas Darter: ***Etheostoma cragini*** **State:** THR **Federal:** CAN **Critical Habitat:** YES

Arkansas River Shiner: ***Notropis girardi*** **State:** END **Federal:** THR **Critical Habitat:** YES

Arkansas River Speckled Chub: ***Macrhybopsis tetranema*** **State:** END **Federal:** NA **Critical Habitat:** YES

Bald Eagle: ***Haliaeetus leucocephalus*** **State:** THR **Federal:** THR **Critical Habitat:** YES

Eastern Spotted Skunk: ***Spilogale putorius*** **State:** THR **Federal:** NA **Critical Habitat:** NO

Eskimo Curlew: ***Numenius borealis*** **State:** END **Federal:** END **Critical Habitat:** NO

Least Tern: ***Sterna antillarum*** **State:** END **Federal:** END **Critical Habitat:** NO

Piping Plover: ***Charadrius melodus*** **State:** THR **Federal:** THR **Critical Habitat:** NO

Silver Chub: ***Macrhybopsis storeriana*** **State:** END **Federal:** NA **Critical Habitat:** YES

Snowy Plover: ***Charadrius alexandrinus*** **State:** THR **Federal:** NA **Critical Habitat:** NO

Topeka Shiner: ***Notropis topeka*** **State:** THR **Federal:** END **Critical Habitat:** NO

Whooping Crane: ***Grus americana*** **State:** END **Federal:** END **Critical Habitat:** NO

SPECIES IN NEED OF CONSERVATION

Black Tern: ***Chlidonias niger***

Bobolink: ***Dolichonyx oryzivorus***

Brindled Madtom: ***Noturus miurus***

Cerulean Warbler: ***Dendroica cerulea***

Creeper Mussel: ***Strophitus undulatus***

Curve-billed Thrasher: ***Toxostoma curvirostre***

Eastern Hognose Snake: ***Heterodon platirhinos***

Fat Mucket Mussel: ***Lampsilis radiata***

Ferruginous Hawk: ***Buteo regalis***

Golden Eagle: ***Aquila chrysaetos***

Plains Minnow: ***Hybognathus placitus***

River Shiner: ***Notropis blennius***

Short-eared Owl: ***Asio flammeus***

Spotted Sucker: ***Minytrema melanops***

Texas Mouse: ***Peromyscus attwaterii***

Wabash Pigtoe Mussel: ***Fusconaia flava***

Western Hognose Snake: ***Heterodon nasicus***

Whip-poor-will: ***Camprimulgus vociferus***

Yellow Sandshell Mussel: ***Lampsilis teres***

APPENDIX P

Groundwater Sampling and Analysis Plan

RCRA PART B PERMIT APPLICATION

APPENDIX P – GROUNDWATER SAMPLING AND ANALYSIS PLAN

MRP PROPERTIES COMPANY, LLC.

ARKANSAS CITY REFINERY

U.S. EPA ID No.: KSD 087418695

Prepared for:

MRP Properties Company, LLC.
San Antonio, Texas

Prepared by:

MWH Americas, Inc.
Denver Colorado

June 10, 2011

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- YSI 556 Multiparameter Meter

1.0 INTRODUCTION

This document describes the groundwater monitoring requirements and procedures for the waste management area (WMA) at the MRP Properties Company, LLC (MRP) site in Arkansas City Kansas (Site), during the post closure care period. The WMA encompasses the Land Treatment Unit (LTU), the No. 1 and No. 2 Closed Surface Impoundments and the Closed No. 3A Aerated Lagoon. The location of the Site is shown on Figure 1 and the WMA is shown on Figure 2.

This groundwater sampling and analysis plan (SAP) consists of two phases. The first phase is the corrective action monitoring program (CAMP), which is discussed in Section 2.0. The CAMP is designed to meet the requirements of CFR 264.100 and to verify the effectiveness of the groundwater corrective action and to monitor the progress of the cleanup effort towards achieving the groundwater protection standards in the compliance monitoring wells downgradient of the WMA. The CAMP has two elements; groundwater quality testing and groundwater capture zone monitoring. The second phase, the compliance groundwater monitoring program (CGMP), is discussed in Section 3.0 of this document. The CGMP will begin once the groundwater analysis conducted in the CAMP demonstrates the water quality within the plume meets the groundwater protection standard at the downgradient boundary of the WMA after the corrective actions have been completed. Section 4.0, describes how sampling and analysis will be conducted during the CAMP and the CGMP.

2.0 CORRECTIVE ACTION MONITORING PROGRAM

The CAMP has two elements; groundwater quality testing and groundwater capture zone monitoring. The CAMP is designed to meet the requirements of CFR 264.100 and to verify the effectiveness of the corrective action and to monitor the progress of the cleanup effort towards achieving the cleanup goals within the WMA. The water quality testing will be used to monitor the progress and effectiveness of the corrective action and the groundwater gradient monitoring will monitor the effectiveness of the recovery system to prevent releases to the Walnut River.

The corrective action groundwater quality monitoring involves the use of indicator compounds. As the corrective action nears completion, the facility may increase the number of analytical constituents tested to include the entire list of the groundwater protection standards (GWPS). Testing of the GWPS constituents will provide an indication of when the transition to groundwater compliance monitoring should be recommended.

2.1. Waste Management Area

As allowed by 40 CFR Sections 264.95(b)(2) and 264.97(b), the four regulated units have been incorporated into one WMA. The WMA is defined as the area encompassing the land treatment unit (LTU) to the southwest and the former surface impoundments #1, #2, and #3A to the northeast extending to the point of compliance near the Walnut river boundary. Figure 2 shows the location of the waste management area.

2.2. Corrective Action Monitoring Well Network

The groundwater monitoring well network is comprised of two upgradient wells, eight corrective action performance monitoring wells and two supplemental wells listed on Table 1. Table 1 also lists the eight capture zone monitoring wells. The survey data for these wells are included on Table 1. The well construction diagrams for each of the monitoring wells are included in Appendix A. Figure 2 shows the corrective action groundwater monitoring well network and the four point of compliance wells. The groundwater corrective action monitoring wells are designed to monitor groundwater quality in the uppermost (alluvial aquifer) groundwater zone upgradient, and within the waste management area.

2.3. Groundwater Quality Monitoring

Groundwater corrective action samples will be analyzed for indicator compounds (Table 2) to monitor the performance and progress of the corrective actions. Benzene, toluene, ethylbenzene and xylenes (BTEX) were selected as the indicator compounds because of their high frequency of detection, mobility in the groundwater and elevated concentrations. These indicator compounds will be analyzed in the laboratory using USEPA SW-846 Method 8260B or currently promulgated version. The corrective action wells will be monitored semiannually, generally in April or May and September or October. The water samples will be analyzed by a KDHE certified laboratory. Table 3 lists the analytical methods, sample bottle specifications, sample preservation requirements and sample holding times. Every three years, groundwater samples collected from the corrective action monitoring wells will be analyzed for the Skinner List constituents (Table 4), every six years three groundwater samples will be analyzed for the Appendix IX constituents (Table 5); the Appendix IX samples will be collected from one well containing low levels of dissolved phase constituents and two wells with moderate to high levels of dissolved phase constituents.

2.4. Groundwater Hydraulic Gradient Monitoring

The RCRA permit requires that a reverse groundwater hydraulic gradient be maintained throughout the groundwater corrective action phase. The facility will demonstrate that a reverse hydraulic gradient is maintained between the recovery wells and the Walnut River by comparing the groundwater elevations between the following capture zone monitoring well pairs: (CMW-1 and RCRA-7), (CMW-2 and 113), CMW-3 and 118), and (CMW-4 and MW-1002). This demonstration will be done quarterly in accordance with the applicable procedures contained in Sections 4.4 and 4.5 of this plan. A sample of the groundwater gradient monitoring field form is presented in Figure 6.

3.0 COMPLIANCE GROUNDWATER MONITORING PROGRAM

The CGMP will be implemented after a demonstration of compliance with the groundwater protection standard established by the permit. The objective of the compliance monitoring program will be to confirm that the groundwater at the compliance point meets the groundwater protection standard. The compliance groundwater monitoring program will include quarterly sampling of the four compliance monitoring wells and the two upgradient monitoring wells.

The groundwater samples will be collected and analyzed in accordance with the sampling and analysis procedures presented herein.

3.1. Point of Compliance [40 CFR 264.95(B)(2)]

The point of compliance is located at the northeastern boundary of the WMA, which is downgradient of the regulated units. Four monitoring wells (CMW-1 through CMW-4) define the point of compliance and were installed between the bank of the Walnut River and the ICM recovery wells. These four monitoring wells (CMW-1 through CMW-4) are shown in Figure 3.

3.2. Compliance Monitoring Well Network

The waste management area will be monitored using a monitoring well network that meets the requirements of Section 264.97(a). The compliance monitoring well network is comprised of two upgradient wells, and four point of compliance wells. The point of compliance wells define the northeastern boundary of the waste management area (located between the bank of the Walnut River and the ICM recovery wells). Six monitor wells are included in the groundwater compliance monitoring network. The groundwater compliance monitoring network is designed to monitor groundwater in the uppermost (alluvial aquifer) groundwater zone upgradient and downgradient of WMA. The locations of groundwater compliance monitoring network wells are shown on Figure 3.

The groundwater compliance monitoring wells and survey data are listed on Table 1. The well construction diagrams for each of these wells are included in Appendix A.

3.3. Groundwater Quality Monitoring

The CGMP wells will be sampled for the Shortened GWPS List constituents listed in Table 6 quarterly.

The groundwater will be analyzed for the GWPS List, Table 7, if a constituent from the Shortened GWPS exceeds the GWPS. The groundwater will be analyzed for the Appendix IX constituents (Table 5) every six years. Table 2 lists the analytical methods, sample bottle specifications, sample preservation requirements and sample holding times for the CGMP samples.

4.0 SAMPLING AND ANALYSIS PLAN [(40 CFR 264.97 (d)]

This section of the plan describes the sampling and analysis procedures. Specifications of the field instruments described in this section are included in Appendix B. Functionally equivalent field instruments may be substituted for those described in Appendix B.

4.1. Pre-Sampling Procedures

The condition of the monitoring wells will be inspected prior to sampling. The condition of the well apron, protective outer casing and inner well casing, locking mechanism, well ID and measuring point mark will be observed and reported on the groundwater sampling form. An example groundwater sampling form is provided on Figure 4.

4.2. Well Maintenance

The total depth of the groundwater monitoring wells will be measured once a year to determine if sediment has accumulated within the well screen interval. Accumulations of sediment that obstruct more than 10 percent of the screened interval will be removed by redeveloping the monitoring well. The redevelopment procedure will be performed by either bailing, surging with a surge block or pumping with a submersible pump as necessary. All well development equipment that is placed inside the monitoring well will be thoroughly decontaminated with a solution of non-phosphate detergent such as Alconox and thoroughly rinsed with potable water. The spent decontamination solution will be managed in the waste water treatment system. The monitoring wells will not be sampled within 48-hours of the well redevelopment.

All repairs to the well head will be completed within 30 days. These repairs will include replacement of well locks, repairs to the cement well apron if cracked and repairs to the well casings if damaged. If additional time is required to complete repairs, notification will be provided to KDHE. A discussion of well maintenance activities will be included in the Annual Groundwater Monitoring Report.

4.3. Maintenance of the Benchmark and Well Elevation Surveys

Two benchmarks have been established on the east side of the closed No. 3A Aerated Lagoon. The

surveying of the monitoring wells and benchmarks will be performed by a land surveyor registered by the State of Kansas. The benchmark elevation and the monitoring well casing elevations will be verified every three years starting in 2013. If the well inspection indicates the well casing has been damaged and the top of casing elevation has changed, then the well will be resurveyed once the repairs have been made.

4.4. Fluid Level Measurements

Prior to initiating groundwater-sampling activities, the fluid levels (groundwater and free product) will be measured at each well using an oil/water interface probe. Fluid level measurements will be taken from the surveyed measuring point at the top of the well casing. The fluid levels will be measured with an accuracy of 0.01 feet. The interface probe is graduated in continuous increments of 0.01 feet. The fluid levels for the entire monitoring network will be measured within a single 24-hour interval.

The following describes the methods by which the fluid level data will be acquired:

- Upon arrival at the first well on the schedule, the date, time, ambient temperature, general weather conditions, and individuals present at the sampling event, including team members and any observers will be logged.
- After entering the general information, the condition of the well will be documented, including whether or not the lock was in place, and evidence of tampering, if there is any water standing near the well, and the condition of the apron.
- The sampling personnel will use clean disposable gloves during the fluid level monitoring. New clean gloves will be used if it is necessary to handle a dedicated groundwater sampling pump.
- The protective casing cap will be removed from the well and placed on a clean surface.
- Fluid levels will be measured from the surveyed reference point. The elevation of the reference point has been established relative to mean sea level.
- The sampler's name, date, and time of measurement will be recorded in the field logbook or monitoring form.
- The depth to the top of free product, if present, will be measured to the nearest 0.01 foot and recorded using an oil/water interface probe.

- The depth to the top of free product, if present, and the top of the water to the nearest 0.01 foot will be measured using the oil/water interface probe and recorded on the field sampling form.

- The total depth of the well will be measured using the oil/water interface probe annually. This measurement will determine: whether a dense non-aqueous phase liquid is present at the bottom of the well; the height of the water column, to be used in purge volume calculations; and the amount of any sediment accumulation in the well. If necessary, the dedicated pump will be removed to obtain a total depth measurement of the monitoring well. Clean plastic sheeting will be placed on the ground next to the monitoring well. Using clean disposable gloves, the first person will start pulling out the dedicated pump while the second person carefully coils the hose on the plastic sheeting until the pump is removed from the monitoring well. After the total depth measurement is completed, the pump will be lowered back into the monitoring well. The pump and hose will be wiped down with clean lint free paper towels as it is lowered into the monitoring well.

- After the measurement is complete, the field personnel will check the well ID and measuring point reference marks are clearly labeled. If the marks are faded, they will be remarked.

4.5. Decontamination of Oil/Water Interface Probe

The interface probe and attached calibrated tape will require decontamination prior to measuring each monitoring well. Procedures to decontaminate interface probe and calibrated tape follow:

- Rinse nitrile or latex gloves between wells and change gloves as necessary
- If free product is present, saturate a clean, lint free paper towel with, methanol (reagent grade); if necessary, on one half and distilled water on the other half. Spray the interface probe lense with distilled or deionized water. If no product is present use Liquinox solution in lieu of the methanol and wipe with distilled or deionized water
- Place the decontaminated interface probe in a clean container.
- Properly dispose of all used gloves and paper towels.

4.6. Calibration of Meters for Monitoring Field Parameters

Water temperature, pH, specific conductance (SC), oxidation-reduction potential (ORP), dissolved oxygen (DO), and turbidity will be monitored during purging. The facility will utilize a multi-parameter

meter such as a YSI 556 MPS or equivalent, equipped with a flow-through cell to measure the water quality indicator parameters temperature, pH, SC, ORP, and DO. During groundwater purging, the discharge tubing from the bladder pump will be connected to the flow-through cell for direct measurement with the YSI 556 MPS meter probes.

The facility will utilize a meter such as a Hach 2100P, or equivalent, to measure water turbidity. A fraction of the water will be put into the turbidity meter sample cell and placed in the turbidity meter for direct readings. Accurate turbidity measurements will be obtained by using clean sample cells and by removing any air bubbles. The sample cells should be free of minor scratches and be cleaned by washing inside and outside with a laboratory detergent (Alconox brand or equivalent). This will be followed by three rinses of distilled water, and then the sample cells will be allowed to air dry. Handling of the cells will be conducted by holding the top of the sample cells to minimize dirt, scratches, and fingerprints in the light path. A clean lint free paper towel will be used to hold the sample cell while putting the cap on. This procedure will be practiced between each monitoring well.

The multi-parameter meter and the turbidimeter will be calibrated according to the manufacturer's recommendations. Appendix B contains the manual for the YSI 556 multi-parameter field meter and the manual for the Hach 2100P turbidimeter. Information and any comments regarding calibration will be recorded on the groundwater sampling form or in the field log book. A calibration log will be kept for each sampling event. Calibration will be done before the start of each workday depending on manufacturer's specifications and whenever equipment drift is suspected. Calibration standards will not be used beyond the date specified by the manufacturer. The multi-parameter meter probes will be rinsed with deionized water between calibration steps to prevent cross-contamination of calibration standards.

pH Meter Calibration

A 3-point calibration, using pH 4.0, 7.0, and 10.0 standards of buffered solution ("buffers"), will be performed for the pH probe. The expiration dates on the calibration standards bottle labels will be checked to ensure that the standards are still viable. For each pH standard, the pH probe will be rinsed with deionized water, dried, and placed in the pH standard. Calibration of the meter will follow the manufacturer guidelines. Appendix B contains the manual for the YSI 556 MPS multi-parameter meter, which includes guidelines for the calibration of the pH probe.

Specific Conductance Meter Calibration

Specific conductance is measured in microsiemens-per-centimeter (µS/cm) corrected to 25°C. The

specific conductance probe will be calibrated with a single standard, closest to the expected conductivity of the groundwater. The expiration date on the calibration standard bottle label will be checked to ensure that the standard is still viable. The conductivity probe will be rinsed with deionized water, dried, and placed in the conductivity standard. Calibration of the meter will follow the manufacturer guidelines. Appendix B contains the manual for the YSI 556 MPS multi-parameter meter, which includes guidelines for the calibration of the specific conductance probe.

Oxidation-Reduction Potential Meter Calibration

Oxidation-Reduction Potential (ORP) is measured in millivolts (mV). The ORP probe will be calibrated with a single standard; a typical ORP standard would have an absolute value of 220 mV at 25°C. The ORP probe will be rinsed with deionized water, dried, and placed in the ORP standard. Calibration of the meter will follow the manufacturer guidelines. Appendix B contains the manual for the YSI 556 MPS multi-parameter meter, which includes guidelines for the calibration of the ORP probe.

Dissolved Oxygen Meter Calibration

The dissolved oxygen concentration of water samples will be recorded in milligrams per liter (mg/L). DO meters require calibration to barometric pressure. At the time of calibration, the current barometric pressure will be obtained and the value will be entered in the logging device according to the manufacturer's specifications. If the YSI 556 MPS multi-parameter probe, or equivalent, features a barometer, then the meter will automatically provide the current barometric pressure. The DO meter probe will be calibrated in percent saturation (water saturated air) mode, following the manufacturer guidelines. Appendix B contains the manual for the YSI 556 MPS multi-parameter meter, which includes guidelines for the calibration of the DO probe.

Turbidity Meter Calibration

Turbidity will be measured in Nephelometric Turbidity Units (NTU). The primary standard for the turbidity meter calibration is based on formazin. The turbidity meter's electronic and optical design provide long-term stability and minimize the need for frequent calibration. Calibration of the meter will follow the manufacturer guidelines. Appendix B contains the manual for the Hach 2100P turbidimeter.

4.7. Monitor Well Sampling Order

The monitoring wells will be sampled with dedicated sampling devices. Consequently, the monitoring well sampling order can be varied. If non-dedicated equipment is used to purge and sample the wells, then the monitoring wells will be sampled according to the sequence below to reduce the possibility of cross-contamination:

CAMP Well Sampling Order	**CGMP Well Sampling Order**
WN-1A, WN-1B, then	WN-1A, then
WN-6A, MW-12, MW-13, MW-6 and RCRA-4, then	WN-1B, then
WN-5B, WN-6B, MW-17, WN-7B and WN-8B.	CMW-1, CMW-2, CMW-3 and CMW-4

The on-site sampling team may vary the sampling order if required by other site activities.

4.8. Monitoring Well Groundwater Sampling and Equipment

Groundwater samples will be collected from the monitoring wells using the low-flow sampling procedure in accordance with the guidelines of ASTM standard D 6771-02. The objective of low-flow sampling is to minimize the velocity/stress on the sample water as it exits the formation into the screened interval of the well and as it enters the pump. Water sampled using the low-flow technique is produced from the screened interval without disturbing stagnant water in the well casing. By using low flow rates (typically between 100 and 1,000 milliliters per minute (mL/min)) to stabilize drawdown at less than the goal of 0.33 feet, only screened interval water will be sampled. Depth to water measurements will be recorded during pumping to verify that less than 0.33 feet of drawdown has occurred. In those cases where drawdown is observed to be greater than the criterion, the drawdown will be reduced by decreasing the pumping rate.

The groundwater purging and sample collection will be accomplished using pneumatic bladder pumps unless low yielding well conditions are encountered. Procedures for sampling low yielding wells are discussed later in this section. Bladder pumps have been installed in each of the corrective action monitoring wells; however, it may be necessary to sample with non-dedicated pumps if the dedicated

equipment is in operable or the facility decides to sample with non-dedicated sampling pumps. In either case, the polyethylene discharge tubing will be dedicated to each well to prevent cross-contamination of groundwater samples. A pneumatic flow controller and compressed nitrogen gas (if necessary, compressed air may be substituted for nitrogen) will be used to operate the bladder pump.

In the event a bladder pump malfunctions during a sampling event, a disposable polyethylene bailer will be substituted until the necessary repairs can be made to the bladder pump. The bailer will only be used one time to purge and sample the well. Polypropylene rope will be used to lower and raise the bailer in the well. New rope will be used at each well. The rope will be placed on a clean surface and not laid on the ground during well purging and sample collection.

The bladder pumps selected for use at this facility are equipped with the water intake at the bottom of the pump. If there is insufficient volume of water in the well (low water level conditions) or the pump is malfunctioning, then a disposable bailer will be used to purge and sample the well as described above.

The following procedures will be used while performing low-flow purging and sampling:

Before initiating purging, the oil-water interface probe will be placed down to the static water level and the depth to groundwater will be recorded in feet below top of casing (btoc). The interface probe will be set at 0.33 feet below static water level to monitor drawdown during purging. With the interface probe in "ON" position, audible beeping of the meter will indicate that drawdown is less than or equal to 0.33 feet. Groundwater purging will be initiated at a rate between 100 mL/min and 500 mL/min (determined using a volume graduated container), making sure to minimize drawdown to less than 0.33 feet. The purge rate will be adjusted as necessary to balance the low purge rate and water level drawdown.

The minimum volume to be purged from the well between stabilization parameter measurements is one times the total volume of the sampling system (bladder pump and discharge tubing volume plus the flow-through cell volume). During purging, the following groundwater stabilization parameters will be measured: specific conductance, pH, temperature ORP, DO, and turbidity. The turbidity measurements will not be used to demonstrate stabilization. The parameters will be considered stable when three consecutive readings, collected at intervals of at least the time to evacuate one volume of the sampling system (volume [mL] divided by flow rate [mL/min]), are within:

Specific Conductance	±10% of reading
pH	±0.2 pH units
Temperature	±1 degree Celsius

Dissolved Oxygen	±10% of reading or ±0.2 mg/L, whichever is greater
ORP	±20 millivolts
Turbidity	<10 NTU (see note below)

However, if the turbidity is not less than 10 NTU, and all other parameters are stable, the samples will be collected.

Once the parameters have stabilized, the flow-through cell will be disconnected and the water samples will be collected at the same flow rate directly out of the discharge tubing. Water samples will be collected in order of the sample volatilization potential. The groundwater level will continue to be monitored during sample collection to prevent drawdown greater than 0.33 feet.

Other supplies that will be used during the sampling event include:

Field log book, groundwater sampling forms, chain-of-custody forms, disposable gloves, paper towels, trash bags, several five gallon containers for decontamination of equipment and volume graduated container for calculating flow rates, spray bottle for decontamination (e.g., Alconox), sample containers, ice chests, ice, shipping labels (Federal Express, UPS as necessary etc.), tape to secure ice chests, packing material for sample containers, distilled or deionized water, potable water, plastic sheeting, polypropylene rope, polyethylene bailers, spare tubing for bladder pumps, bladder pump flow controller, compressed nitrogen gas bottles, container for purge water, field instruments (pH, temperature, specific conductance, ORP, DO, turbidity, interface probe) and pH buffers (4.0, 7.0, 10.0), conductivity meter calibration standard, ORP meter calibration standard, spare batteries for field instruments, keys for wells, and miscellaneous tools. Safety equipment including glasses, nitrile gloves, and goggles.

4.9. Groundwater Sample Collection

The monitoring wells will be purged and sampled with either a disposable bailer or a bladder pump. In both cases precautions will be taken to prevent agitating the water in the well to avoid volatilizing dissolved constituents or creating turbid water samples.

For monitoring wells sampled using a bladder pump and the low-flow purging technique, the water samples will be collected from the bladder pump discharge tubing, operating the bladder pump at the same flow rate as used for low-flow purging.

Sampling a well with a bailer will involve lowering the bailer slowly and gently until it is submerged and

in the middle of the well screen. To avoid stirring up any sediment, the bailer will not be lowered to the bottom of the well. The bailer will be carefully raised out of the water column to the surface. Care will be taken to not bang the bailer against the side of the well. A bottom emptying device will be used to collect the water samples from the bailer.

The following groundwater sampling procedures are to be followed to facilitate the collection of representative groundwater samples:

- Prior to sampling, ice will be placed in the sample coolers to avoid temperature fluctuations while in the field.
- Equipment calibration information will be written in the field logbook.
- Purge water will be managed in the wastewater treatment system.
- Collect the groundwater sample directly from the pump discharge line before the flow-through cell.
- Collect and containerize samples in order of the parameter's volatilization sensitivity (i.e., VOCs, then SVOCs, and lastly, metals).
- Pour groundwater into VOC sample vials and minimize introduction of air bubbles.
- Invert and tap VOC vials gently on a gloved hand to check for air bubbles. If a headspace is detected in the sample container, discard the sample, and then refill, add additional HCl preservative as necessary.
- Store samples with ice in an ice chest pending delivery to the laboratory.

In addition to these pertinent sampling procedures, a special procedure will be followed for low yielding wells (a well that is incapable of sampling with a bladder pump). This sampling procedure includes the following tasks:

- Measure pH, temperature, specific conductance and turbidity of the purge water from the well;
- Purge the well until it is dry;
- Monitor and record the volume of water purged from the well;

- Collect the sample after it has sufficiently recharged; and,
- Measure and record the temperature, pH, specific conductance, ORP, DO, and turbidity of the groundwater after the sample is collected to check the stability of the groundwater between purging and sampling.

After all samples have been taken, the well will be secured by replacing the casing cap and protective cap. Make sure any protective covers or caps have been put in place and secured. Before moving on to the next well, make sure well identification number and static water level measurement points are clearly marked on the well casing.

4.10. Bioreactor Influent Sampling

Groundwater from the recovery wells is pumped into the bioreactor for treatment. The bioreactor influent water stream will be sampled quarterly. The bioreactor influent samples will be collected from each inlet pipe in service at the time of sampling. The water sample(s) will be collected directly from sample ports installed on each inlet pipe. The sample containers will be filled directly from the sample ports. Field measurements of pH, temperature, specific conductance, ORP, DO, and turbidity will be measured at the time the sample(s) are collected. The groundwater flow rate measured at the bioreactor flow meter(s) at the time of sample collection will be recorded. The field measurements will be recorded in a field book or on a bioreactor influent sampling form (Figure 5). The samples will be managed under the same chain-of-custody protocols specified for the groundwater samples. The samples will be tested for the indicator parameters; benzene, toluene, ethylbenzene and total xylenes (Table 2) using USEPA SW-846 Method 8260B or current method.

4.11. Sample Preservation and Shipping

All groundwater samples will be placed into the appropriate container and preserved as shown on Table 2. After collection of groundwater samples, the sample containers will be packed into coolers filled with ice to maintain an approximate sample temperature of 4° C ± 2° C. A temperature blank will be placed in each shipping container. The ice will be of sufficient volume and will be distributed in the coolers so that proper storage temperature will be maintained until the samples reach the laboratory. Upon reaching the laboratory the temperature of each cooler of samples will be measured and recorded on the laboratory sample login form.

Sample bottles will be suitably packed to avoid breakage. After packing, the coolers will be taped shut and sealed for shipment with reinforced packing tape to indicate unauthorized opening of the cooler.

Sample will be shipped to the laboratory by groundwater samplers, or by facility employees using commercial carriers such as Federal Express and United Parcel Service etc. or hand delivered directly to the laboratory maintaining chain-of-custody procedures throughout shipment.

4.12 Analytical Methods [40 CFR 264.100(a)(1)]

Parameters to be monitored are discussed in Sections 2 and 3. The groundwater samples will be analyzed using USEPA SW-846 methods. The parameters and method numbers are summarized on Table 3. Sample dilution will be performed as necessary to bring an elevated compound into the instrument's calibration range.

4.13 Quality Assurance/Quality Control Samples [40 CFR 264.97(d)]

The samples described in the following sections will be collected to document the accuracy and precision of the sampling.

4.13.1 Field Quality Assurance/Quality Control

Field QC samples will be collected to ensure the quality of sample collection, shipping and storage. Field QC samples will be documented in field logbooks and submitted to the laboratory.

One VOC trip blank will be provided in each sample cooler containing water samples selected for VOC analysis. A trip blank is a sample of organic-free water that is placed in the sample bottle in an uncontaminated area in the laboratory prior to going to the field. These samples will be used to detect potential contamination or cross contamination during handling and transportation. The trip blanks will only be analyzed for VOCs by EPA SW-846 Method 8260B and are subjected to the same handling as other samples.

Field blanks will be collected at a frequency of one for every 20 samples collected during each groundwater sampling event; field blanks will not be collected when only bioreactor influent samples are collected. These samples consist of sample bottles that are filled with reagent grade water provided by the laboratory at the sample collection site. These samples will be used to evaluate potential

contamination from sample containers and airborne contaminants. The field blanks will only be analyzed for VOCs by EPA SW-846 Method 8260B.

Field duplicates will be collected for 5 percent of the samples (1 per 20 samples) collected during each groundwater sampling event. These samples will document field-sampling precision, including variability associated with both the laboratory analysis and the sample collection process. The field duplicate samples are collected simultaneously or in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis. Field duplicate samples will be collected from wells containing moderate levels of dissolved phase constituents. In the event that any selected well(s) are found to be low yielding or dry, an alternative well(s) will be chosen. Field duplicates will be analyzed for the same constituents as groundwater samples, identified on the chain-of-custody form and the container label with a unique sample name and submitted to the laboratory as a blind duplicate sample. Field duplicates will not be collected during the bioreactor influent sampling.

Rinseate blanks will not be required during a sampling event unless non-dedicated sampling equipment is used on more than two monitoring wells. If non-dedicated sampling equipment is used, the equipment rinseate blanks will be collected at a frequency of 1 to 20 samples. Rinseate blanks will be analyzed for the same constituents as groundwater samples.

4.13.2 Laboratory Quality Assurance/Quality Control

Laboratory quality assurance and quality control is presented in the Quality Assurance Project Plan (QAPP) approved by KDHE (October 2010).

4.14 Data Assessment/Evaluation

When reporting the sample data, the laboratory is required to provide the results of associated QC sample analyses so the project staff can evaluate the performance of the analytical process. Problems with analytical data can occur in spite of all precautions taken in planning and execution of the sampling and analysis plan. In these cases, the data assessment will identify the problem, determine which data are affected, state how these data may be affected, state how these data may be limited for use in the intended application, and make recommendations for corrective actions as necessary. After the data have been reported, it is necessary to identify any part of the process that could not be controlled, and to what extent that may affect the quality of the reported data. A discussion of data assessment will be provided that pertains to the post-closure-related evaluation of data that is performed <u>after</u> data have been reported by

the laboratory and laboratory analyses have been completed.

4.14.1 Corrective Action Monitoring Data Evaluation

The groundwater analytical results from the individual monitoring wells will be statistically analyzed with trend analyses. The indicator compound concentrations will be plotted on time-concentration graphs to monitor trends in the water quality.

4.14.2 Compliance Groundwater Monitoring Data Evaluation

At the time compliance monitoring is implemented, the primary test for the compliance monitoring data will be a comparison of the analytical results with the GWPS following each sampling event. If there is an exceedance of the GWPS, then the results will be statistically compared to the groundwater quality data collected during the previous sampling events to determine whether there is a statistically significant evidence of an exceedance as described below. The facility will also resample the well exhibiting the GWPS exceedance and test the well for the GWPS constituents (Table 7) to confirm the exceedance. If the GWPS exceedance occurs within the first two years of the compliance monitoring period, then the compliance monitoring data will be statistically analyzed using the monitoring data supplemented from the data collected during the final three years of quarterly groundwater monitoring at the end of the corrective action program. The statistical test method will be consistent with the requirements of 40 CFR Section 264.97 (h). The facility will, depending upon the situation, implement corrective action within 90 days, submit a report which demonstrates that a source other than the regulated unit caused the exceedance, or submit a request for a permit modification to make appropriate changes to the compliance monitoring program.

4.15 Groundwater Sampling Data Management [40 CFR 264.97(d)]

The following section describes the data management process associated with the groundwater sampling.

4.15.1 Field Logbooks, Groundwater Sampling Form and Sample Container Labels

Sampling personnel will record and retain pertinent data in a field logbook and the groundwater sampling form. An example groundwater sampling form is presented on Figure 4 and an example bioreactor influent sampling form is presented on Figure 5. The facility may replace these forms with forms with

equivalent information. Information to be included in the field logbook and sampling form includes:

- Sample description (e.g. groundwater);
- Sampler's identity - chain-of-custody should be maintained; each time transfer of a sample occurs, a record including signatures of parties involved in transfer should be made;
- Time and date of sampling;
- Significant weather conditions;
- Pertinent well data (e.g. depth to water surface);
- Sampling method (e.g. bailer, bladder pump etc.);
- Preservatives (e.g. H_2SO_4, HC1, NaOH or thermal);
- Sample containers (e.g. type, size, and number);
- Appearance of sample (e.g. color, turbidity, sediment, oil on surface, etc.);
- Name and location of laboratory performing analysis;
- Sample temperature upon sampling;
- Analytical determinations performed in the field at the time of sampling and results obtained (e.g., pH, temperature, specific conductance, ORP, DO, turbidity, etc.);
- In the field logbook, identify the cooler(s) in which the sample was shipped and shipping date; and,
- The field logbook should contain notes of deviation from the approved sampling plan, any unusual occurrences in the field, and actions taken during the event.

A label will be attached to each sample bottle. The labels will contain the following information:

- Sample identification
- Sample description
- Analyte fraction (s) (e.g. metals, VOCs, SVOCs, etc.)
- Date and time of sampling
- Preservative used, and
- Samplers' initials.

4.15.2 Chain-of-Custody Procedures

A chain-of-custody record will accompany sample shipments. Chain-of-custody information includes sample location, identity of sampler(s), sample identification, date, type (grab or composite), number of

samples, required analysis, and signatures of the person relinquishing the samples for shipment, and the person receiving the samples at the contact laboratory. An example chain-of-custody form is found on Figure 7.

4.16 Personal Protection Equipment (PPE)

Personal protection equipment will be consistent with the requirements in the site health and safety plan (MWH, 2010).

TABLES

Table 1 Groundwater Monitoring Well Completion Data
MRP Properties Company, LLC - Arkansas City, Kansas

Identification		Survey Data*			Well Completion							
Well ID	Compliance Well Association	Measuring Point. Elev (feet amsl)	Northing (feet)	Easting (feet)	Well Depth (feet btoc)	Screened Interval (feet bgs)	Pump Intake[1] (feet bgs)	Pump Type[2]	Casing DIA. (inch)	Alluvial Zone Monitored	Location	Avg. Depth to Water (feet bgs)
WN-1A	Background	1066.37	-2594.42	1161.17	44.42	30-45	37	B	2	Deep	Upgradient of LTU	15.12
WN-1B	Background	1066.39	-2589.15	1164.46	31.14	13-28	21	B	2	Shallow	Upgradient of LTU	15.32
WN-5B	CAP	1064.69	-2257.63	1428.19	27.04	11.6 -26.0	19	B	2	Shallow	Downgradient of LTU	13.74
WN-6A	CAP	1065.10	-1892.44	1417.60	44.93	29-44	37	B	2	Deep	Downgradient of LTU	13.86
WN-6B	CAP	1064.41	-1893.16	1425.30	29.95	13-28	21	B	2	Shallow	Downgradient of LTU	13.96
WN-7B	CAP	1064.76	-2252.46	1015.28	32.52	16-31	24	B	2	Shallow	Upgradient of LTU	12.61
WN-8B	CAP	1064.43	-1980.97	1029.39	32.53	15-30	23	B	2	Shallow	Crossgradient of LTU	12.68
MW-6	CAP	1062.28	-1303.38	1878.81	25.14	0.76-20.36	18	R	2	Shallow	Upgradient of CSI	13.69
MW-13	CAP	1062.90	-1310.79	1891.13	37.90	25-34.76	30	B	2	Deep	Upgradient of CSI	16.50
MW-17	CAP	1065.33	-1861.38	1172.48	34.90	4.05-31.55	25	B	2	Shallow	Downgradient of LTU	13.59
MW-12	SUPP	1071.79	-879.36	2211.01	48.77	35-44.73	40	B	2	Deep	Downgradient of CSI	26.13
RCRA-4	SUPP	1061.20	-1593.58	3414.62	24.23	6.5-21.5	18	B	4	Shallow	Down/Crossgradient	13.42
CMW-01	CPZ	1059.71	-574.50	2188.97	31.44	23-28	26[3]	R	2	Shallow	Downgradient of WMA	14.11
CMW-02	CPZ	1061.75	-704.03	2279.58	35.15	26.5-31.5	30[3]	R	2	Shallow	Downgradient of WMA	16.14
CMW-03	CPZ	1061.47	-963.38	2595.68	33.84	25-30	28[3]	R	2	Shallow	Downgradient of WMA	14.92
CMW-04	CPZ	1061.93	-1128.71	2770.58	35.42	26.4-31.4	26.5[3]	R	2	Shallow	Downgradient of WMA	13.28
RCRA-7	CPZ	1063.72	-647.73	2054.45	46.04	33.0-43.0	NA	B	2	Shallow	Downgradient of WMA	19.86
113	CPZ	1072.23	-770.86	2162.00	52.06	38.8-48.8	NA	B	2	Shallow	Downgradient of WMA	29.81
118	CPZ	1070.70	-1059.31	2453.93	46.43	36.2-43.7	NA	B	2	Shallow	Downgradient of WMA	29.27
MW-1002	CPZ	1072.11	-1169.29	2699.25	50.82	37.7-47.7	NA	B	2	Shallow	Downgradient of WMA	17.99

Notes:

Well coordinates are based on the plant coordinate system.
Average depth to groundwater is based on measurements between June 1999 and May 2000 inclusive. MW-17 data based on measurements between February 2002 and July 2003.
Monitor well 118 data based on measurements between December 2001 and September 2003.
LTU = land treatment unit
CSI = closed surface impoundments
WMA = waste management area
CAP = corrective action performance monitoring wells
SUPP = supplemental information wells
CPZ = capture zone monitoring wells

* Background, CAP, SUPP, and CPZ wells were surveyed April 23, 2010 by Smith & Oakes, Inc. of Arkansas City, KS
AMSL = above mean sea level
BTOC = below top of casing
BGS = below ground surface
NA = not available - new well with insufficient data or no pump.
1 = Pump depths may vary depending on water level and recharge rate
2 = B indicates bladder pump and R indicates bailer
3 = These wells may be sampled with a bailer

Table 2 BTEX List Constituents
MRP Properties Company, LLC - Arkansas City, Kansas

Volatile Organic Compounds (VOC)
Benzene
Toluene
Ethylbenzene
Xylenes (total)

Table 3 Analytical Methods, Preservatives, and Containers
MRP Properties Company, LLC - Arkansas City, Kansas
(Page 1 of 2)

Analytical Method	Sample Container[(a)]	Preservative	Unit of Measure	Holding Time
Groundwater				
VOCs (SW-846 8260B)	3, 40-ml glass bottles with a Teflon™ septum cap; No head space	HCl; pH < 2 Chill to 4°C	µg/L	14 days from sample collection to analysis
SVOCs (SW-846 8270D)	2, 1-liter amber glass bottle with a Teflon™ lined cap	Chill to 4°C	µg/L	7 days from sample collection to extraction 40 days from sample extraction to analysis
SVOCs (SW-846 8270D) -- PAHs only, SIM mode	2, 1-liter amber glass bottle with a Teflon™ lined cap	Chill to 4°C	µg/L	7 days from sample collection to extraction 40 days from sample extraction to analysis
1,2-Dibromomethane (EDB) (SW-846 8011)	3, 40-ml glass bottles with a Teflon™ septum cap; No head space	Sodium thiosulfate Chill to 4°C	µg/L	14 days from sample collection to analysis
TPH-Gasoline Range Organics, C6-C10 (SW-846 8015C)	3, 40-ml glass bottles with a Teflon™ septum cap; No head space	HCl; pH < 2 Chill to 4°C	µg/L	14 days from sample collection to analysis
TPH-Diesel Range Organics, C10-C36 (SW-846 8015C)	2, 1–liter amber glass bottle with a Teflon™ lined cap	5-mL 1:1 HCl Chill to 4°C	µg/L	14 days from sample collection to extraction 40 days from sample extraction to analysis
Organochlorine Pesticides (SW-846 8081A)	2, 1–liter amber glass bottle with a Teflon™ lined cap	Chill to 4°C	µg/L	7 days from sample collection to extraction 40 days from sample extraction to analysis
Polychlorinated biphenyls (PCBs) (SW-846 8082)	2, 1–liter amber glass bottle with a Teflon™ lined cap	Chill to 4°C	µg/L	7 days from sample collection to extraction 40 days from sample extraction to analysis
Chlorinated Herbicides (SW-846 8151A)	2, 1–liter amber glass bottle with a Teflon™ lined cap	Chill to 4°C	µg/L	7 days from sample collection to extraction 40 days from sample extraction to analysis
Dioxins (SW-846 8280A)	2, 1–liter amber glass bottle with a Teflon™ lined cap	Chill to 4°C	ng/L	30 days from sample collection to extraction 45 days from sample extraction to analysis
Furans (SW-846 8280A)	2, 1–liter amber glass bottle with a Teflon™ lined cap	Chill to 4°C	ng/L	30 days from sample collection to extraction 45 days from sample extraction to analysis
Metals (except mercury) (SW-846 6010C or SW-846 6020A)	500-ml or 1-liter polyethylene bottle with a LDPE lined cap	HNO_3; pH < 2 Chill to 4°C	µg/L	180 days from sample collection to analysis
Mercury (SW-846 7470A)				28 days from sample collection to analysis
Chloride, Fluoride, Sulfate, Nitrate, Nitrite (SW-846 9056A)	125-ml polyethylene bottle with a LDPE lined cap	Chill to 4°C	mg/L	28 days from sample collection to analysis; 48 hours from sample collection to analysis (nitrate, nitrite)

Table 3 Analytical Methods, Preservatives, and Containers
MRP Properties Company, LLC - Arkansas City, Kansas
(Page 2 of 2)

Analytical Method	Sample Container[(a)]	Preservative	Unit of Measure	Holding Time
Groundwater				
Carbonate/Bicarbonate Alkalinity (SM2320B)	250-ml polyethylene bottle with a LDPE lined cap	Chill to 4°C	mg/L	14 days from sample collection to analysis
Sulfide (SW-846 9030B/9034)	500-ml polyethylene bottle with a LDPE lined cap	ZnAc+NaOH; pH > 9 Chill to 4°C	mg/L	7 days from sample collection to analysis
Total Dissolved Solids (SM2540C)	250-ml polyethylene bottle with a LDPE lined cap	Chill to 4°C	mg/L	7 days from sample collection to analysis
Cyanide (SW-846 9012B/9014)	250-ml polyethylene bottle with a LDPE lined cap	Chill to 4°C	mg/L	14 days from sample collection to analysis
Total Organic Carbon (SW-846 9060A)	100-ml polyethylene bottle or glass bottle with a LDPE lined cap	HCl or H_2SO_4; pH < 2 Chill to 4°C	µg/L	28 days from sample collection to analysis

EPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846; U.S. EPA Third Edition, Final Update III, December 1996 and Final Update IV, February 2007).
Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998.

µg/L	Microgram per liter
ng/L	Nanogram per liter
mg/L	Milligram per liter
mL	Milliliter
°C	Degrees Celsius
HNO_3	Nitric acid
NaOH	Sodium hydroxide
H_2SO_4	Sulfuric acid
VOCs	Volatile organic compounds
SVOCs	Semi-volatile organic compounds
SIM	Selected ion monitoring
TPH	Total petroleum hydrocarbons
HCl	Hydrochloric acid
ZnAc	Zinc Acetate
LDPE	Low-density polyethylene

Table 4 Skinner List Constituents
MRP Properties Company, LLC - Arkansas City, Kansas

Inorganics
Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Lead
Mercury
Nickel
Selenium
Silver
Vanadium
Zinc
Cyanide, Total

Volatile Organic Compounds
Benzene
2-Butanone (MEK)
Carbon disulfide
Chlorobenzene
Chloroform
1,2-Dibromoethane (EDB)
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
1,2-Dichloroethane
1,1-Dichloroethene
1,4-Dioxane
Ethylbenzene
Methyl tert-butyl ether
Styrene
tert-Butyl Alcohol
Tetrachloroethene (PCE)
Toluene
1,1,1-Trichloroethane
Trichloroethene (TCE)
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene
Xylenes (total)

Semi-Volatile Organic Compounds
Acenaphthene
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Bis(2-ethylhexyl) phthalate
Butyl benzyl phthalate
Chrysene
Dibenz(a,h)anthracene
7,12-Dimethylbenz(a)anthracene
2,4-Dimethylphenol
2,4-Dinitrotoluene
Di-n-butyl phthalate
Di-n-octyl phthalate
Fluoranthene
Fluorene
Indeno(1,2,3-cd)pyrene
1-Methylnaphthalene
2-Methylnaphthalene
2-Methylphenol
3-Methylphenol
4-Methylphenol
Naphthalene
Nitrobenzene
Phenanthrene
Phenol
Pyrene
Pyridine

Total Petroleum Hydrocarbons
Gasoline Range Organics (C6-C10)
Diesel Range Organics (C10-C24)
Motor Oil Range Organics (C24-C36)
TPH-DRO (C10-C36)

Table 5 Appendix IX List Constituents
MRP Properties Company, LLC - Arkansas City, Kansas

Inorganics
Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Copper
Lead
Mercury
Nickel
Selenium
Silver
Thallium
Tin
Vanadium
Zinc
Total Cyanide (mg/L)
Total Sulfide (mg/L)

Organochlorine Pesticides
4,4'-DDD
4,4'-DDE
4,4'-DDT
Aldrin
alpha-BHC
beta-BHC
Chlordane (technical)
delta-BHC
Dieldrin
Endosulfan I
Endosulfan II
Endosulfan sulfate
Endrin
Endrin aldehyde
gamma-BHC (Lindane)
Heptachlor
Heptachlor epoxide
Kepone
Methoxychlor
Toxaphene

Polychlorinated biphenyls (PCBs)
Aroclor 1016
Aroclor 1221
Aroclor 1232
Aroclor 1242
Aroclor 1248
Aroclor 1254
Aroclor 1260

Chlorinated Herbicides
2,4,5-T
2,4,5-TP (Silvex)
2,4-D
Dinoseb

Dioxins
1,2,3,4,6,7,8-HpCDD
1,2,3,4,7,8-HxCDD
1,2,3,6,7,8-HxCDD
1,2,3,7,8,9-HxCDD
1,2,3,7,8-PeCDD
2,3,7,8-TCDD
OCDD
Total HpCDD
Total HxCDD
Total PeCDD
Total TCDD

Furans (ng/L)
1,2,3,4,6,7,8-HpCDF
1,2,3,4,7,8,9-HpCDF
1,2,3,4,7,8-HxCDF
1,2,3,6,7,8-HxCDF
1,2,3,7,8,9-HxCDF
1,2,3,7,8-PeCDF
2,3,4,6,7,8-HxCDF
2,3,4,7,8-PeCDF
2,3,7,8-TCDF
OCDF
Total HpCDF
Total HxCDF
Total PeCDF
Total TCDF

Volatile Organic Compounds
1,1,1,2-Tetrachloroethane
1,1,1-Trichloroethane
1,1,2,2-Tetrachloroethane
1,1,2-Trichloroethane
1,1-Dichloroethane
1,1-Dichloroethene
1,2,3-Trichloropropane
1,2,4-Trimethylbenzene
1,2-Dibromo-3-chloropropane (DBCP)
1,2-Dibromoethane (EDB)
1,2-Dichloroethane
1,2-Dichloropropane
1,3,5-Trimethylbenzene
2-Butanone (MEK)
2-Hexanone
4-Methyl-2-pentanone
Acetone
Acetonitrile
Acrolein
Acrylonitrile
Allyl chloride
Benzene
Bromodichloromethane
Bromoform
Bromomethane
Carbon disulfide

Volatile Organic Compounds
Carbon tetrachloride
Chlorobenzene
Chloroethane
Chloroform
Chloromethane
Chloroprene
cis-1,3-Dichloropropene
Dibromochloromethane
Dibromomethane
Dichlorodifluoromethane
Ethyl methacrylate
Ethylbenzene
Iodomethane
Isobutyl alcohol
Methacrylonitrile
Methyl methacrylate
Methyl tert-butyl ether
Methylene chloride
Propionitrile
Styrene
tert-Butyl alcohol
Tetrachloroethene
Toluene
trans-1,2-Dichloroethene
trans-1,3-Dichloropropene
trans-1,4-Dichloro-2-butene
Trichloroethene
Trichlorofluoromethane
Vinyl acetate
Vinyl chloride
Xylenes (total)

Semi-Volatile Organic Compounds
1,2,4,5-Tetrachlorobenzene
1,2,4-Trichlorobenzene
1,2-Dichlorobenzene
1,3,5-Trinitrobenzene
1,3-Dichlorobenzene
1,3-Dinitrobenzene
1,4-Dichlorobenzene
1,4-Dioxane
1,4-Naphthoquinone
1-Methylnaphthalene
1-Naphthylamine
2,2'-oxybis(1-Chloropropane)
2,3,4,6-Tetrachlorophenol
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,4-Dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,6-Dichlorophenol
2,6-Dinitrotoluene

Table 5 Appendix IX List Constituents
MRP Properties Company, LLC - Arkansas City, Kansas

Semi-Volatile Organic Compounds

2-Acetylaminofluorene
2-Chloronaphthalene
2-Chlorophenol
2-Methylnaphthalene
2-Methylphenol
2-Naphthylamine
2-Nitroaniline
2-Nitrophenol
2-Picoline
3,3'-Dichlorobenzidine
3,3'-Dimethylbenzidine
3-Methylcholanthrene
3-Methylphenol & 4-Methylphenol
3-Nitroaniline
4,6-Dinitro-2-methylphenol
4-Aminobiphenyl
4-Bromophenyl phenyl ether
4-Chloro-3-methylphenol
4-Chloroaniline
4-Chlorophenyl phenyl ether
4-Dimethylaminoazobenzene
4-Nitroaniline
4-Nitrophenol
4-Nitroquinoline-1-oxide
4-Phenylenediamine
5-Nitro-o-toluidine
7,12-Dimethylbenz(a)anthracene
a,a-Dimethylphenethylamine
Acetophenone
Aniline
Aramite
Benzyl alcohol
bis(2-Chloroethoxy)methane
bis(2-Chloroethyl) ether
bis(2-Ethylhexyl) phthalate
Butyl benzyl phthalate
Chlorobenzilate
Diallate
Dibenzofuran
Diethyl phthalate
Dimethoate
Dimethyl phthalate
Di-n-butyl phthalate
Di-n-octyl phthalate
Diphenylamine
Disulfoton
Ethyl methanesulfonate
Famphur
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene

Semi-Volatile Organic Compounds

Hexachloroethane
Hexachlorophene
Hexachloropropene
Isodrin
Isophorone
Isosafrole
Methapyrilene
Methyl methanesulfonate
Methyl parathion
Nitrobenzene
N-Nitrosodiethylamine
N-Nitrosodimethylamine
N-Nitrosodi-n-butylamine
N-Nitrosodi-n-propylamine
N-Nitrosodiphenylamine
N-Nitrosomethylethylamine
N-Nitrosomorpholine
N-Nitrosopiperidine
N-Nitrosopyrrolidine
O,O,O-Triethyl phosphorothioate
o-Toluidine
Parathion
Pentachlorobenzene
Pentachloroethane
Pentachloronitrobenzene
Pentachlorophenol
Phenacetin
Phenol
Phorate
Pronamide
Pyridine
Safrole
Sulfotepp
Thionazin

Polycyclic Aromatic Hydrocarbons

Acenaphthene
Acenaphthylene
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(ghi)perylene
Benzo(k)fluoranthene
Chrysene
Dibenzo(a,h)anthracene
Fluoranthene
Fluorene
Indeno(1,2,3-cd)pyrene
Naphthalene
Phenanthrene
Pyrene

Notes:

ng/L = nanograms per liter
µg/L = micrograms per liter
mg/L = milligrams per liter

Table 6 Shortened Groundwater Protection Standard List Constituents
MRP Properties Company, LLC - Arkansas City, Kansas

Arsenic
Barium
Beryllium
Cadmium
Chromium
Cyanide
Lead
Mercury
Nickel
Selenium
Silver
Vanadium
Zinc
Benzene
Carbon Disulfide
Ethylbenzene
Fluorene
Napthalene
Styrene
Toluene
Trichloroethylene
Xylenes (Totals)

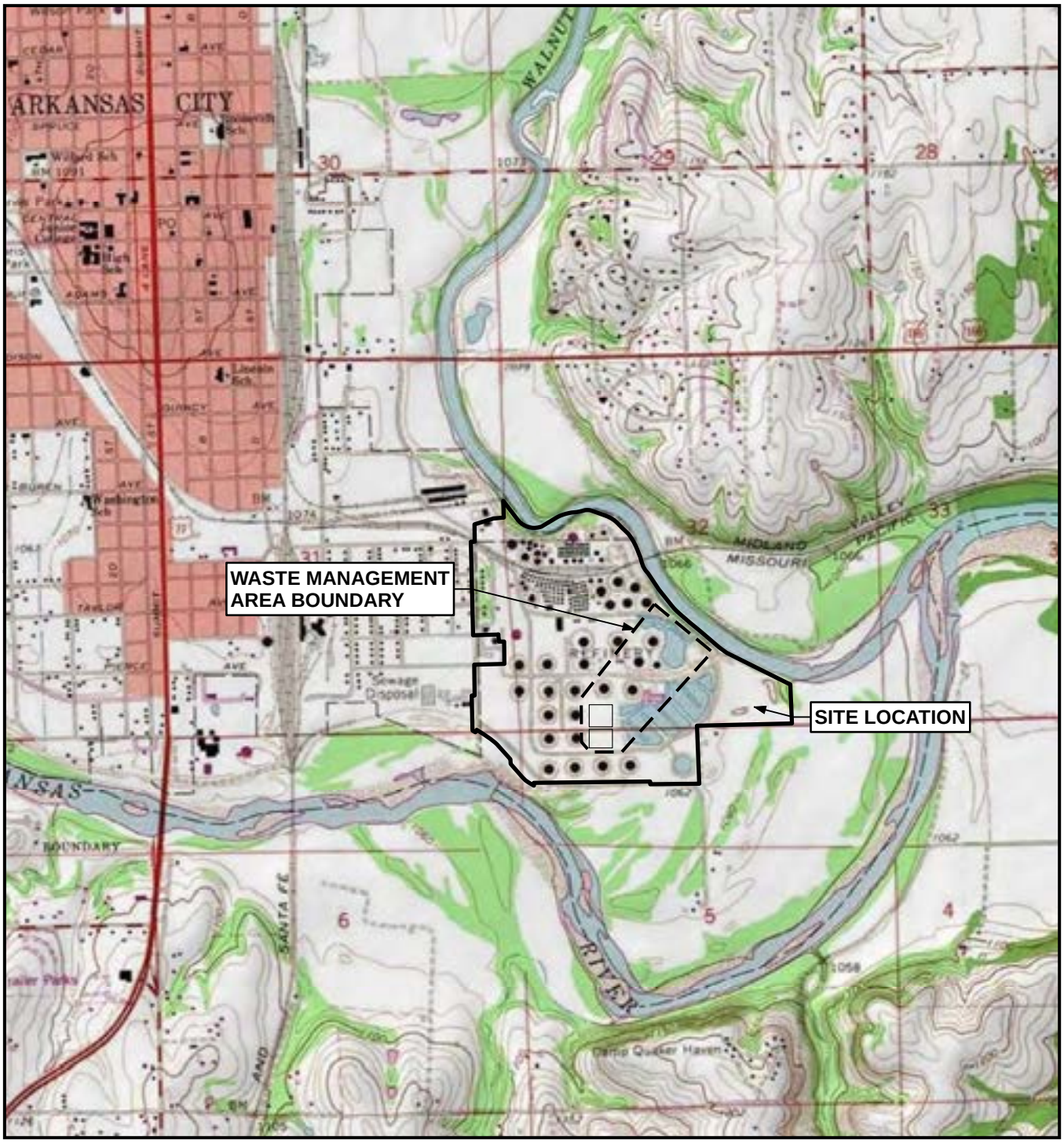
Table 7 Groundwater Protection Standards List Constituents
MRP Properties Company, LLC - Arkansas City, Kansas

Antimony	1,4-Dichlorobenzene
Arsenic	1,2-Dichloroethane
Barium	1,1-Dichloroethylene
Beryllium	2,4-Dimethylphenol
Cadmium	7,12-Dimethylbenz(a)-anthracene
Chromium	2,4-Dinitrotoluene
Cyanide	Di-n-octyl phthalate
Lead	1,4-Dioxane
Mercury	Ethylbenzene
Nickel	Ethylene dibromide
Selenium	Fluoranthene
Silver	Fluorene
Vanadium	Indeno (1,2,3-cd) pyrene
Zinc	Methyl ethyl ketone
Acenapthene	1-Methylnaphthalene
Anthracene	2-Methylnaphthalene
Benzene	Naphthalene
Benzo (a) anthracene	Nitrobenzene
Benzo (b) fluoranthene	Phenanthrene
Benzo (a) pyrene	Phenol
Bis (2-ethylhexyl) phthalate	Pyrene
Butyl benzyl phthalate	Pyridine
Carbon Disulfide	Styrene
Chlorobenzene	Tetrachloroethylene
Chloroform	Toluene
Chrysene	Trichloroethylene
Cresols (methylphenols)	1,1,1-Trichloroethane
Dibenz (a,h) anthracene	1,2,4-Trimethylbenzene
Di-n-butyl phthalate	1,3,5-Trimethylbenzene
1,2-Dichlorobenzene	Xylenes (Total)

FIGURES

N:\GIS\Part_B_2011\MXD\FIG01_SiteLocationUTM_Arc10.mxd

R 4 E



T 34 S

T 35 S

EXPLANATION

SITE BOUNDARIES ARE APPROXIMATE.
SOURCE: USDA-NRCS-NCGC DIGITAL RASTER GRAPHIC (DRG) MrSID MOSAIC.
CONTOUR INTERVAL: 10 FEET.
NATIONAL GEODETIC VERTICAL DATUM OF 1929.
NORTH AMERICAN HORIZONTAL DATUM OF 1983 (NAD83).
ARKANSAS CITY, KANSAS. N3700-W9700/7.5. 1965; PHOTOREVISED 1979.
AMS 6558 II SE-SERIES V878

SCALE 1: 24,000

0 0.5 1 MILE

0 2,000 4,000 FEET

N W E S

DATE	DESIGN BY	DRAWN BY	REVIEWED BY
5/11/2011	RPH	RPH	JFM

TITLE:

SITE LOCATION MAP

PROJECT:

MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:

1

N:\GIS\Part_B_2011\MXD\Appendix_P_FIG02_Corrective_Action.mxd

EXPLANATION

WN-6B	SHALLOW ALLUVIAL MONITORING WELL
WN-6A	DEEP ALLUVIAL MONITORING WELL
CMW-3	CAPTURE ZONE MONITORING WELL
	DIRECTION OF SURFACE WATER FLOW
	SITE PROPERTY BOUNDARY
	LTU CORRECTIVE ACTION SOIL VAPOR EXTRACTION / GROUNDWATER AIR SPARGE SYSTEM

N
W E
S

SCALE IN FEET

0 400 800

AERIAL PHOTO: MARCH 12, 2005

DATE	DESIGN BY	DRAWN BY	REVIEWED BY
5/19/2011	RPH	RPH	JFM

TITLE:

CORRECTIVE ACTION GROUNDWATER MONITORING PROGRAM

PROJECT:

MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:

2

N:\GIS\Part_B_2011\MXD\Appendix_P_FIG03_Compliance.mxd

EXPLANATION

WN-1B — SHALLOW ALLUVIAL MONITORING WELL

WN-1A — DEEP ALLUVIAL MONITORING WELL

CMW-3 — CAPTURE ZONE MONITORING WELL

DIRECTION OF SURFACE WATER FLOW

SITE PROPERTY BOUNDARY

LTU CORRECTIVE ACTION SOIL VAPOR EXTRACTION / GROUNDWATER AIR SPARGE SYSTEM

N
W E
S

SCALE IN FEET

0 400 800

AERIAL PHOTO: MARCH 12, 2005

DATE	DESIGN BY	DRAWN BY	REVIEWED BY
5/19/2011	RPH	RPH	JFM

TITLE:

COMPLIANCE GROUNDWATER MONITORING PROGRAM

PROJECT:

MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.: **3**

MWH

MONITORING WELL SAMPLING LOG
PROJECT: ARKANSAS CITY, KANSAS

Well ID: _____ Screened Interval (ft): ____ ft. to ____ ft. Well Diameter (in): _____
Date: _____ Pump Inlet Depth (ft btoc): _____ Depth to Water (ft btoc): _____
Sample ID: _____ Flow Rate (mL/min) _____ Depth to Product (ft btoc): _____
Time: _____ Purging Device: _____ Total Well Depth (ft btoc): _____
Analyses: _____ Sampling Device: _____ Height of Water in Well (ft): _____
QA/QC - Field Blank: _____ Water Level Instrument: _____ Samplers: _____
Rinsate ID: _____ Water Quality Meter(s): _____ _____

Time	Volume Purged (mL)	Flow Rate (mL/min)	Water Level (feet - TOC)	SC (µS/cm)	pH	Temp (°C)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments
Final Field Parameter Measurements										

Analyses, Sample Bottles and Preservatives: _____

Comments: _____

Duplicate Sample: Y / N Duplicate Sample Name: MS/MSD Sample: Y / N

NOTES
Example groundwater sampling form, shown for reference only.

TITLE:
EXAMPLE GROUNDWATER SAMPLING FORM

PROJECT:
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.: **4**

MWH

BIOREACTOR INFLUENT SAMPLING LOG
PROJECT: ARKANSAS CITY, KANSAS

Bioreactor Influent Location: _____

Date: _____ **QA/QC - Field Blank:** _____ **Water Quality Meter(s):** _____

Sample ID: _____ **Rinsate ID:** _____ _____

Time: _____ **Sample Type:** _____ **Samplers:** _____

Analyses: _____ _____

_____

Time	Pumping Rate (GPM)	SC (µS/cm)	pH	Temp (°C)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments
Final Field Parameter Measurements								

Analyses, Sample Bottles and Preservatives:

_____
_____
_____
_____

Comments: _____
_____
_____
_____
_____

Duplicate Sample: Y / N **Duplicate Sample Name:** **MS/MSD Sample: Y / N**

NOTES
Example bioreactor influent sampling form, shown for reference only.

TITLE:
EXAMPLE BIOREACTOR INFLUENT SAMPLING FORM

PROJECT:
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.: **5**

WELL:	CMW-1	DATE:	TIME:
1	**MEASURING POINT ELEV.**		**1059.71**
2	**DEPTH TO WATER**		
3	DEPTH TO PRODUCT		
4	PRODUCT THICKNESS (2-3)		
5	(DEPTH TO WATER + (PROD THICK*D))		
6	**GROUNDWATER ELEVATION (1-5)**		
Groundwater Elevation Difference (CMW-1 - RCRA-7)			

WELL:	RCRA-7	DATE:	TIME:
1	**MEASURING POINT ELEV.**		**1063.72**
2	**DEPTH TO WATER**		
3	DEPTH TO PRODUCT		
4	PRODUCT THICKNESS (2-3)		
5	(DEPTH TO WATER + (PROD THICK*D))		
6	**GROUNDWATER ELEVATION (1-5)**		

WELL:	CMW-2	DATE:	TIME:
1	**MEASURING POINT ELEV.**		**1061.75**
2	**DEPTH TO WATER**		
3	DEPTH TO PRODUCT		
4	PRODUCT THICKNESS (2-3)		
5	(DEPTH TO WATER + (PROD THICK*D))		
6	**GROUNDWATER ELEVATION (1-5)**		
Groundwater Elevation Difference (CMW-2 - 113)			

WELL:	113	DATE:	TIME:
1	**MEASURING POINT ELEV.**		**1072.23**
2	**DEPTH TO WATER**		
3	DEPTH TO PRODUCT		
4	PRODUCT THICKNESS (2-3)		
5	(DEPTH TO WATER + (PROD THICK*D))		
6	**GROUNDWATER ELEVATION (1-5)**		

WELL:	CMW-3	DATE:	TIME:
1	**MEASURING POINT ELEV.**		**1061.47**
2	**DEPTH TO WATER**		
3	DEPTH TO PRODUCT		
4	PRODUCT THICKNESS (2-3)		
5	(DEPTH TO WATER + (PROD THICK*D))		
6	**GROUNDWATER ELEVATION (1-5)**		
Groundwater Elevation Difference (CMW-3 - 118)			

WELL:	118	DATE:	TIME:
1	**MEASURING POINT ELEV.**		**1070.70**
2	**DEPTH TO WATER**		
3	DEPTH TO PRODUCT		
4	PRODUCT THICKNESS (2-3)		
5	(DEPTH TO WATER + (PROD THICK*D))		
6	**GROUNDWATER ELEVATION (1-5)**		

WELL:	CMW-4	DATE:	TIME:
1	**MEASURING POINT ELEV.**		**1061.93**
2	**DEPTH TO WATER**		
3	DEPTH TO PRODUCT		
4	PRODUCT THICKNESS (2-3)		
5	(DEPTH TO WATER + (PROD THICK*D))		
6	**GROUNDWATER ELEVATION (1-5)**		
Groundwater Elevation Difference (CMW-4 - MW-1002)			

WELL:	MW-1002	DATE:	TIME:
1	**MEASURING POINT ELEV.**		**1072.11**
2	**DEPTH TO WATER**		
3	DEPTH TO PRODUCT		
4	PRODUCT THICKNESS (2-3)		
5	(DEPTH TO WATER + (PROD THICK*D))		
6	**GROUNDWATER ELEVATION (1-5)**		

Note: D = product density
Measuring Point Elevations as of 04/23/10

Measured by:_____

EXPLANATION

Groundwater Gradient Monitoring Measurement Form

PROJECT:

MPR PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:

6

Denver
4955 Yarrow Street
Arvada, CO 80002
phone 303.736.0100 fax 303.431.7171

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
TestAmerica Laboratories, Inc.

Client Contact	Project Manager:	Site Contact:	Date:	COC No:
	Tel/Fax:	Lab Contact: Pat McEntee	Carrier: FedEx	of ____ COCs
	Analysis Turnaround Time			Job No:
	Calendar (C) or Work Days (W)			
Phone	TAT if different from Below _____			
(xxx) xxx-xxxx FAX	☐ 2 Weeks			SDG No.
Project Name:	☐ 1 week			
Site:	☐ 2 days			
	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Filtered Sample																	Sample Specific Notes:

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* *Poison B* ☐ *Unknown* ☐

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* _____ *Months*

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

NOTES
Example chain-of-custody form, shown for reference only.

TITLE:
EXAMPLE CHAIN-OF-CUSTODY FORM

PROJECT:
MRP PROPERTIES COMPANY, LLC
ARKANSAS CITY, KANSAS

MWH

Figure No.:
7

APPENDIX A

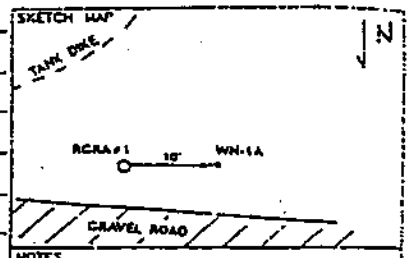
Monitoring Well Construction Logs

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

WELL NUMBER WN-1 A

T Total RCRA		OWNER Total Petroleum, Inc.	
CATION Ark City, KS		PROJECT NUMBER 422-875-9023	
TE DRILLED 8-1-88	TOTAL DEPTH OF HOLE 45.0	DIAMETER 8.0"	
RFACE ELEVATION 1066.17	WATER LEVEL INITIAL 18.0'	24-HRS. 18.0'	
REEN DIA. 2.0"	LENGTH 15.0'	SLOT SIZE 0.02"	
SING DIA. 2.0"	LENGTH 31.0'	TYP. Stainless Steel	
LLING COMPANY GTI		DRILLING METHOD 8.0" Hollow Stem	
LLER Frank Baker		LOG BY Barry McFarland	

SKETCH MAP



NOTES
10' W of RCRA #1

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		Concrete	SC		Clayey Sand: Dark Brown; 20-30% fines, dry, fine grained, medium dense.
		5' continuous sampler used from 0-20'	SP		Sand: Yellowish Brown-Light Brown; 0-10% fines, fine to medium grained, medium dense (with some clay seams to 2")
5		Volclay Grout			
10			SP		A.A. but medium grained and wet to very wet at 16.0'.
15					
20			SP		Sand- Light Grey; 0-10% fines, saturated medium and coarse grained, medium dense (slight fuel odor)
		Bentonite Chips			
25					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

WELL NUMBER WN-1-A

PROJECT Total/RCRA OWNER Total Petroleum, Inc.

LOCATION Ark City, KS PROJECT NUMBER 422-875-9023

DATE DRILLED 8-1-88 TOTAL DEPTH OF HOLE 45.0 DIAMETER 8.0"

SURFACE ELEVATION _____ WATER LEVEL INITIAL _____ 24-HRS. _____

SCREEN DIA. _____ LENGTH _____ SLOT SIZE _____

CASING DIA. _____ LENGTH _____ TYP. _____

DRILLING COMPANY _____ DRILLING METHOD _____

DRILLER _____ LOG BY _____

SKETCH MAP

NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
26			SP		A.A.
30					
35					
			SP		Gravelly Sand: Light Grey; 0-10% fines, saturated medium dense; coarse grained, (with limestone gravels to 3")
40					
45					Shale: Light Greyish Brown; medium hard

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

WELL NUMBER WN-1-B

OJECT Total/RCRA OWNER Total Petroleum, Inc.
CATION Arkansas City, KS PROJECT NUMBER 422-875-9023
TE DRILLED 8-10-88 TOTAL DEPTH OF HOLE 28.0' DIAMETER 8.0'
RFACE ELEVATION 1065.12 WATER LEVEL INITIAL 18.0' 24-HRS. 18.0'
REEN DIA. 2.0" LENGTH 15.0' SLOT SIZE 0.02"
SING DIA. 2.0" LENGTH 16.0' TYP. Stainless Steel
RILLING COMPANY GTI DRILLING METHOD Hollow Stem
RILLER Frank Baker LOG BY Barry McFarland

SKETCH MAP

NOTES
7' NE of WN-1-A

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURE)
0		Concrete			Same as WN-1-A
		Volclay Grout			
5					
		Bentonite			
10					
		Screen 13'-28'			
15					
20					
25					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

WELL NUMBER WN-1-B

PROJECT Total/RCRA OWNER Total Petroleum, Inc.

LOCATION Arkansas City, KS PROJECT NUMBER 422-875-9023

DATE DRILLED 8-10-88 TOTAL DEPTH OF HOLE 28.0' DIAMETER 8.0"

SURFACE ELEVATION _____ WATER LEVEL INITIAL _____ 24-HRS. _____

SCREEN DIA. _____ LENGTH _____ SLOT SIZE _____

CASING DIA. _____ LENGTH _____ TYP. _____

DRILLING COMPANY _____ DRILLING METHOD _____

DRILLER _____ LOG BY _____

SKETCH MAP

NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
26					Same as WN-1-A

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

WELL NUMBER WN-5-B

PROJECT Total/RCRA
OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS
PROJECT NUMBER 422-875-9023
DATE DRILLED 8-9-88
TOTAL DEPTH OF HOLE 26.0'
DIAMETER 8.0"
SURFACE ELEVATION 1062.86
WATER LEVEL INITIAL 17.0'
24-HRS 17.0'
SCREEN DIA. 2.0"
LENGTH 15.0'
SLOT SIZE 0.02"
CASING DIA. 2.0"
LENGTH 15.0'
TYP. Stainless Steel
DRILLING COMPANY GTI
DRILLING METHOD Hollow Stem
DRILLER Frank Baker
LOG BY Barry McFarland

SKETCH MAP

NOTES
7' S of WN-5-A

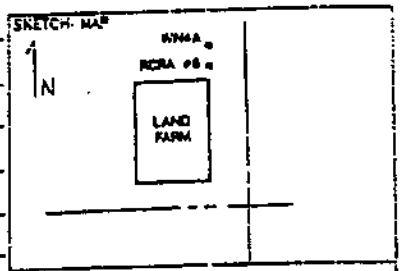
DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		Concrete			Same as WN-5-A
		Volclay Grout			
		Bentonite Chips			
10					
		Sand Pack			
20					
30					
40					
50					

TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

WELL NUMBER WN-6-A

OWNER	Total Refinery/RCRA
LOCATION	Arkansas City, KS
PROJECT NUMBER	422-875-9023
DATE DRILLED	8-4-88
TOTAL DEPTH OF HOLE	44.0'
DIAMETER	8.0"
SURFACE ELEVATION	1062.81
WATER LEVEL INITIAL	18.0'
24-HRS.	18.0'
SCREEN DIA.	2.0"
LENGTH	15.0'
SLOT SIZE	0.02"
CASING DIA.	2.0"
LENGTH	32.0'
TYP.	Stainless Steel
DRILLING COMPANY	GTI
DRILLING METHOD	Hollow Stem
DRILLER	Frank Baker
LOG BY	Barry McFarland

SKETCH MAP



NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		Concrete	CL		Sandy Clay: Dark Brown; 20-30% fine sand; moist; low plastic; medium dense (w/ roots upper 6")
		5' continuous sampler from 0-20'	SM		Silty Sand: Brown; 10-20% fines; moist to wet at 6'; fine & medium grains; medium dense
5		Volclay Grout			
			SP		A.A. but Yellowish Brown, 0-10% fines
10		Composite Jar Samples 10-15' and 15-20'			
		Bentonite Chips			
15		HNU 100-150 ppm @ sample	SP		Sand: Light Grey; 0-10% fines; very wet; medium grains; medium dense (w/ some fuel odor)
20			SP		A.A. but saturated with medium & coarse grains (some large gravels to 1")
25					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

WELL NUMBER WN-6-A

PROJECT Total/RCRA OWNER Total Petroleum, Inc.

LOCATION Ark City, KS PROJECT NUMBER 422-875-9023

DATE DRILLED 8-4-88 TOTAL DEPTH OF HOLE 44.0' DIAMETER 8.0"

SURFACE ELEVATION _____ WATER LEVEL INITIAL _____ 24-HRS _____

SCREEN DIA. _____ LENGTH _____ SLOT SIZE _____

CASING DIA. _____ LENGTH _____ TYP. _____

DRILLING COMPANY _____ DRILLING METHOD _____

DRILLER _____ LOG BY _____

SKETCH MAP

NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
26					As above
30		Screen 29-44'			
35					
40					A.A. but with limestone gravels to 3" diameter.
45					Shale: Very Light Brown - Light Grey; moist, medium hard rock.
50					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

WELL NUMBER WN-6-B

PROJECT Total/RCRA OWNER Total Petroleum, Inc.
LOCATION Arkansas, KS PROJECT NUMBER 422-875-9023
DATE DRILLED 8-9-88 TOTAL DEPTH OF HOLE 28.0' DIAMETER 8.0'
SURFACE ELEVATION 1062.79 WATER LEVEL INITIAL 18.0' 24-HRS 18.0'
SCREEN DIA. 2.0" LENGTH 15.0' SLOT SIZE 0.02"
CASING DIA. 2.0" LENGTH 15.0' TYP. Stainless Steel
DRILLING COMPANY GTI DRILLING METHOD Hollow Stem
DRILLER Frank Baker LOG BY Barry McFarland

SKETCH MAP

NOTES
8' E of WN-4A

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0	Concrete				Same as WN-4 A
	Volclay Grout				
	Bentonite Chips				
	Sand Pack				
20					
30					
40					
50					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

WELL NUMBER WN-7-B

PROJECT Total/RCRA OWNER Total Petroleum, Inc.
LOCATION Arkansas City, KS PROJECT NUMBER 422-875-9023
DATE DRILLED 8-10-88 TOTAL DEPTH OF HOLE 31.0' DIAMETER 8.0"
SURFACE ELEVATION 1062.27 WATER LEVEL INITIAL 19.5' 24-HRS 19.5'
SCREEN DIA. 2.0" LENGTH 15.0' SLOT SIZE
CASING DIA. 2.0" LENGTH 19.0' TYP. Stainless Steel
DRILLING COMPANY GTI DRILLING METHOD Hollow Stem
DRILLER Frank Baker LOG BY Barry McFarland

SKETCH MAP

NOTES

DEPTH (FEET)	WELL CONSTRUCTION	NOTES	U.S.C.S.	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0		Concrete			Sand: Very pale brown; 0-10% fines, dry-moist, fine grained, medium dense (with some black staining in upper 2.0')
		Volclay Grout			
10		Bentonite Chips			Sand: Light grey and light greyish brown, 0-10% fines, wet, fine to medium grained, medium dense (with fuel odor and staining)
20		Sand Pack			As above but medium and coarse grained, saturated.
30					
40					

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS

WELL NUMBER WN 8-B

PROJECT: Total/RCRA
OWNER: Total Petroleum, Inc.
LOCATION: Ark City, KS
PROJECT NUMBER: 422-875-9023
DATE DRILLED: 8-10-88
TOTAL DEPTH OF HOLE: 30.0'
DIAMETER: 8.0"
SURFACE ELEVATION: 1062.07
WATER LEVEL INITIAL: 19.0'
24-HRS: 19.0'
SCREEN DIA.: 2.0"
LENGTH: 15.0'
SLOT SIZE: 0.02"
CASING DIA.: 2.0"
LENGTH: 20.0'
TYP.: Stainless Steel
DRILLING COMPANY: GTI
DRILLING METHOD: Hollow Stem
DRILLER: Frank Baker
LOG BY: Barry McFarland

SKETCH MAP

NOTES: 8' NE of WN-8-A

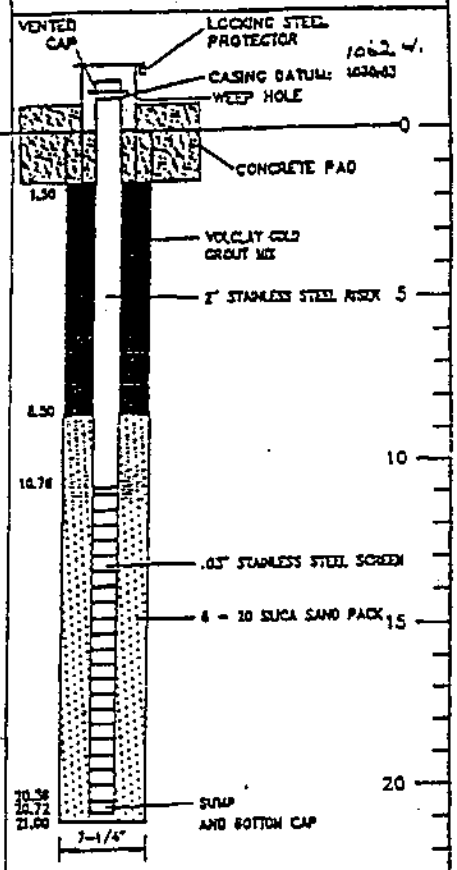
DEPTH (FEET)	WELL CONSTRUCTION	NOTES	GRAPHIC LOG	DESCRIPTION / SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)
0	Concrete			Same as WN-8-A
	Volclay Grout			
10	Bentonite Chips			
	Sand Pack			
20				
30				
40				
50				

WELL COMPLETION RECORD

DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
	GROUND SURFACE: 1060.34				
0	CLAYEY SANDY SILT: 7.5 YR 6/4, LT. BROWN, MOIST, SOFT, 10% CLAY, 30% SAND, VF–F GRAIN, RND–SUBRND., 60% SILT, L–PLAST.	ML		NS	
1.0		CH			
2.0	CLAY: 7.5 YR BROWN, MOIST, FIRM IN DI N–PLAST.	ML			
3.0	CLAYEY SANDY SILT: 7.5 YR 6/4, LT. BROWN, MOIST, SOFT, 10% CLAY, 30% SAND, VF–F GRAIN, RND–SUBRND., 60% SILT, L–PLAST.	SM		1	
5	SILTY SAND: 7.5 YR 6/0, GRAY, MOIST, SOFT, ODOR, 10% SILT, 30% SAND, VF–C GRAIN, RND–SUBRND.	SP		NS	
	SAND: POORLY GRD., VF–F GRAIN, QRTZ, LT. GRAY, 10 YR 7/1 TO 7/2, STRONG HYDROCARBON ODOR, LOOSE, DRY				
10				2 / NS	
14.0	SILTY SANDY CLAY: VF GRAIN SD., 60% CLAY, 30% SD./SILT, L–PLAST., RED GRAYISH, 5 YR 5/2, VERY MOIST, FIRM	ML		3	1.5
15 / 15.5	SAND: POORLY GRD., FINE TO COARSE GRAIN, SUBRND, QTZ, CHERT, LT. GRAY 10 YR 7/1, SAT., LOOSE, STRONG HYDROCARBON ODOR	SP		NS / NS	
20				4	1.5
	T.D. 21.0'				
	NOTE: DEEP BORING LOGS USED FOR BOTH DEEP AND SHALLOW DETAILS FOR NESTED WELLS				
25					
30					
35					

13.1'

WELL COMPLETION DETAIL



CHE 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 *TOTAL/89035*

BORING NUMBER *MW-6 (BH-13)*

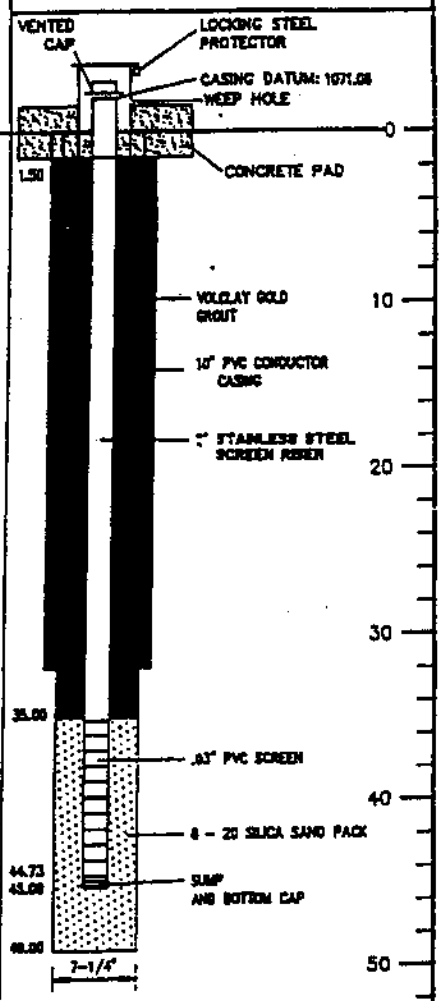
DATE DRILLED 3/12/90 – 3/15/90
DRILLING METHOD HA/HSA
DRILLED BY LATHE/WESTERN
LOGGED BY TPC/MCP
CHECKED BY BJS
DRAWN BY: CAP PAGE 1 OF 1

ROBERTS/SCHORNICK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALVE
		GROUND SURFACE: 1087.40				
	0 – 0.5	TOPSOIL: SILTY CLAY, GRASS ROOTS				
		SILTY CLAY: 10 YR 4/3, DARK BROWN, MOIST, SOFT–FIRM M–H PLAST., SLI–MOTTLED, 30% SILT, 70% CLAY	CH–CL		HAND AUGER	
	5.0	SILTY SAND: VF GRAIN, 80% SAND, 15% SILT, 5% CLAY, POORLY GRADED, DARK GRAYISH BROWN 10 YR 4/2, DRY, LOOSE	SM		1 NR NS 0.2"	
	7.0	SILTY CLAY: 70% CLAY, 30% SILT, MED PLAST., VERY DARK GRAY 7.5 YR 3/0, SOFT, MASSIVE, MOIST	CL		NS	
	10 – 10.5 – 11.1	SILTY SAND: POORLY GRADED, VF–F GRAIN, 80% SAND, 10% SILT, BLACK 10 YR 7/1, SLI MOIST, LOOSE	SM CL		2 NR NS 1.5"	
	15.8	SILTY CLAY: 90% CLAY, 10% SILT, MED. PLAST., BLACK 10 YR 2/1, SM, SOFT, MASSIVE	SP		3 NR NS 1.5"	
		SAND: POORLY GRD, F–M GRAIN, 100% SAND, SUBRND, QTZ., CHERT, PALE BROWN 10 YR 6/3, SLI MOIST, LOOSE				
	20 – 20.1 – 20.5	CLAYEY SAND: F–M GRAIN, 80% SAND, 20% CLAY SUBRND, BLACK 2.5 YR 4/0, QTZ., SLI MOIST	SC SP		4 NR NS 1.5"	
24.0'		SAND: POORLY GRD, F–M GRAIN, SUBRND, QTZ., PALE BROWN 10 YR 2/1, MOIST, LOOSE TO DARK GRAY 5 YR 4/1 AT 21.1' SATURATED–STRONG HYDROCARBON ODOR 25.0'			5 NR NS 1.5"	
	30				6 NR NS 1.5"	
	35.5	GRAVELLY SAND: F–VC SAND, WELL GRD., 80% SAND, 10% GRAVEL, MINOR ANGULAR LIMESTONE ROCKS TO 2", QTZ., SATURATED, LOOSE, STRONG HYDROCARBON ODOR, DARK GRAY 10 YR 4/1	SW		7 NR NS 1.5"	
	40	SAND: FINE–COARSE POORLY GRD., SUBRND, QTZ. DARK GRAY 10 YR 4/1, SAT., LOOSE, STRONG HYDROCARBON ODOR	SP		8 NR NS 1.5"	
		VF–FINE GRAIN SAND AT 45.8'			9 NR NS 1.5"	
	48.0 – 50	AUGER REFUSAL 48.0'				
		NOTE: DEEP BORING LOGS USED FOR BOTH DEEP AND SHALLOW DETAILS FOR NESTED WELLS				
	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.)

JOB NAME/NUMBER *TOTAL/89035*

BORING NUMBER *MW-12 (BH-18)*

DATE DRILLED 5/2/90 – 5/9/90
DRILLING METHOD HA/HSA
DRILLED BY LAYNE/WEST.
LOGGED BY TPG/WEP
CHECKED BY SJS
DRAWN BY: SAR PAGE 1 OF 1

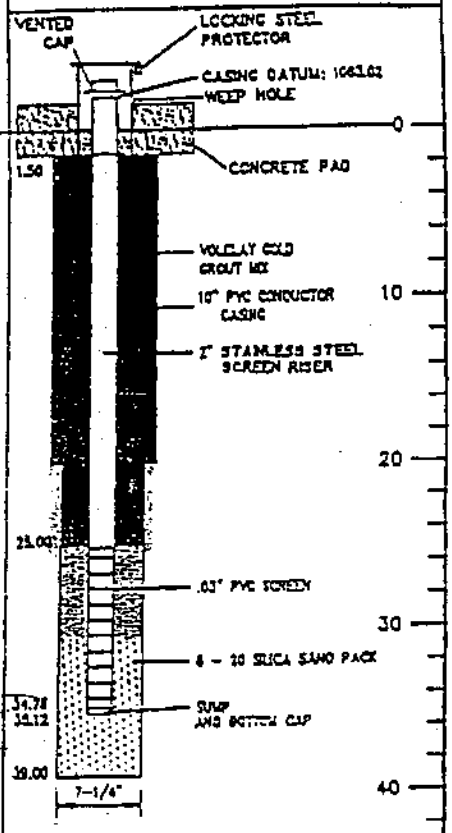
ROBERTS/SCHORNICK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3998

WELL COMPLETION RECORD

GEOLOG.	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE 1060.26				
	0 – 1.0	CLAYEY SANDY SILT 7.5 YR 6/4, LT. BROWN, MOIST, SOFT, 10% CLAY, 30% SAND, VF–F GRAIN, RND–SUBRND, 60% SILT, L–PLAST.	CL			
	1.0 – 2.0	CLAY 7.5 YR BROWN, MOIST, FIRM WITH H–PLAST.	CH		1	NS
	2.0 – 5.0	CLAYEY SANDY SILT 7.5 YR 6/4, LT. BROWN, MOIST, SOFT, 10% CLAY, 30% SAND, VF–F GRAIN, RND–SUBRND, 60% SILT, L–PLAST.	ML			
	5.0 – 10	SILTY SAND: 7.5 YR 6/2, GRAY, MOIST, SOFT, ODOR, 10% SILT, 90% SAND, VF–C GRAIN, RND–SUBRND.	SM		2	NS
	10 – 14.0	SAND: POORLY GRD., VF–F GRAIN, QTZ, LT. GRAY, 10 YR 7/1 TO 7/2, STRONG HYDROCARBON ODOR, LOOSE, DRY	SP			
▽ 15.5'	14.0 – 15.5	SILTY SANDY CLAY: VF GRAIN SD., 60% CLAY, 20% SD./SILT, L–PLAST., RED GRAYISH, 5 YR 5/2, VERY MOIST, FIRM	ML / SC		3 / 4	1.5 / NR / NS
	15.5 – 20	SAND: POORLY GRD., FINE TO COARSE GRAIN, SUBRND, QTZ., CHERT, LT. GRAY 10 YR 7/1, SAT., LOOSE, STRONG HYDROCARBON ODOR COARSENING WITH DEPTH	SP		4 / 5	1.5 / NR / NS / 1.5 / NR / NS
	20 – 30	GRAVELLY SAND: POORLY GRD., 20% GRAVEL, 80% SAND, M–VC GRAIN, GRAVEL TO 1/8" SUB–ANG., QTZ., CHERT, GRAYISH BROWN, 10 YR 5/2, SATURATED, LOOSE, HYDROCARBON ODOR	SP		6 / 7	1.5 / NR / NS / 1.5 / NR / NS
	30 – 39.0	ANGULAR LIMESTONE FRAGMENT, MICRO–CRYSTALLINE, V. HARD, LT. BROWNISH GRAY 10 YR 5/2	SP		7	1.5
	39.0	AUGER REFUSAL AT 39.0'				

NOTE: DEEP BORING LOGS USED FOR BOTH DEEP AND SHALLOW DETAILS FOR NESTED WELLS

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.)

JOB NAME/NUMBER TOTAL/89035

BORING NUMBER MW-13 (BH-19)

DATE DRILLED 3/2/90 – 3/15/90
DRILLING METHOD HA/HSA
DRILLED BY LATHE/WESTERN
LOGGED BY TPC/WEP
CHECKED BY BJS
DRAWN BY SAR

PAGE 1 OF 1

ROBERTS/SCHORNICK & ASSOCIATES, INC.
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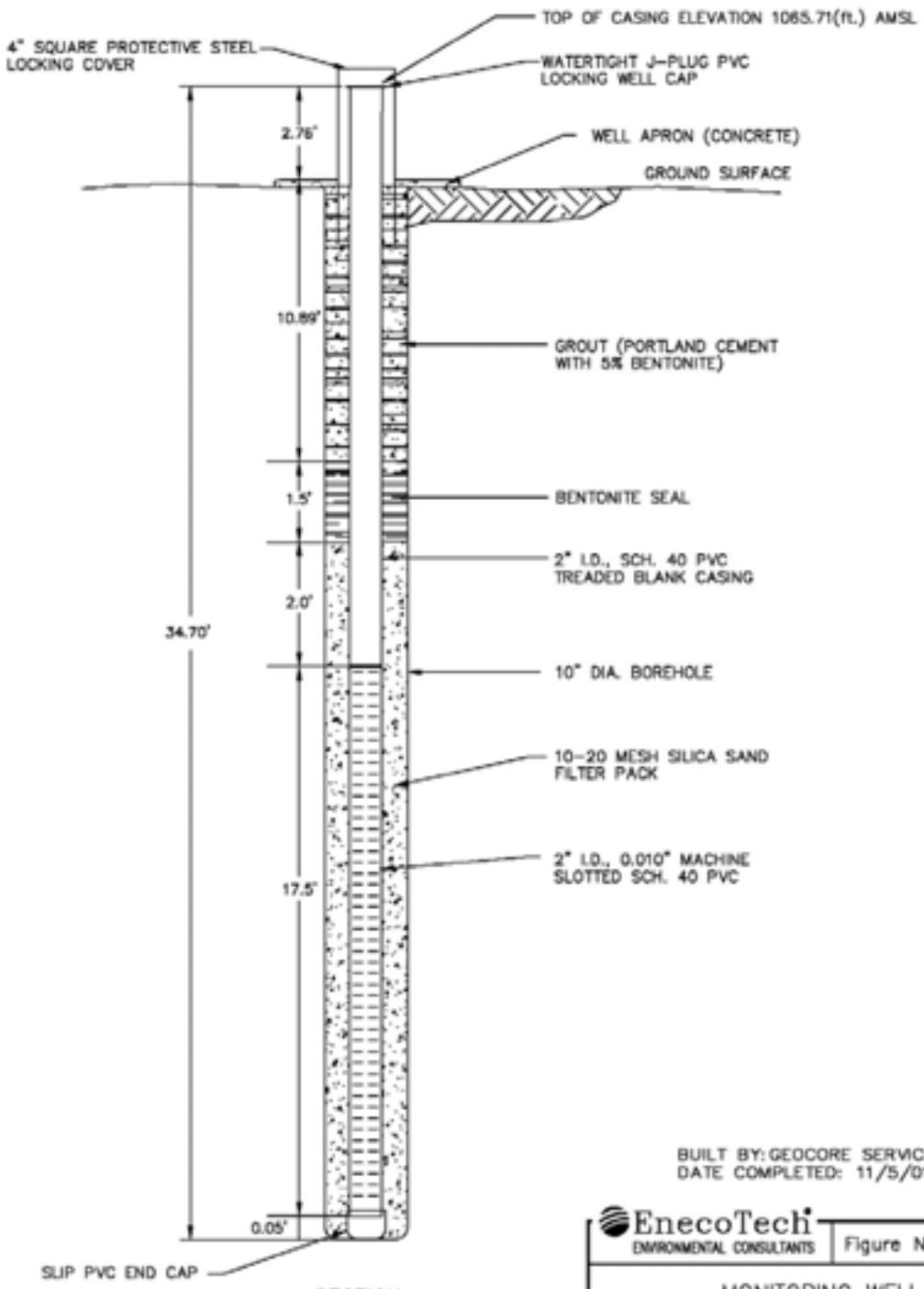
(405) 321-3098



SECTION
NOT TO SCALE

BUILT BY: GEOCORE SERVICES, INC.
DATE COMPLETED: 11/5/01

LOCATION (Plant Coordinates)

NORTHING -1872.404(ft.)
EASTING 1186.906(ft.)

ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (AMSL)

NOTE: PVC CASING CONNECTIONS ARE THREADED AND FLUSH JOINTED

EnecoTech
ENVIRONMENTAL CONSULTANTS

Figure No.:

MONITORING WELL
MW-17
CONSTRUCTION DIAGRAM

PROJECT: TPI PETROLEUM INC. - ARKANSAS CITY REFINERY

1001-014	DESIGNED BY: JFM	APPROVED BY: JFM	
18-MW_17	DRAWN BY: LKB	DATE: 1/15/02	REV.

ENGINEERING Enterprises, Inc.

RCRA MONITORING WELL No. 4

Date Completed: 9-1-81
7 5/8" Hole by mud rotary

Location: East side of refinery
See Location Map in Text

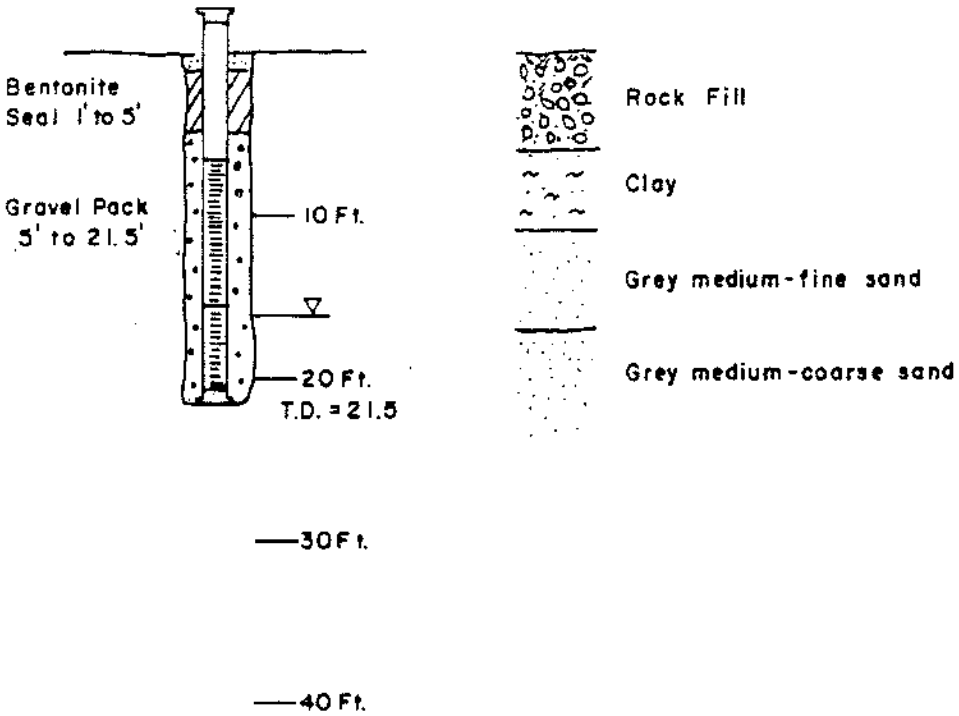
Ground Elevation: 1059.7

Casing: 4" PVC

Top of Casing Elevation: 1061.16

Screen: 4" Plastic (ABS), Continuous Wrap (0.045') Slot 6.7' to 16.5'
(0.050') Slot 16.5' to 21.5'

Static Water Level: 1045.00 (10-2-81)



PROJECT: [illegible]

LOCATION: Arkansas City, KS

BORING DATE: 11/[illegible]

DATUM: GROUND SURFACE

BOREHOLE RFI2-5C

LOGGED: Chuck Gay

DEPTH SCALE (METRES / FEET)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	DEPTH B.G.S. (ft)	Sampler: Sample ID	USCS Symbol	Recovery (%)	MEASUREMENTS: PID (PPM)	
0 / 0		GROUND SURFACE							
		Soil, dark brown, dry, organic.		0.0					
		Clay, brown, very firm, friable, dry, low plasticity, iron oxide mottles.		1.3		ML			
2 / 8		Clay, brown, friable, dry to moist at 6.5', sparse iron oxide mottles.		5.0		ML			
3 / 10		Sand, black to light brown, very fine to fine grained, subrounded, strong hydrocarbon odor and staining at 8.8-10.0', moist, 10% silt.		8.2		SM			
4 / 12–14		Sand, black turning to pale yellowish brown at 13.3-15.0', wet at 14.0', strong hydrocarbon odor and stain at 10.0-12.75', medium to coarse grain 11.5-13.0', turning very fine to fine grained, sub rounded.		10.0		SP			
5 / 16		Sand, pale yellowish brown, very fine to fine grained, faint hydrocarbon odor, wet.		15.0		SP			

Continued on next page

CEMENT APPROX 0.0ft TO 2.5ft

BENTONITE GROUT 2.5ft TO 19.5ft

DRAWN: JS

CHECKED: JWH

BOREHOLE/MONITORING WELL NAME: CMW-1 (RFI2-5C)

LOCATION & ELEVATIONS

NORTHING:

EASTING:

COORDINATE SYSTEM: Plant Coords.

TOP OF CASING ELEV.: XXXX.XX ft.

GROUND ELEV.: XXXX.XX ft.

DRILLING SUMMARY

TOTAL WELL DEPTH: 29.00 ft bgs

SURFACE MOUNT: X STICKUP:

DATE DRILLED: 11/19/99

LOGGED BY: Chuck Gay EnecoTech

DRILLING CONTRACTOR:
Geocore Services, Inc., Salina, KS.

DRILLING RIG: CME-75
DRILLING METHOD: Hollow stem auger

BOREHOLE DIAMETER: 10"

HOLLOW STEM AUGER ID: 6.25"

WATER LEVEL (btoc): NA

WELL DESIGN AND MATERIALS

CASING: 2" ID sch. 40 PVC

SCREEN: 2" ID sch. 40 PVC 0.020" machine slot
SCREENED INTERVAL: 23.00-28.00 ft bgs

FILTER PACK: 10-20 silica sand
FILTER PACK INTERVAL: 21.00-29.00 ft bgs

BENTONITE PELLETS: 2.50-19.50 ft bgs

GROUT INTERVAL 1: Benseal w/Aqua-Grout
GROUT INTERVAL 1: 19.50-21.00 ft bgs
GROUT INTERVAL 2: Cement
GROUT INTERVAL 2: 0.00-2.50 ft bgs

SAMPLING

WELL DEVELOPMENT

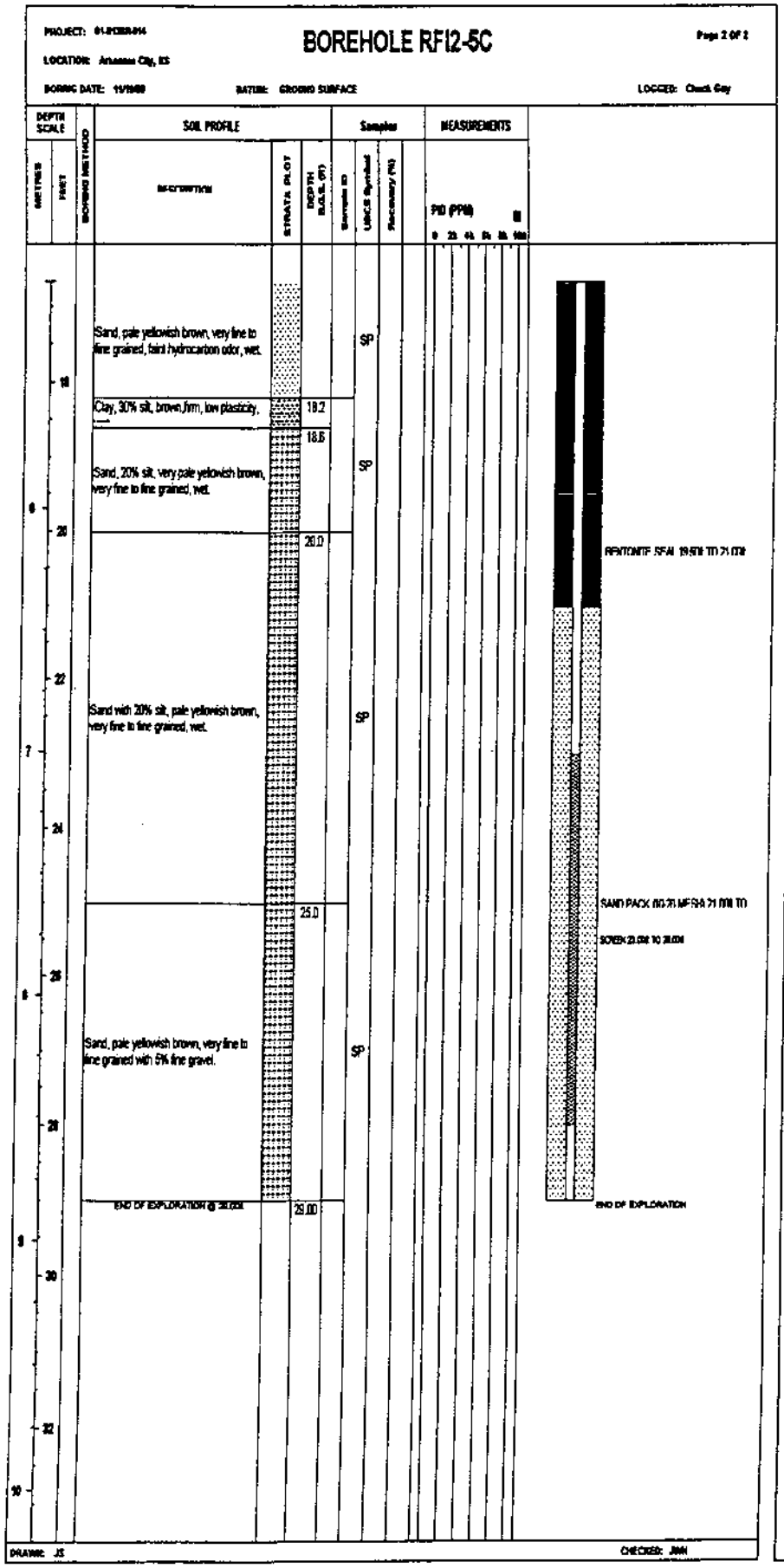
The wells were surged and pumped for approximately one hour until the water was sediment free.

COMMENTS

The stratification lines on the borehole log represent the approximate boundary between soil and rock types. The transition between these boundaries may be more gradual than depicted on this log.

Lithologic description from adjacent well RFI2-5A.

EnecoTech Inc.
1580 Lincoln Street, Suite 1000
Denver, Colorado 80203
(303) 861-2200



BOREHOLE/MONITORING WELL NAME: CMW-1 (RFI2-5C)

LOCATION & ELEVATIONS

NORTHING:

EASTING:

COORDINATE SYSTEM: Plant Coords.

TOP OF CASING ELEV.: XXXX.XX ft.

GROUND ELEV.: XXXX.XX ft.

DRILLING SUMMARY

TOTAL WELL DEPTH: 29.00 ft bgs

SURFACE MOUNT: X STICKUP:

DATE DRILLED: 11/19/99

LOGGED BY: Chuck Gay EnecoTech

DRILLING CONTRACTOR:
Geocore Services, Inc., Salina, KS.

DRILLING RIG: CME-75
DRILLING METHOD: Hollow stem auger

BOREHOLE DIAMETER: 10"

HOLLOW STEM AUGER ID: 6.25"

WATER LEVEL (btoc): NA

WELL DESIGN AND MATERIALS

CASING: 2" ID sch. 40 PVC

SCREEN: 2" ID sch. 40 PVC 0.020" machine slot
SCREENED INTERVAL: 23.00-28.00 ft bgs

FILTER PACK: 10-20 silica sand
FILTER PACK INTERVAL: 21.00-29.00 ft bgs

BENTONITE PELLETS: 2.50-19.50 ft bgs

GROUT INTERVAL 1: Benseal w/Aqua-Grout
GROUT INTERVAL 1: 19.50-21.00 ft bgs
GROUT INTERVAL 2: Cement
GROUT INTERVAL 2: 0.00-2.50 ft bgs

SAMPLING

WELL DEVELOPMENT

The wells were surged and pumped for approximately one hour until the water was sediment free.

COMMENTS

The stratification lines on the borehole log represent the approximate boundary between soil and rock types. The transition between these boundaries may be more gradual than depicted on this log.

Lithologic description from adjacent well RFI2-5A.

EnecoTech Inc.
1580 Lincoln Street, Suite 1000
Denver, Colorado 80203
(303) 861-2200

PROJECT: [illegible]

LOCATION: Arkansas City, KS

BORING DATE: 11/19/99

DATUM: GROUND SURFACE

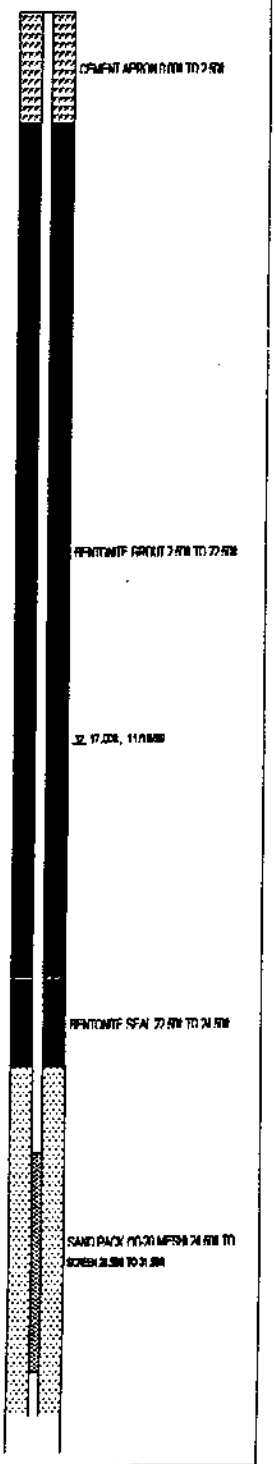
BOREHOLE CMW-2

Page 1 OF 2

LOGGED: Chuck Gay

DEPTH SCALE METRES	DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	DEPTH BLOW (m)	Samples ID	USCS Symbol	Recovery (%)	MEASUREMENTS PID (PPM)
			CONCRETE SIDEWALK						
			Sand, yellowish orange, no odor or staining, well sorted, fine grained.		0.0		SP	100	
			Sand, light gray, strong hydrocarbon odor, heavy staining, well sorted, fine grained.		4.0		SP	100	
			Sand, olive gray, strong hydrocarbon odor, heavy staing, well sorted, fine grained.		4.0		SP	100	
			Sand, olive gray, strong hydrocarbon odor, heavy staining, well sorted, fine grained.		10.0		SP	50	
			Sand, olive gray, strong hydrocarbon odor, heavy staining, well sorted, medium		12.0		SP	50	
			Sand, olive gray, strong hydrocarbon odor, heavy staining, fine grained, well sorted.		14.00		SP	50	
			Sand, olive gray, strong hydrocarbon odor, heavy staining, fine grained, well sorted.		16.0		SP	80	
			Sand, olive gray, water at approximately 17.0', heavily stained, free product present, strong hydrocarbon odor, medium grained, poorly sorted.		18.0		SP	80	
			Sand, olive gray, strong hydrocarbon odor, free product present, fine grained, well sorted.		19.0		SW	80	
			Sand, olive gray, moderate hydrocarbon odor and staing, fine grained, well sorted.		20.0		SW	80	
			Sand, olive gray, slight odor and staining, fine grained, well sorted.		26.0		SW	50	
			Sand, olive gray, fine grained, well sorted, slight hydrocarbon odor and staining.		30.0		SW	40	

Continued on next page



DRAWN: JS

CHECKED: JMH

BOREHOLE/MONITORING WELL NAME: CMW-2

LOCATION & ELEVATIONS

NORTHING:

EASTING:

COORDINATE SYSTEM: Plant Coords.

TOP OF CASING ELEV.: XXXX.XX ft.

GROUND ELEV.: XXXX.XX ft.

DRILLING SUMMARY

TOTAL WELL DEPTH: 32.50 ft bgs

SURFACE MOUNT: STICKUP:

DATE DRILLED: 11/19/99

LOGGED BY: Chuck Gay EnecoTech

DRILLING CONTRACTOR:
Geocore Services, Inc., Salina, KS.

DRILLING RIG: CME-75
DRILLING METHOD: Hollow stem auger

BOREHOLE DIAMETER: 10"

HOLLOW STEM AUGER ID:
PILOT BOREHOLE: 4.25"
REAMED BOREHOLE: 6.25"

WATER LEVEL (btoc): NA

WELL DESIGN AND MATERIALS

CASING: 2" ID sch. 40 PVC

SCREEN: 2" ID sch. 40 PVC 0.020" machine slot
SCREENED INTERVAL: 26.50-31.50 ft bg.

FILTER PACK: 10-20 silica sand
FILTER PACK INTERVAL: 24.50-32.50 ft bgs

BENTONITE PELLETS: 2.50-22.50 ft bgs

GROUT INTERVAL 1: Benseal w/Aqua-Grout
GROUT INTERVAL 1: 22.50-24.50 ft bgs
GROUT INTERVAL 2: Cement
GROUT INTERVAL 2: 0.00-2.50 ft bgs

SAMPLING

The borehole was sampled continuously with a 5-foot sampler. Percent recoveries and sample intervals are noted on the borehole log diagram.

WELL DEVELOPMENT

The wells were surged and pumped for approximately one hour until the water was sediment free.

COMMENTS

The stratification lines on the borehole log represent the approximate boundary between soil and rock types. The transition between these boundaries may be more gradual than depicted on this log.

Borehole below bottom of screen pugged with bentonite.

EnecoTech Inc.
1580 Lincoln Street, Suite 1000
Denver, Colorado 80203
(303) 861-2200

PROJECT: [illegible]

LOCATION: Arkansas City, KS

BORING DATE: [illegible]

BOREHOLE CMW-2

Page 1 of 2

DATUM: GROUND SURFACE

LOGGER: Chuck Gay

DEPTH SCALE METRES	DEPTH SCALE FEET	SOIL PROFILE DESCRIPTION	STRATA PLOT	DEPTH BLOW (m)	Sample ID	USCS Symbol	Recovery (%)	MEASUREMENTS PID (PPM) 0 200 400 600 800 1000
		Sand, olive gray, fine grained, well sorted, slight hydrocarbon odor and staining.				SW	40	
		Sand, olive gray, fine grained, well sorted, very slight hydrocarbon odor.		26 ft		SW	20	
		Sand, olive gray, medium grained, well sorted, very slight hydrocarbon odor.		30 ft		SW	20	
		Shale.		32 ft				
		END OF EXPLORATION @ 40.00ft		40 ft				

END OF EXPLORATION

DRAWN: JS

CHECKED: JMK

BOREHOLE/MONITORING WELL NAME: CMW-2

LOCATION & ELEVATIONS

NORTHING:

EASTING:

COORDINATE SYSTEM: Plant Coords.

TOP OF CASING ELEV.: XXXX.XX ft.

GROUND ELEV.: XXXX.XX ft.

DRILLING SUMMARY

TOTAL WELL DEPTH: 32.50 ft bgs

SURFACE MOUNT: STICKUP:

DATE DRILLED: 11/19/99

LOGGED BY: Chuck Gay EnecoTech

DRILLING CONTRACTOR:
Geocore Services, Inc., Salina, KS.

DRILLING RIG: CME-75
DRILLING METHOD: Hollow stem auger

BOREHOLE DIAMETER: 10"

HOLLOW STEM AUGER ID:
PILOT BOREHOLE: 4.25"
REAMED BOREHOLE: 6.25"

WATER LEVEL (btoc): NA

WELL DESIGN AND MATERIALS

CASING: 2" ID sch. 40 PVC

SCREEN: 2" ID sch. 40 PVC 0.020" machine slot
SCREENED INTERVAL: 26.50-31.50 ft bgs

FILTER PACK: 10-20 silica sand
FILTER PACK INTERVAL: 24.50-32.50 ft bgs

BENTONITE PELLETS: 2.50-22.50 ft bgs

GROUT INTERVAL 1: Bensesl w/Aqua-Grout
GROUT INTERVAL 1: 22.50-24.50 ft bgs
GROUT INTERVAL 2: Cement
GROUT INTERVAL 2: 0.00-2.50 ft bgs

SAMPLING

The borehole was sampled continuously with a 5-foot sampler. Percent recoveries and sample intervals are noted on the borehole log diagram.

WELL DEVELOPMENT

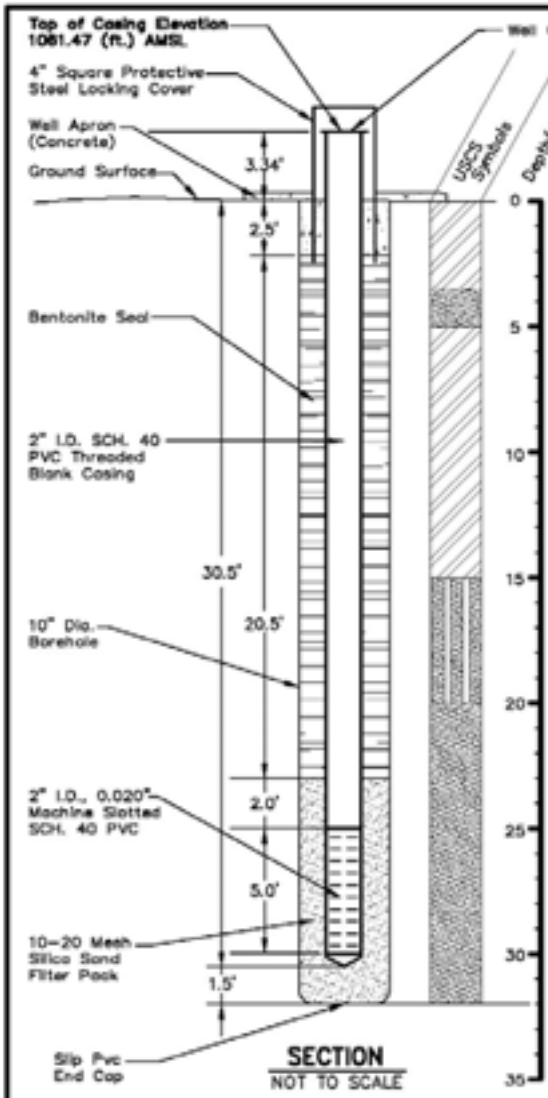
The wells were surged and pumped for approximately one hour until the water was sediment free.

COMMENTS

The stratification lines on the borehole log represent the approximate boundary between soil and rock types. The transition between these boundaries may be more gradual than depicted on this log.

Borehole below bottom of screen pugged with bentonite.

EnecoTech Inc.
1580 Lincoln Street, Suite 1000
Denver, Colorado 80203
(303) 861-2200



COMMENTS

The stratification lines on the borehole log represent the approximate boundary between soil and rock types. The transition between these boundaries may be more gradual than depicted on this log.

PID Reading (ppm)	Classification USCS	Depth (ft.)	Lithology/Remarks
0	CL	0–3.5ft.	Clayey Silt, Dark Brown, Moist, Slight Plasticity, Some Fine Sand, No Odor
	SP	3.5–5.0ft.	Sand, Brown, Very Fine to Fine Grained, Moist, No Odor
0	CL	5.0– 15.0ft.	Silty Clay, Brown, Moist, Medium to High Plasticity, No Odor
0	SM	15.0–20.0ft.	Silty Sand, Dark Grayish Brown, Moist, Cohesive, Fine to Very Coarse Grained, Slight Weathered Hydrocarbon Odor
0	SP	20.0–32.0ft.	Sand, Brown, Some Silt, Medium to Very Coarse Grained with Small Gravel, Wet, Well Graded, Poorly Sorted, Subrounded to Angular, Weathered Hydrocarbon Odor to No Odor

End of Boring @ 32.0 ft. BGS

BUILT BY: GEOCORE SERVICES, INC.
DATE COMPLETED: 4/13/08

DATE	DRAWN BY	CHECKED BY	REVISED BY
04/08	JTW	LKD	JTW

LOCATION (Plant Coordinates)

NORTHING -963.380 (ft.)
EASTING 2595.681 (ft.)

ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (AMSL)

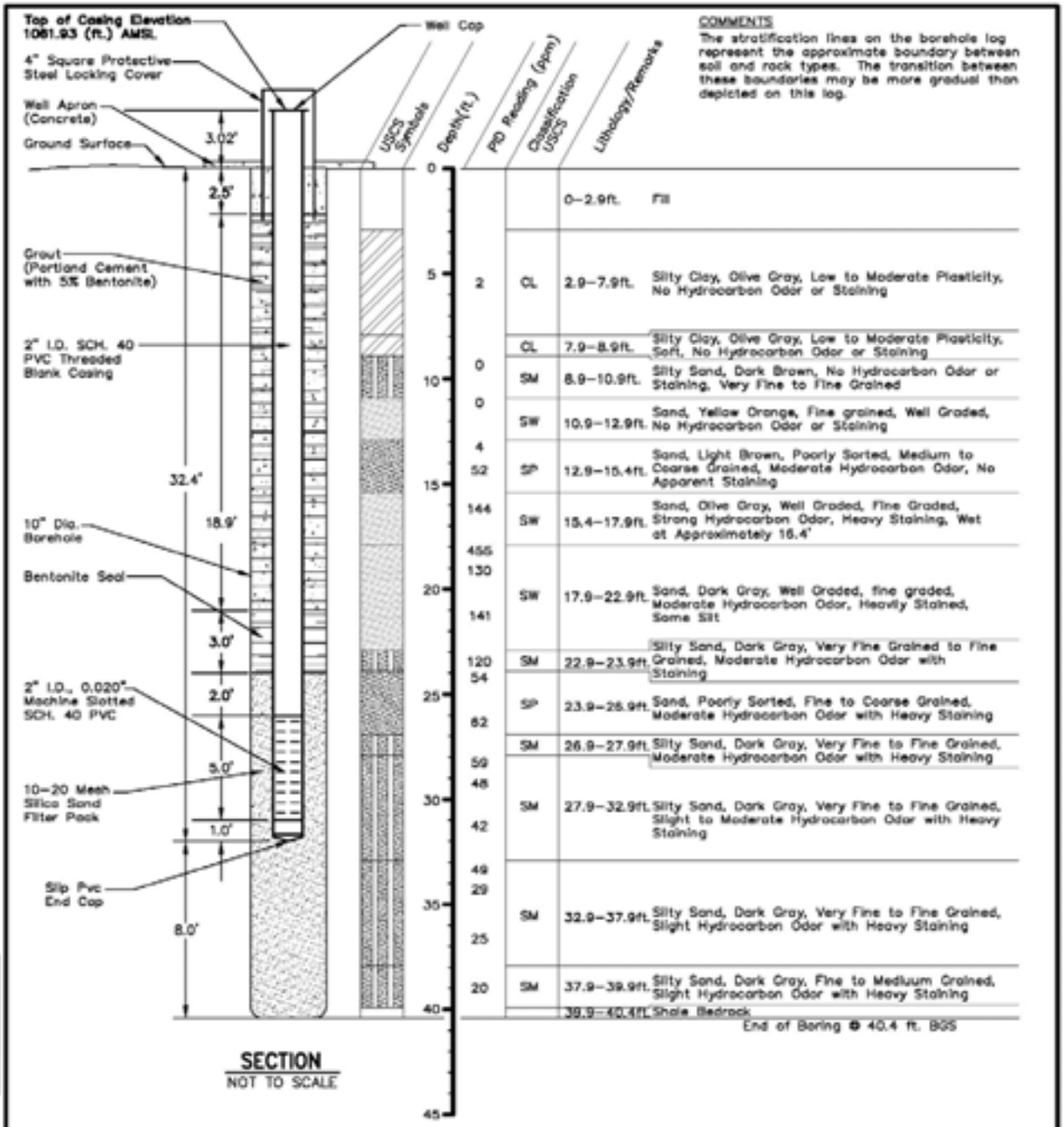
NOTE: PVC CASING CONNECTIONS ARE THREADED AND FLUSH JOINTED

MONITORING WELL
CMW-03
CONSTRUCTION DIAGRAM

PROJECT: ARKANSAS CITY, KANSAS
MICHIGAN REUTILIZATION, LLC.

MWH

Figure No.:



COMMENTS

The stratification lines on the borehole log represent the approximate boundary between soil and rock types. The transition between these boundaries may be more gradual than depicted on this log.

BUILT BY: GEOCORE SERVICES, INC.
DATE COMPLETED: 4/13/06

DATE	DRAWN BY	CHECKED BY	REVISED BY
06/06	JTW	LKD	JTW

LOCATION (Plant Coordinates)

NORTHING -1128.715 (ft.)
EASTING 2770.582 (ft.)

ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (AMSL)

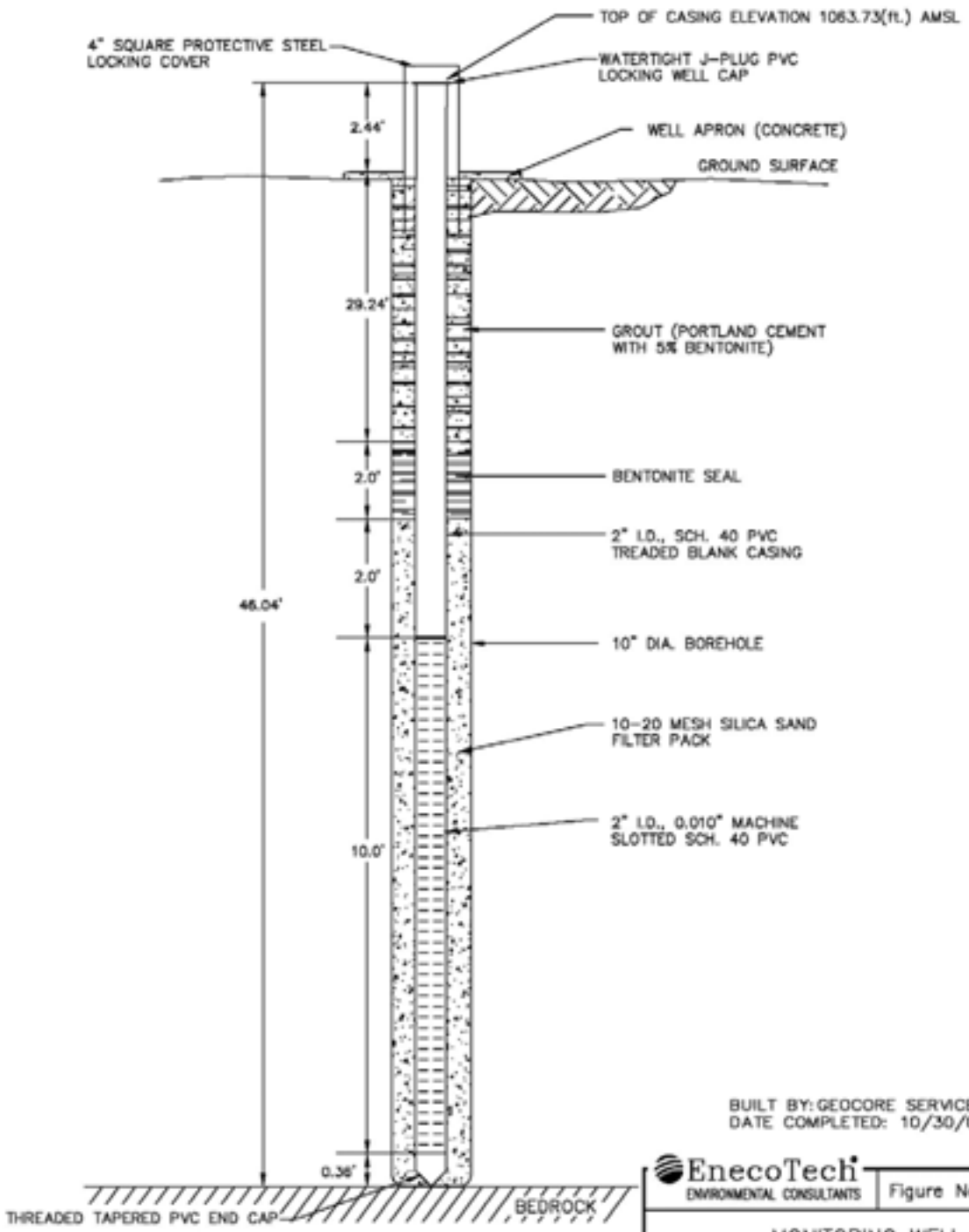
NOTE: PVC CASING CONNECTIONS ARE THREADED AND FLUSH JOINTED

MONITORING WELL
CMW-04
CONSTRUCTION DIAGRAM

PROJECT: ARKANSAS CITY, KANSAS
MICHIGAN REUTILIZATION, LLC.

MWH

Figure No.:



SECTION
NOT TO SCALE

BUILT BY: GEOCORE SERVICES, INC.
DATE COMPLETED: 10/30/01

LOCATION (Plant Coordinates)

NORTHING -647.635(ft.)
EASTING 2054.371(ft.)

ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (AMSL)

NOTE: PVC CASING CONNECTIONS ARE THREADED AND FLUSH JOINTED

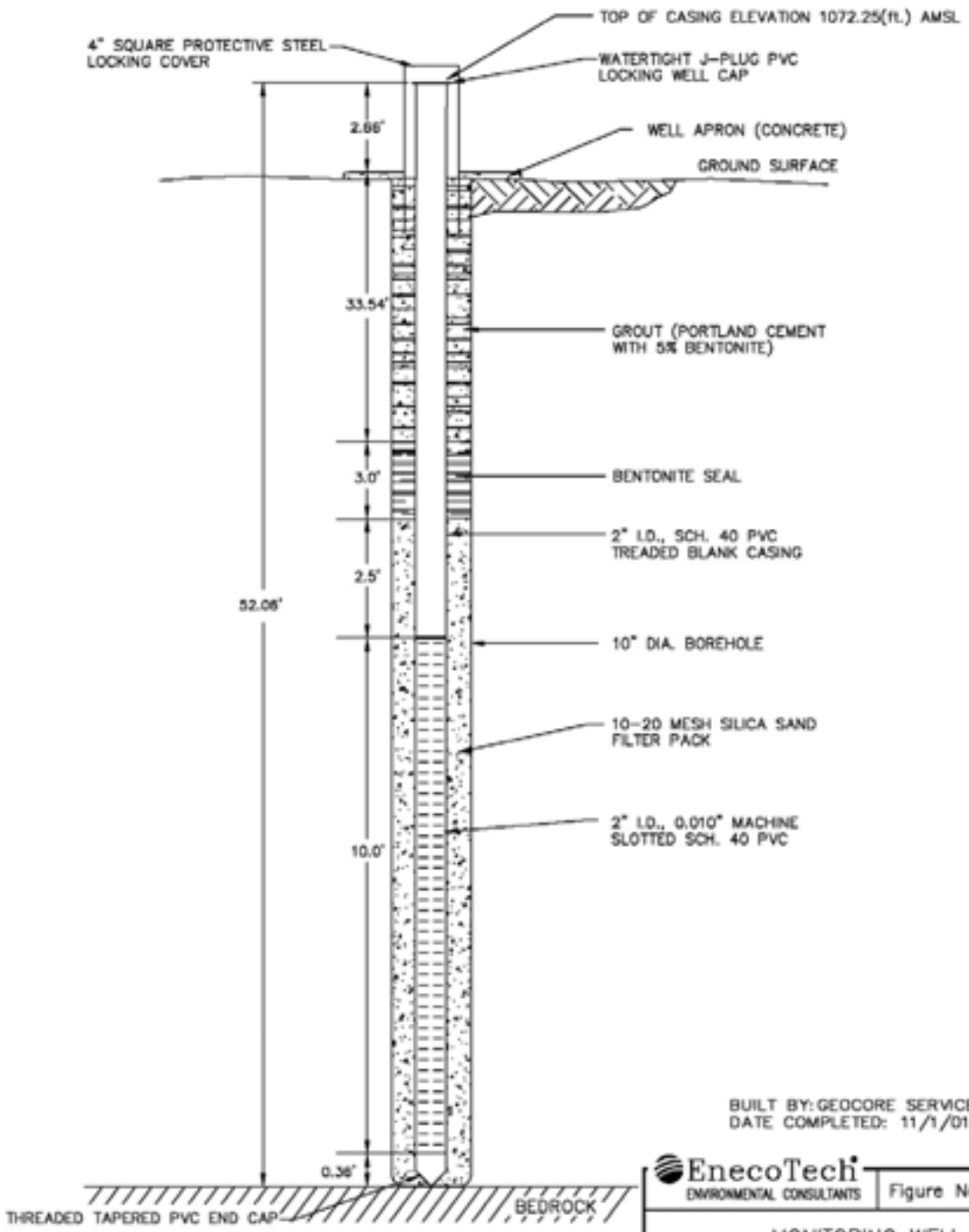
EnecoTech
ENVIRONMENTAL CONSULTANTS

Figure No.:

MONITORING WELL
RCRA-7
CONSTRUCTION DIAGRAM

PROJECT: TPI PETROLEUM INC. - ARKANSAS CITY REFINERY

1301-014	DESIGNED BY: JFW	APPROVED BY: JFW	
15-RCRA_7	DRAWN BY: LKB	DATE: 1/15/02	REV.



SECTION
NOT TO SCALE

BUILT BY: GEOCORE SERVICES, INC.
DATE COMPLETED: 11/1/01

LOCATION (Plant Coordinates)

NORTHING -770.862(ft.)
EASTING 2162.007(ft.)

ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (AMSL)

NOTE: PVC CASING CONNECTIONS ARE THREADED AND FLUSH JOINTED

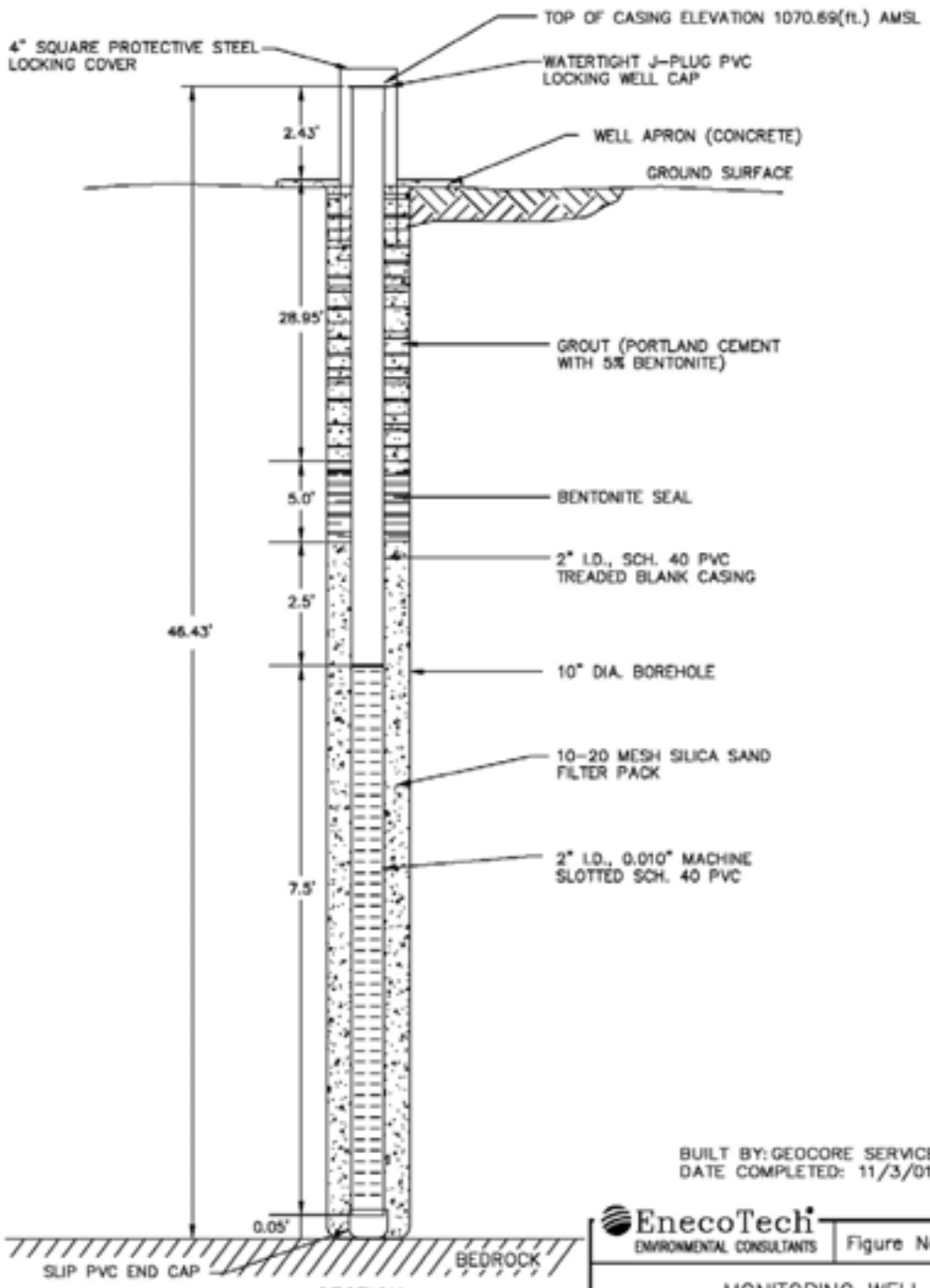
EnecoTech
ENVIRONMENTAL CONSULTANTS

Figure No.:

MONITORING WELL
113
CONSTRUCTION DIAGRAM

PROJECT: TPI PETROLEUM INC. - ARKANSAS CITY REFINERY

1301-014	DESIGNED BY: JFW	APPROVED BY: JFW	
18-113	DRAWN BY: LKB	DATE: 1/15/02	REV.



SECTION
NOT TO SCALE

BUILT BY: GEOCORE SERVICES, INC.
DATE COMPLETED: 11/3/01

LOCATION (Plant Coordinates)

NORTHING -1059.369(ft.)
EASTING 2453.611(ft.)

ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (AMSL)

NOTE: PVC CASING CONNECTIONS ARE THREADED AND FLUSH JOINTED

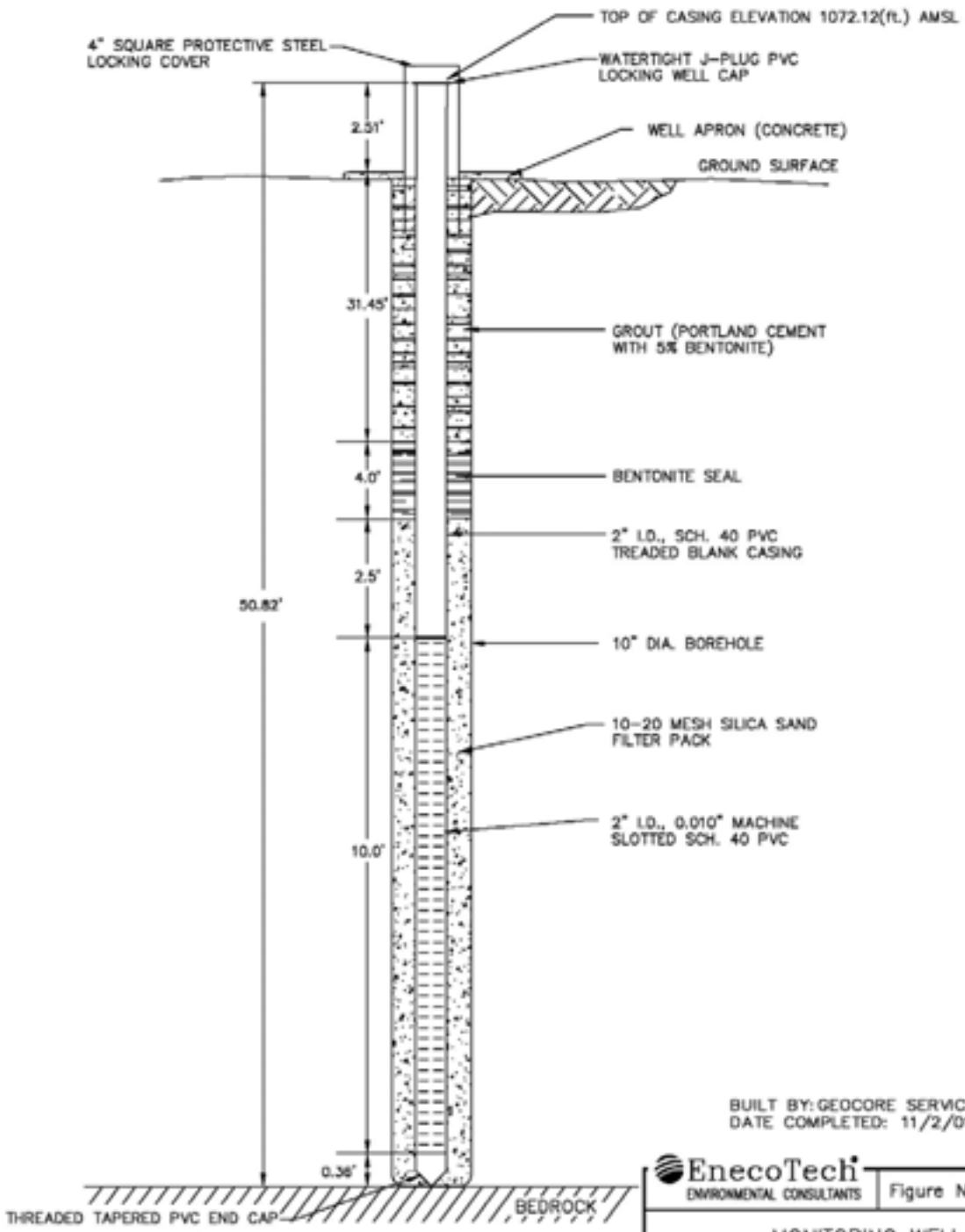
EnecoTech
ENVIRONMENTAL CONSULTANTS

Figure No.:

MONITORING WELL
118
CONSTRUCTION DIAGRAM

PROJECT: TPI PETROLEUM INC. - ARKANSAS CITY REFINERY

1001-016	DESIGNED BY: JFW	APPROVED BY: JFW	
18-118	DRAWN BY: LKB	DATE: 1/15/02	REV.



SECTION
NOT TO SCALE

BUILT BY: GEOCORE SERVICES, INC.
DATE COMPLETED: 11/2/01

LOCATION (Plant Coordinates)

NORTHING -1169.513(ft.)
EASTING 2699.092(ft.)

ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL (AMSL)

NOTE: PVC CASING CONNECTIONS ARE THREADED AND FLUSH JOINTED

EnecoTech
ENVIRONMENTAL CONSULTANTS

Figure No.:

MONITORING WELL
MW-1002
CONSTRUCTION DIAGRAM

PROJECT: TPI PETROLEUM INC. - ARKANSAS CITY REFINERY

1301-014	DESIGNED BY: JFW	APPROVED BY: JFW	
15-MW_1002	DRAWN BY: LKB	DATE: 1/15/02	REV.

APPENDIX B

Field Instrument Manuals

Maintenance Guide

For the H.01L and Sm.Oil Oil / Water Interface Meters

This interface is designed to measure the thickness of floating product (L.N.A.P.L.). It will also detect and measure sinking layers of L.N.A.P.L.s.

This instrument has been designed and built to give years of reliable and accurate use.

Please follow the simple guidelines given in this booklet for the best performance from your unit.

Signals indicate the following:
The continuous tone and light indicates product (hydrocarbon). Intermittent tone and light indicates water.

General Hints

Cold Weather

In cold weather condensation will form on the lens as it enters the well and contacts the warmer moist air in the well. This causes the unit to sound as product. To overcome this allow the probe to acclimatize in the well or lower the probe into the water, the n take readings.

A dirty or scratched probe lens aggravates this problem.

Removing The Probe

This requires two wrenches - a 1/2"AF and 9/16"AF. When the knurled nut has been loosened the link may be still tight in the probe. Gently separate the link from the probe by hand. Care must be taken to avoid either breaking the wires while removing the probe or crimping the wire while replacing the probe.

Do...

- Avoid sharp edged casing
- Avoid entanglement with other equipment in boreholes and wells.
- Clean and dry probe after use
- Rewind tape onto reel after each use

Warranty is conditional upon adherence to these guide lines.

Do Not...

- Do not use to plumb borehole depths
- Do not use as guide to backfilling with sand etc. Instrument may get locked in sand.

Remember to...

- CLEAN THE UNIT AFTER USE
- AVOID SCRATCHING THE LENS
- HANG THE UNIT ON THE CASING WHERE POSSIBLE, AND RUN THE TAPE OVER THE FRAME LEG. THIS PROTECTS THE TAPE AGAINST CUTS AND NICKS
- THIS IS A TOOL TO HELP YOU TO DO YOUR JOB WELL. TREAT IT PROPERLY AND IT WILL NOT LET YOU DOWN

IF YOU HAVE ANY OTHER QUESTIONS OR COMMENTS
CALL 1-800-331-2032 OR YOUR SUPPLIER.

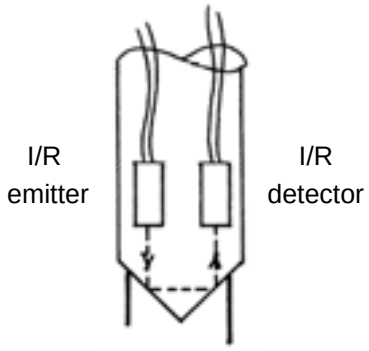
Tips For Using The Oil/Water Interface Meter

THE WAY IT WORKS

IN AIR the infrared emitter sends out an I/R beam inside a 45 degree prism.

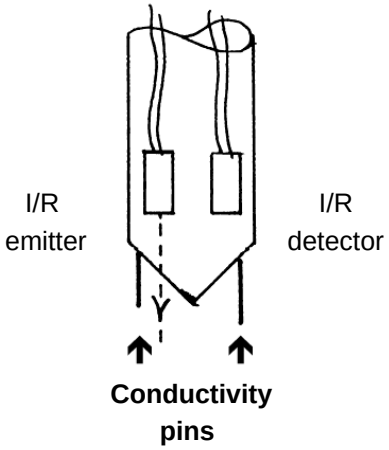
The I/R beam reflects off the internal face of the prism to the opposite face, which then reflects the beam to the detector.

In this state the instrument is silent.



IN FLUIDS which are denser than air, the SNELL principle operates.
The I/R beam is not reflected internally, but exits the prism. The detector does not detect the I/R beam.

In this state the instrument is emitts a tone and the red light is on.
At the same time the two conductivity probes are testing for conductivity.
If the fluid does not conduct electricity, the sound tone and light are solid (product) If the fluid does conduct electricity, the tone is intermittent (water).



Care of Reel

Remove electronic front panel before wash down.

Reel may be cleaned with the following:

Aliphatics: Hexane, Heptane, White Kerosene, Mineral Spirits

Alcohols: Methyl, Isopropyl, Isobutyl
1 + 3 Denatured Alcohol

Halogenated Hydrocarbons: Freons TF + TE

Others: Soap solution Naptha Alconox 10%, Fantastic®, Windex®, Joy®, Top Job®, Mr. Clean®, Formula 409®.

® Registered Trade Marks

Care of Tape and Probe

Tape and Probe may be cleaned and de-greased with the following:

Alcohols: Hexane, Heptane

Aliphatics: Hexane, Heptane, White Kerosene, Mineral Spirits

Halogenated Hydrocarbons: Fully Halogenated Freon

Others: Soap Solution, Naptha Alconox 10%, Joy detergent® 10%, Lestoil®

Do Not clean with abrasives.

The Probe lens is made from an Amorphous Thermoplastic, highly resistant to many chemicals, however, contact with the following should be avoided or approached with caution:

Chloroform I.I.2. Cresol, Iodine, Oleum, Resorcinol

Partially Halogenated Hydrocarbons such as Methylene Chloride, Phenol (saturated solution) should be approached with care. Exposure to any of the above causes damage to the instrument

English

INSTRUCTIONS

PRESS BUTTON = METER ON FOR 4 MINUTES
GREEN LIGHT ON = METER ACTIVE - BATTERY GOOD
GREEN LIGHT OFF = METER OFF OR BATTERY NO GOOD

INTERFACE METER

GROUND METER WITH LEAD PROVIDED
OIL STEADY LIGHTS AND BUZZER TONE
TAKE MEASUREMENTS GOING THROUGH THE OIL INTO THE WATER, THEN BACK FROM THE WATER INTO THE OIL - REPEAT TO GET CONSTANT READING

AFTER USE

REMOVE EXCESS MOISTURE
CLEAN PROBE AND TAPE WITH SOAP AND WATER

• DO NOT USE ABRASIVES OR SOLVENTS •
PROTECT AND MAINTAIN POLISHED PROBE TIP FOR TOTAL WASHDOWN - REMOVE ELECTRONIC PANEL FROM REEL. DO NOT WASH ELECTRONICS. DRY REEL AND REPLACE ELECTRONIC PANEL.

Spanish

INSTRUCCIONES

OPRIMA EL BOTON = MEDIDOR EN MARCHA DURANTE 4 MINUTOS
LUZ VERDE ENCENDIDA = MEDIDOR EN MARCHA - BATERIA EN BUEN ESTADO
LUZ VERDE APAGADA = MEDIDOR DETENIDO - BATERIA AGOTADA

MEDIDOR DE INTERFAZ

PONGA EL MEDIDOR A TIERRA CON EL CONDUCTOR PROVISTO
PETROLEO = LUCES Y ALARMA SONORA PERMANENTES
AGUA = LUCES Y ALARMA SONARA INTERMITENTES
TOME LAS MEDIDAS PASANDO DEL PETROLEO AL AGUA, LUEGO DEL AGUA AL PETROLEO - REPITA PARA OBTENER LECTURAS CONSTANTES.

DESPUES DEL USO

ELIMINAR EL EXCESO DE HUMEDAD
LIMPIAR LA SONDA Y CINTA CON AGUA JABONOSA
*** NO USAR ABRASIVOS NI SOLVENTES ***
PROTEGER Y MANTENER LIMPIA LA PUNTA DE LA SONDA

PARA LIMPIEZA TOTAL - SACAR EL PANEL ELECTRONICO DEL CARRETE. NO LAVE LOS DISPOSITIVOS ELECTRONICOS. SECAR EL CARRETE Y VOLVER A COLOCAR EL PANEL ELECTRONICO.

French

INSTRUCTIONS

APPUYER SUR LE BOUTON = APPAREIL DE MESURE EN MARCHE PENDANT 4 MINUTES.
TÉMOIN VERT ALLUMÉ = APPAREIL DE MESURE EN MARCHE - PILE EN BON ÉTAT.
TÉMOIN VERT ÉTEINT = APPAREIL À L'ARRÊT OU PILE MAUVAISE.

APPAREIL DE MESURE-INTERFACE

METTRE L'APPAREIL À LA TERRE À L'AIDE DU CONDUCTEUR FOURNI.
PÉTROLE = TÉMOIN ET AVERTISSEUR CONTINUELLEMENT ALLUMÉS.
EAU = TÉMOIN ET AVERTISSEUR ALLUMÉS PAR INTERMITTENCE.
PRENDRE DES MESURES EN PASSANT DU PÉTROLE À L'EAU, PUIS DE L'EAU AU PÉTROLE. RÉPÉTER POUR OBTENIR UNE LECTURE UNIFORME.

APRÈS USAGE

ENLEVER L'EXCÈS D'HUMIDITÉ.
NETTOYER LA SONDE ET LE RUBAN AVEC UNE SOLUTION D'EAU SAVONNEUSE.
*** NE PAS UTILISER DE SOLVANT NI DE PRODUIT ABRASIF. ***
PROTÉGER ET GARDER LA POINTE DE LA SONDE BIEN PROPRE.
POUR UN NETTOYAGE TOTAL - ENLEVER LE PANNEAU ÉLECTRONIQUE DU DÉVIDOIR. NE PAS NETTOYER LES ÉLÉMENTS ÉLECTRONIQUES. SÉCHER LE DÉVIDOIR ET REMETTRE LE PANNEAU ÉLECTRONIQUE.

German

BEDIENUNGSANLEITUNG

KNOPF DRÜCKEN = MESSGERÄT IST 4 MINUTEN AN
GRÜNES LICHT AN = MESSGERÄT AKTIV - BATTERIE GUT
GRÜNES LICHT AUS = MESSGERÄT AUS ODER SCHLECHTE BATTERIE

SCHNITTSTELLEN-MESSER

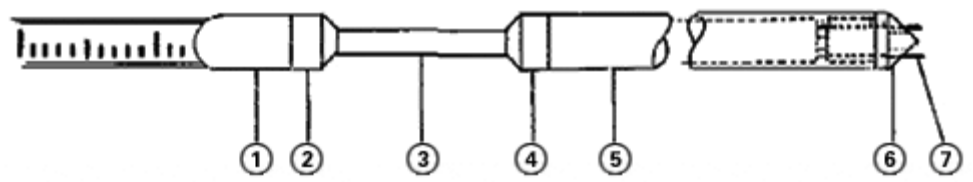
ERDSCHLUSS-MESSGERÄT MIT MITGELIEFERTEM ANSCHLUSSDRAHT.
Ö L = ANHALTENDES AUFLEUCHTEN DER LAMPEN UND SUMMERTON
WASSER = INTERMITTIERENDES AUFLEUCHTEN DER LAMPEN UND SUMMERTON

NEHMEN SIE MESSUNGEN VOR, INDEM SIE DURCHS ÖL INS WASSER STOSSEN, DANN ZURÜCK VOM WASSER INS ÖL. UM KONSTANTE ABLESUNGEN ZU ERZIELEN, MÜSSEN SIE DIESES VERFAHREN WIEDERHOLEN.

NACH GEBRAUCH

Ü BERSCHÜSSIGE FEUCHTIGKEIT ENTFERNEN.
MESS-SONDE UND BAND MIT SEIFE UND WASSER SÄUBERN.
*** KEINE SCHEUER-ODER LÖSUNGSMITTEL ANWENDEN ***
DIE POLIERTE SONDENPRÜFSPITZE MUSS GESCHUTZT UND GEGEWARTET WERDEN.
ZUR KOMPLETTEN WASCHUNG MUSS DIE ELEKTRONIKTAFEL VON DER SPULE ABMONTIERT WERDEN. NICHT DIE ELEKTRONIK WASCHEN! DIE SPULE TROCKNEN UND DIE ELEKTRONIKTAFEL WIEDER ANMONTIEREN.

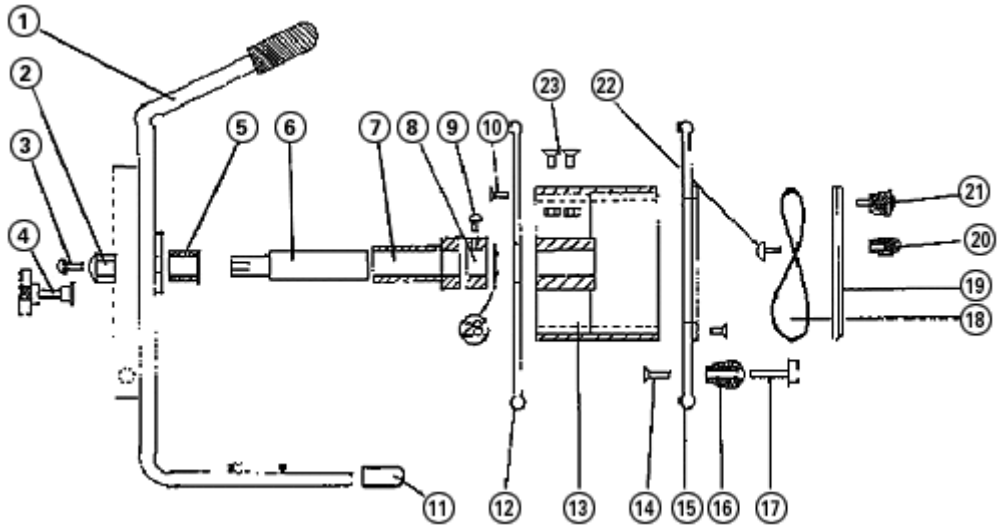
Probe Electronics

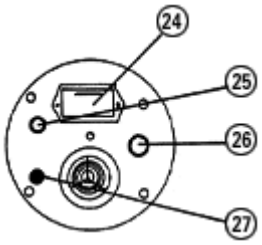


1 0100-41	Tape Connector	**5** 0100-35/43	Probe Body
2 0100-34	Link/Tape Connector	**6** 0100-38 (WLM)-36(1/F)	1/F Lens.WLM Tip.
3 0100-42	Link	**7** 0100-39	Conductivity Pins
4 0100-40	Link/Probe Connector	**8** 0100-45/44	Reel Electronics

Note: Items 1 to 8 are servicable only by supplier.

Reel Electronics





1 01001A1B	Frame	**15** 0100-3	Front Plate
2 0100-9	Nut	**16** 0100-5	Cranking Handle
3 0100-23	Screw	**17** 0100-11	Spindle
4 0100-6/24	Brake	**18** 0100-18	O Ring
5 0100-18	Spacer	**19** 0100-56	Electric Disk
6 0100-8	Shaft	**20** 0100-54	Disk Handle
7 0100-13	Bearing	**21** 0100-55/68	Disk Retaining Knob
8 0100-15	Ground Ring	**22** 0100-71	Screw

9	0100-62	Screw	**23**	0100-59/60	Tape Screws
10	0100-20	Screw	**24**	0100-53	Battery Holder
11	0100-7	Frame Boot	**25**	0100-48/49	Battery L.E.D.
12	0100-2	Rear Plate	**26**	0100-46/47	Oil/Water L.E.D.
13	0100-4	Hub	**27**	0100-50/51	On/Off Button
14	0100-12	Screw	**28**	0100-14	Bearing Retainer

Home Page **Close Window** **Print This Page**

CAT. NO. 46500-88

PORTABLE TURBIDIMETER

Model 2100P

Instrument and Procedure Manual

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CERTIFICATION

Hach Company certifies this instrument was tested thoroughly, inspected and found to meet its published specifications when it was shipped from the factory.

The Model 2100P Portable Turbidimeter has been tested and is certified as indicated to the following instrumentation standards:

Product Safety

Battery/Eliminator Power Supply Only:
120 Vac, 60 Hz, UL Listed & CSA Certified, Class 2
230 Vac, 50 Hz, VDE Approved, GS & CE marked

Immunity

2100P Turbidimeter Tested with external Battery/Eliminator Power Supply:
EN 50082-1 (European Generic Immunity Standard) **per 89/336/EEC EMC:** Supporting test records with Dash Straus and Goodhue, Inc. (now Intertek Testing Services), certified compliance by Hach Company.

Standards include:
IEC 801-2 Electro-Static Discharge
IEC 801-3 Radiated RF Electro-Magnetic Fields
IEC 801-4 Electrical Fast Transients/Burst

Emissions

2100P Turbidimeter Tested with external Battery/Eliminator Power Supply:
EN 50081-1 (Emissions) **per 89/336/EEC EMC:** Supporting test records by Amador Corp. (now TUV Product Services), certified compliance by Hach Company

Standards include:
EN 55022 (CISPR 22) Emissions, Class B Limits

Canadian Radio Interference-Causing Regulation, Chapter 1374, Class A: Supporting test records by Amador Corp. (now TUV Product Services), certified compliance by Hach Company

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

CERTIFICATION, continued

FCC Part 15, Class "A" Limits: Supporting test records by Amador Corp. (now TUV Product Services), certified compliance by Hach Company.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. this device may not cause harmful interference, and
2. this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area may cause harmful interference in which case the user will be required to correct the interference at his own expense.

The following techniques of reducing interference problems are applied easily:

1. Disconnect the battery eliminator from it's power source and from the 2100P Portable Turbidimeter to verify if it is the source of the interference
2. If the battery eliminator for the 2100P Portable Turbidimeter is plugged into the same outlet as the device with which it is interfering, try another outlet.
3. Move the 2100P Portable Turbidimeter away from the device receiving the interference.
4. Reposition the receiving antenna for the device receiving the interference.
5. Try combinations of the above.

SAFETY PRECAUTIONS

Please read this entire manual before unpacking, setting up, or operating this instrument. Pay particular attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that which is specified in this manual.

Use of Hazard Information

If multiple hazards exist, this manual will use the signal word (Danger, Caution, Note) corresponding to the greatest hazard.

DANGER
Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION
Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTE
Information that requires special emphasis.

Precautionary Labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed.

⚠ This symbol, if noted on the instrument, references the instruction manual for operational and/or safety information.

SPECIFICATIONS

Specifications subject to change without notice.
Operating specifications applicable at 25 °C unless noted.
Program software copyrighted by Hach Company, 1991.

Measurement Method: Ratio Nephelometric signal (90°) scatter light ratio to transmitted light

Range: 0-1000 NTU with automatic decimal point placement or manual range selection of 0-9.99, 0-99.9 and 0-1000 NTU

Accuracy: ± 2% of reading plus stray light from 0-1000 NTU

Resolution: 0.01 NTU on lowest range

Repeatability: ±1% of reading or 0.01 NTU, whichever is greater (with Gelex standards)

Response Time: 6 seconds for full step change without signal averaging in constant reading mode

Stray Light: <0.02 NTU

Standardization: StablCal® Stabilized Formazin primary standards or Formazin primary standards

Secondary Standards: Gelex® Secondary Standards

Display: Four-digit liquid crystal; 10.16 mm (0.4 in) high digits with custom icons

Light Source: Tungsten filament lamp; lamp life typically greater than 100,000 readings

Detectors: Silicon photovoltaic

Signal Averaging: Operator selectable on or off

Sample Cells: (Height X width) 60.0 X 25 mm (2.36 X 1 in)
Borosilicate glass with screw caps, marking band and fill line

Sample Required: 15 mL (0.5 oz.)

Storage Temperature: -40 to 60 °C (-40 to 140 °F) (instrument only)

SPECIFICATIONS, continued

Operating Temperature: 0 to 50 °C (32 to 122 °F) (instrument only)

Operating Humidity Range: 0 to 90% RH noncondensing at 30 °C;
0 to 80% RH noncondensing at 40 °C;
0 to 70% RH noncondensing at 50 °C

Power Requirements: Four AA Alkaline cells or optional battery eliminator

Battery Life: Typically 300 tests with signal average mode off;
180 tests with signal average mode on

Battery Eliminator (optional):

For 120 V eliminator: CSA and UL approved for 120 VAC ±10%, 60 Hz, 6 V at 800 mA DC output

For 230 V eliminator: CE (VDE) approval pending for 230 VAC ±10%, 50 Hz, 6 V at 900 mA DC output

Enclosure: High impact ABS plastic

Dimensions: 22.2 X 9.5 X 7.9 cm (8.75 X 3.75 X 3.12 in)

Instrument Weight: 520 kg (1 lb 2.5 oz)

Shipping Weight: 3.1 kg (6 lbs 8.5 oz)

OPERATION

DANGER

Handling chemical samples, standards, and reagents can be dangerous. Review the necessary Material Safety Data Sheets and become familiar with all safety procedures before handling any chemicals.

DANGER

La manipulation des échantillons chimiques, étalons et réactifs peut être dangereuse. Lire les Fiches de Données de Sécurité des Produits (FDSP) et se familiariser avec toutes les procédures de sécurité avant de manipuler tous les produits chimiques.

PELIGRO

La manipulación de muestras químicas, estándares y reactivos puede ser peligrosa. Revise las fichas de seguridad de materiales y familiarícese con los procedimientos de seguridad antes de manipular productos químicos.

GEFAHR

Das Arbeiten mit chemischen Proben, Standards und Reagenzien ist mit Gefahren verbunden. Es wird dem Benutzer dieser Produkte empfohlen, sich vor der Arbeit mit sicheren Verfahrensweisen und dem richtigen Gebrauch der Chemikalien vertraut zu machen und alle entsprechenden Materialsicherheitsdatenblätter aufmerksam zu lesen.

PERIGO

A manipulação de amostras, padrões e reagentes químicos pode ser perigosa. Reveja a folha dos dados de segurança do material e familiarize-se com todos os procedimentos de segurança antes de manipular quaisquer produtos químicos.

PERICOLO

La manipolazione di campioni, standard e reattivi chimici può essere pericolosa. La preghiamo di prendere conoscenza delle Schede Techniche necessarie legate alla Sicurezza dei Materiali e di abituarsi con tutte le procedure di sicurezza prima di manipolare ogni prodotto chimico.

SECTION 1 DESCRIPTION

1.1 General Description

The Hach Model 2100P Portable Turbidimeter (*Figure 1*) measures turbidity from 0.01 to 1000 NTU in automatic range mode with automatic decimal point placement. The manual range mode measures turbidity in three ranges: 0.01 to 9.99, 10 to 99.9 and 100 to 1000 NTU. Designed primarily for field use, the microprocessor-based Model 2100P has the range, accuracy, and resolution of many laboratory instruments. The instrument operates on four AA batteries or with an optional battery eliminator. Rechargeable nickel-cadmium cells may be used, but cannot be recharged in the instrument. The instrument automatically shuts off after 5.5 minutes if no keystrokes occur (does not influence operation). If this occurs, simply turn the instrument on – the 2100P will resume operation as if the power had not been interrupted. The instrument, all standard accessories, and the optional battery eliminator may be conveniently stored in the carrying case.

Figure 1 2100P Turbidimeter and Accessories

Note: *Avoid prolonged exposure to ultraviolet light and sunlight.*

Note: *Do not hold the instrument during measurements; place the instrument on a flat, steady surface.*

1.2 Accessories

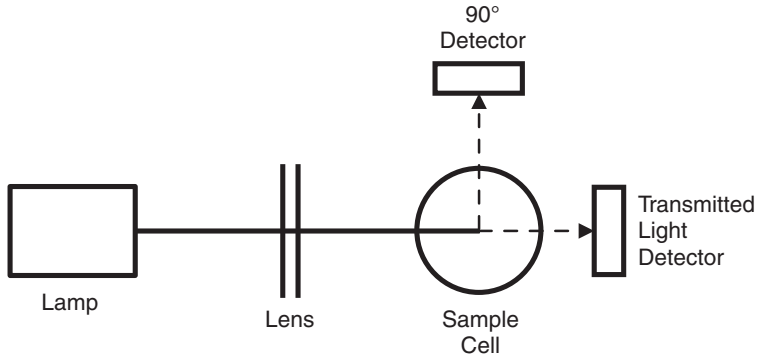
Accessories supplied with the turbidimeter include nine sample cells; three Gelex® Secondary Standards; one sealed vial each of: <0.1-NTU, 20-NTU, 100-NTU, and 800-NTU StablCal® Stabilized Formazin Standards; 4 AA alkaline batteries; 15 mL of silicone oil; oiling cloth; carrying case; instrument manual; and quick reference card.

1.3 Principle of Operation

The Model 2100P Portable Turbidimeter operates on the nephelometric principle of turbidity measurement. This instrument meets the design criteria specified by the United States Environmental Protection Agency, Method 180.1.

The optical system* (*Figure 2*) includes a tungsten-filament lamp, a 90° detector to monitor scattered light and a transmitted light detector. The instrument's microprocessor calculates the ratio of the signals from the 90° and transmitted light detectors. This ratio technique corrects for interferences from color and/or light absorbing materials (such as activated carbon) and compensates for fluctuations in lamp intensity, providing long-term calibration stability. The optical design also minimizes stray light, increasing measurement accuracy.

Figure 2 Ratio Optical System



* Patent number 4,198,161; other patents pending.

1.4 Preparation for Use

1.4.1 Unpacking

Remove the instrument and accessories from the shipping box and inspect them for damage that may have occurred due to rough handling or extreme weather conditions. Verify the following are present:

- Model 2100P Portable Turbidimeter
- Instrument Manual (with quick reference card)
- Set of StablCal Primary Standards in sealed vials, one each of:
  <0.1 NTU*
  20 NTU
  100 NTU
  800 NTU
- Standardization Kit containing Gelex Secondary Standards (0-10, 0-100 and 0-1000 ranges) plus nine sample cells with caps.
- Silicone Oil, 15-mL (0.5 oz) dropping bottle
- Oiling Cloth
- Carrying Case
- Four AA alkaline batteries

If any of the items are missing or damaged, please contact the Customer Service Department, Hach Company, Loveland, Colorado. The toll-free number in the United States is 800-227-4224. International customers should contact the Hach office or authorized distributor serving your area. Refer to *REPAIR SERVICE* on page *77*. **Please do not return the instrument without prior authorization from Hach.**

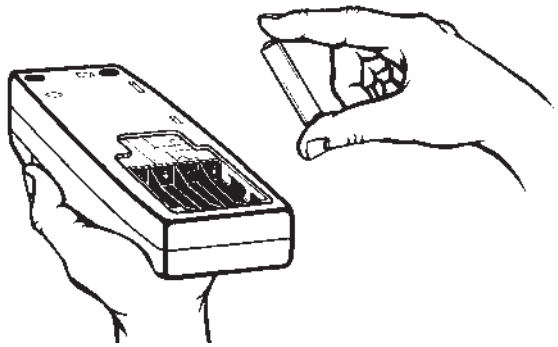
⚠ 1.4.2 Battery Installation

The instrument is shipped completely assembled without the batteries installed. Before use, install the four AA alkaline batteries or connect

* Used in place of the dilution water standard when performing a calibration.

the battery eliminator (*Figure 3*). For battery operation, remove the battery compartment cover on the instrument bottom and install the batteries. Correct battery polarity is shown on the battery holder. The instrument will not function if the batteries are not installed correctly. Reinstall the battery compartment cover.

Figure 3 Battery Installation



⚠ 1.4.3 Using the Battery Eliminator and Rechargeable Batteries

For operation with the optional battery eliminator, plug the eliminator jack into the connector on the turbidimeter side. The battery eliminator may be used with or without the batteries installed. **The eliminator will not charge batteries.** Rechargeable batteries may be used in the instrument, but must be removed for recharging. See *HOW TO ORDER* on page *76* for ordering information. To prolong battery life, the instrument lamp turns on temporarily when the **READ** key is depressed. Batteries are not necessary for battery eliminator operation.

1.4.4 Calibration

The 2100P Portable Turbidimeter is calibrated with Formazin Primary Standard at the factory and **does not require recalibration before use.** Hach recommends recalibration with formazin once every three months, or more often as experience dictates. The Gelex Secondary Standards supplied with the instrument are labelled with general ranges

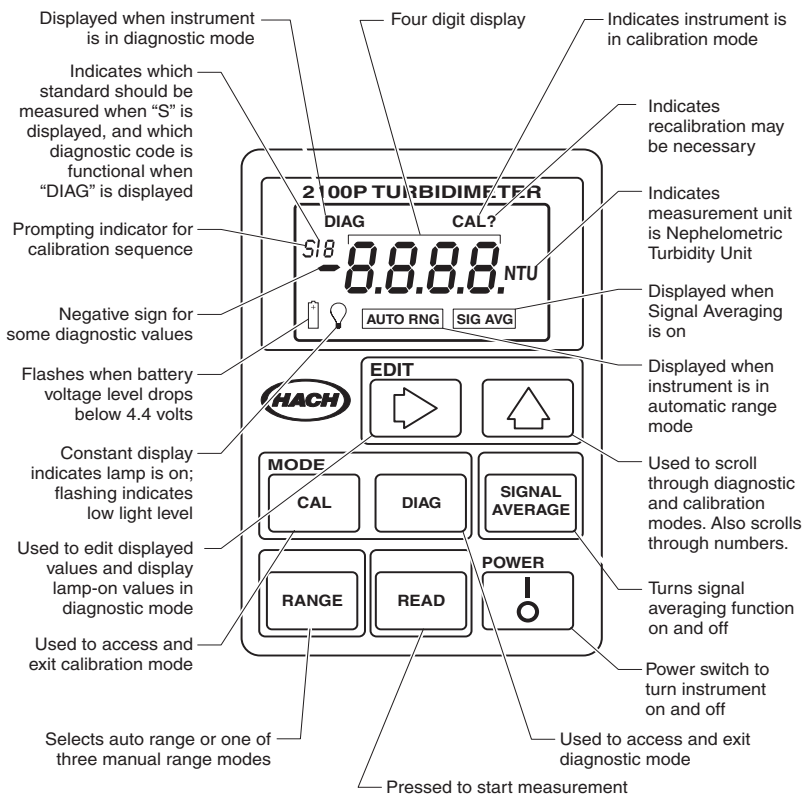
for application, but must be assigned values before use from formazin calibration. See *Section 3.6* on page *37* for calibration instructions.

SECTION 2 TURBIDITY MEASUREMENT

2.1 Operating Controls and Indicators

Figure 4 shows the 2100P controls and indicators. Refer to *SECTION 3* for a detailed description of each control and indicator.

Figure 4 Keyboard and Display with Descriptions



2.2 Turbidity Measurement

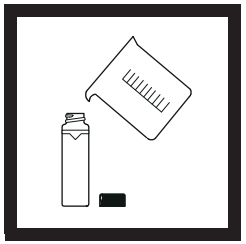
Measurements may be made with the signal average mode on or off and in manual or automatic range selection mode. Using automatic range selection is recommended. Signal averaging uses more power and should be used only when the sample causes an unstable reading. Signal averaging measures and averages ten measurements while displaying

intermediate results. The initial value is displayed after about 11 seconds and the display is updated every 1.2 seconds until all ten measurements are taken (about 20 seconds). After this, the lamp turns off, but the final measured turbidity value continues to be displayed until another key is pressed.

When not in signal average mode, the final value is displayed after about 13 seconds.

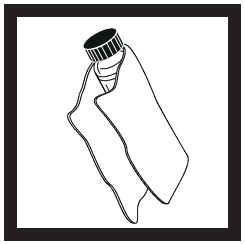
Accurate turbidity measurement depends on good measurement technique by the analyst, such as using clean sample cells in good condition and removing air bubbles (degassing). Refer to *Section 2.3* on page *22* for a detailed discussion of measurement techniques.

2.2.1 Turbidity Measurement Procedure

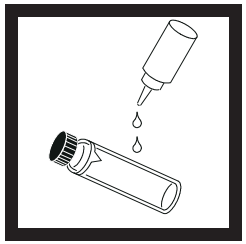


1. Collect a representative sample in a clean container. Fill a sample cell to the line (about 15 mL), taking care to handle the sample cell by the top. Cap the cell. (See *Section 2.3* on page *22* for more information about collecting a representative sample).

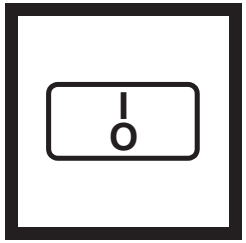
Note: *The instrument automatically shuts off after 5.5 minutes if no keystrokes occur. To resume operation, press* **I/O**.



2. Wipe the cell with a soft, lint-free cloth to remove water spots and fingerprints.



3. Apply a thin film of silicone oil. Wipe with a soft cloth to obtain an even film over the entire surface.

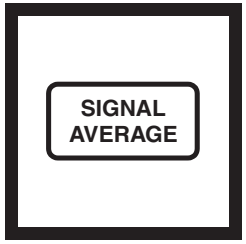


4. Press: **I/O**.

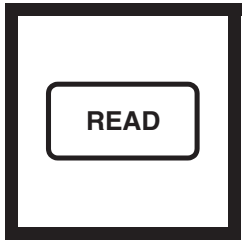
The instrument will turn on. Place the instrument on a flat, sturdy surface. Do not hold the instrument while making measurements.

5. Insert the sample cell in the instrument cell compartment so the diamond or orientation mark aligns with the raised orientation mark in front of the cell compartment.
Close the lid.

6. Select manual or automatic range selection by pressing the **RANGE** key. The display will show **AUTO RNG** when the instrument is in automatic range selection.



7. Select signal averaging mode by pressing the **SIGNAL AVERAGE** key. The display will show **SIG AVG** when the instrument is using signal averaging. Use signal average mode if the sample causes a noisy signal (display changes constantly).



8. Press: **READ**

The display will show **- - - - NTU**, then the turbidity in NTU. Record the turbidity after the lamp symbol turns off.

Note: *The instrument defaults to the last operating mode selected. If automatic range mode and signal averaging were used on the previous measurements, these options will automatically be selected for subsequent samples.*

2.2.2 Measurement Notes

- Always cap the sample cell to prevent spillage of sample into the instrument.
- When taking a reading, place the instrument on a level, stationary surface. It should not be held in the hand during measurement.
- Always close the sample compartment lid during measurement and storage.
- Always use clean sample cells in good condition. Dirty, scratched, or damaged cells can cause inaccurate readings.
- Do not leave a sample cell in the cell compartment for extended periods of time. This may compress the spring in the cell holder.
- Remove sample cell and batteries from instrument if the instrument is stored for extended time period (more than a month).
- Avoid operating in direct sunlight.
- Make certain cold samples do not “fog” the sample cell.
- Avoid settling of sample prior to measurement.
- Keep sample compartment lid closed to prevent dust and dirt from entering.

2.3 Measurement Techniques

Proper measurement techniques are important in minimizing the effects of instrument variation, stray light and air bubbles. Regardless of the instrument used, measurements are more accurate, precise and repeatable if the analyst pays close attention to proper measurement techniques.

Measure samples immediately to prevent temperature changes and settling. Avoid sample dilution when possible. Particles suspended in the original sample may dissolve or otherwise change characteristics when the sample temperature changes or when the sample is diluted, resulting in a non-representative sample measurement.

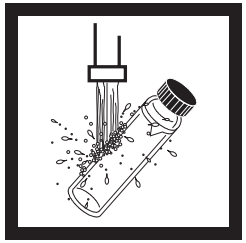
2.3.1 Cleaning Sample Cells

Cells must be extremely clean and free from significant scratches. The glass used to make cells is easily scratched – manufacturing cells free of minor scratches and other imperfections is difficult. However, minor imperfections are effectively masked by applying silicone oil as outlined in *Section 2.3.2*.

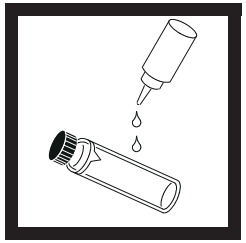
Clean the inside and outside of the cells by washing with laboratory detergent. Follow with multiple rinses of distilled or deionized water. Allow cells to air dry. Handle cells only by the top to minimize dirt, scratches and fingerprints in the light path.

2.3.2 Oiling the Sample Cell

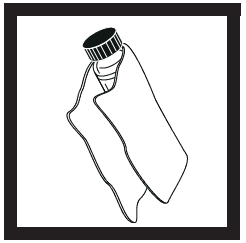
Applying a thin coat of silicone oil will mask minor imperfections and scratches which may contribute to turbidity or stray light. Use silicone oil equivalent to Hach Cat. No. 1269-36. This silicone oil has the same refractive index as glass. When applied in a thin, uniform coat, the oil fills in and masks minor scratches and other imperfections in the glass. Apply the oil uniformly by wiping with a soft, lint-free cloth.
Avoid application of excess oil. Applying excess oil may retain dirt and contaminate the instrument's cell compartment.



1. Thoroughly clean the sample cell.



2. Apply a small bead of silicone oil from the top to the bottom of the cell-- just enough to coat the cell with a thin layer of oil.



3. Using a soft, lint-free cloth, spread the oil uniformly, then wipe off the excess so that only a thin coat of oil is left. The cell should appear nearly dry with little or no visible oil.

Note: *Soft, lint-free cloth (velvet) works well for oiling. Store the oiling cloth with the sample cells and keep it free of dirt. After a few applications of oil, the cloth will contain enough residual oil that simply wiping the cell with the oiled cloth will provide a sufficient oil coat on the sample cell. Periodically, add a small amount of oil to the sample cell surface to replenish the oil in the cloth.*

Note: *Only a thin coat of oil on the sample cells is necessary.* ***Avoid using excessive amounts of oil.***

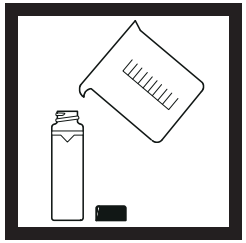
2.3.3 Orienting Sample Cells

Note: *When orienting and matching cells, it may be more efficient to use the continuous reading mode. The instrument performs continuous readings if the* **READ** *key is pressed and held. As long as the key is held, the lamp remains on and the display is updated every 1.2 seconds. The instrument cannot be used in continuous read mode if the Signal Averaging mode is on.*

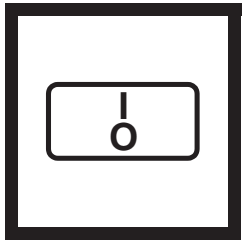
Precise measurements for very low turbidity samples require using a single cell for all measurements or optically matching the cells. Using one cell provides the best precision and repeatability. When one cell is used, an orientation mark (other than the factory-placed diamond) can be placed on the cell so it's inserted into the instrument with the same orientation each time.

2.3.3.1 Orienting a single cell

When using a single cell, make an index or orientation mark on the cell as follows:

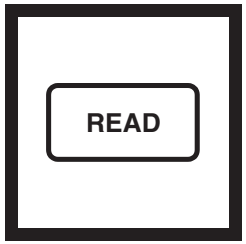


1. Fill the clean sample cell to the line with high quality water (< 0.5 NTU). Cap and wipe with lint-free cloth. Apply silicone oil. See *Section 3.6.2.2* on page *40* for more information about high quality water.



2. Press: **I/O** to turn the instrument on.

3. Insert the sample cell into the sample compartment. Close the cover.



4. Press: **READ**

Record the cell's position in the cell compartment and the displayed reading.

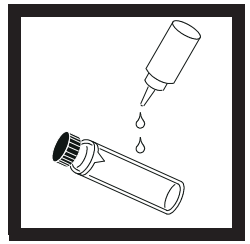
Note: *This procedure may be easier if the user holds the* **READ** *key through the whole process. This allows the lamp to remain on and make continuous readings.*

5. Remove the cell, rotate it slightly and reinsert it into the cell compartment. Close the cover, then press **READ**. Record the cell's position and the displayed reading.

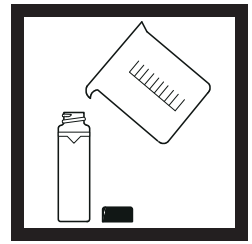
6. Repeat *step 5* until the lowest reading is displayed. Place an orientation mark on the cell's marking band near the top of the cell so the cell can be consistently inserted in the position that yields the lowest reading. When using the cell, always place it in the instrument so the orientation mark aligns with the raised mark on the instrument.

2.3.4 Matching multiple sample cells

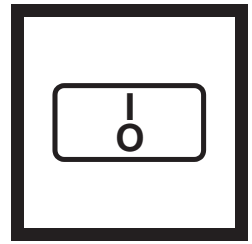
Precise measurements of very low turbidity samples require the cells be optically matched or a single cell be used for all measurements. If more than one cell is used, follow this procedure to match (index) the cells:



1. Clean and oil the sample cells as instructed in *Section 2.3.1* on page *23* and *Section 2.3.2* on page *23*.

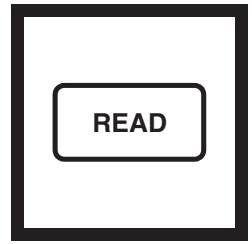


2. Fill the clean sample cells to the line with the same sample.



3. Press: **I/O** to turn the instrument on.

4. Insert the **first** sample cell into the sample compartment and close the cover.

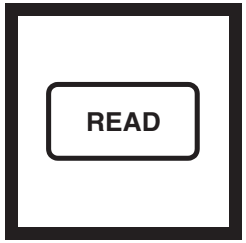


5. Press: **READ**

Record the cell's position in the cell compartment and the displayed reading. Place an orientation mark on the cell's marking band.

Note: *This procedure may be easier if the user holds the* **READ** *key through the whole process. This allows the lamp to remain on and make continuous readings.*

6. Insert the **second** sample cell into the cell compartment and close the cover.



7. Press: **READ**

Record the cell's position in the cell compartment and the displayed reading.

8. Remove the cell, rotate it slightly and reinsert into the cell compartment. Close the cover, then press **READ** again. Record the cell's position and the displayed reading.

9. Repeat *step 8* until the value displayed for the second cell is within 0.01 NTU (or 1%) of the value obtained for the first cell. Place an orientation mark on the second cell's marking band so it is consistently inserted in this position.

Note: *Due to variability in glass, it may not be possible to match all cells.*

10. Repeat *step 6* through *step 9* if matching other sample cells.

2.3.5 Removing Bubbles (Degassing)

Before measurement, removing air and other trapped gasses from the sample is strongly recommended, even if bubbles are not visible. Four degassing methods are commonly used:

1. applying a partial vacuum
2. adding a surfactant
3. using an ultrasonic bath
4. heating the sample

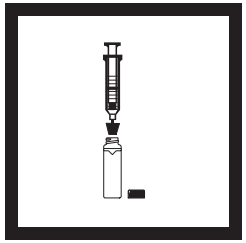
In some cases, more than one method may be necessary for effective bubble removal. For example, use of both a surfactant and ultrasonic bath may be necessary for some severe conditions. Use care with these techniques. If misused, sample turbidity can be altered.

Removing air bubbles by letting the sample stand for a period of time is not recommended. Particulates that cause turbidity may settle and the sample temperature may change. Both conditions may alter sample turbidity, resulting in measurements not representative of the original turbidity.

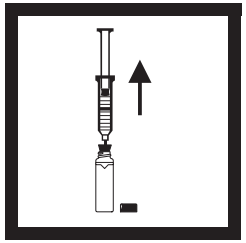
2.3.5.1 Application of vacuum

Apply a vacuum with any convenient, clean, oil-free vacuum source. The vacuum lowers the atmospheric pressure, allowing trapped bubbles to escape into the air above the sample. Vacuum works well with non-viscous samples (such as water) that don't contain volatile components. Applying vacuum to viscous, volatile-containing samples (paint resins) may cause the volatile components to come out of solution and aggravate the bubble problem.

To apply a vacuum, use a sample degassing kit equivalent to Cat No. 43975-00 (Degassing Kit) or 43975-10 (Degassing and Filtration Kit). These kits contain a syringe and rubber stopper for vacuum degassing. An electric or hand-operated pump equivalent to Cat No. 14283-00 or 14697-00, respectively, may also be used.



1. Fill a sample cell to the mark with sample. Insert a #2 single-hole rubber stopper and syringe into the cell. If using a pump, insert a piece of glass tubing into the stopper.



2. **Slowly** apply the vacuum by carefully pulling the plunger upward, then holding it. If using a hand or electric pump, connect the tubing to the vacuum pump with vacuum hose. Apply vacuum until visible gas bubbles disappear. **Slowly** release the vacuum. Remove the vacuum apparatus and cap the cell.

2.3.5.2 Adding a surfactant

Surfactants should be limited to severe problems when other degassing methods are ineffective. Surfactants change the surface tension of the water, which releases trapped gases. Hach recommends a surfactant such as Triton X-100 or the equivalent, Hach Cat No. 14096-37. Put one drop of Triton X-100 in the sample cell before adding sample.

Note: *Any turbidity contributed by surfactant addition is negligible.*

This technique is very effective when the water is super-saturated with air. However, changing the surface tension may accelerate settling of turbidity-causing particles. Mix the sample gently, but thoroughly, and analyze as soon as possible after adding the surfactant. Avoid vigorous mixing as the surfactant may foam. Rinse the sample cells thoroughly between samples to prevent surfactant accumulation.

2.3.5.3 Using an ultrasonic bath

Note: *The time necessary to expel bubbles may vary from a few seconds to a minute or more. To avoid excessive application of ultrasound, a simple procedure can be followed. First, apply ultrasound until all visible bubbles are absent. Then measure the sample turbidity. Apply ultrasound for a short time period and again measure turbidity. Continue for several repetitions, noting the treatment time and turbidity readings. If turbidity begins to increase instead of decrease, the ultrasound waves have probably started to alter the suspended particles. Note the time it takes for this to occur and record it as the maximum time limit for ultrasonic treatment.*

Ultrasonic baths effectively remove gas bubbles from most samples, especially viscous liquids. However, the ultrasonic waves which cause degassing may also alter the characteristics of the particles causing the turbidity. Turbidity depends on the size, shape, composition and refractive index of the suspended particles. Excessive ultrasound application may alter particle size and shape, thus changing sample turbidity. In some cases, ultrasound may aggravate air bubble removal by fracturing the bubbles, making degassing more difficult.

1. Fill a clean sample cell to the line with sample. Leave uncapped.
2. Immerse the cell (1/2 to 2/3 immersed) in an ultrasonic bath and allow it to stand until visible bubbles are expelled.
3. Remove the cell, cap, then thoroughly dry the cell. Apply silicone oil as directed.

2.3.5.4 Application of heat

Whenever possible, avoid using heat to degas samples because heat may change the characteristics of the suspended particles and cause volatile components to come out of solution. Gentle heating may be helpful for degassing some very viscous samples when combined with application of vacuum or ultrasound. If heat is necessary, heat the sample only until degassing occurs. The simplest technique is to prepare a warm water bath and partially immerse the filled sample cell. Use the shortest time necessary for expelling visible bubbles. Cool sample to original sample temperature before taking measurements.

2.3.6 Measuring Overrange Samples

Nephelometric turbidity measurement depends on detection of light scattered from particles suspended in the liquid. If the turbidity is very high, a significant amount of light is blocked or absorbed by the particles and only a small amount of light reaches the detector. This results in a negative interference – the measured turbidity is lower than the actual turbidity. This condition is called "going blind". A multidetector ratioing instrument, such as the Hach 2100P Turbidimeter, minimizes this effect and extends the instrument range. Highly turbid samples may also be diluted, but this should be avoided when possible since it may alter the characteristics of the suspended particles and produce erroneous results.

Light absorbing particles such as activated carbon and highly colored samples may also cause an instrument to "go blind". Dilution may not correct for these interferences. A ratioing instrument will correct for the presence of light absorbing particles and color.

2.3.7 Condensation (fogging)

Condensation may occur on the outside of the sample cell when measuring a cold sample in a warm, humid environment. Condensation interferes with turbidity measurement, so all moisture must be thoroughly wiped off the sample cell before measurement. If fogging recurs, let the sample warm slightly by standing at room temperature or immersing it in a warm bath for a short period. After warming, mix the sample thoroughly before measurement. Allowing samples to warm can alter sample turbidity, so it is best to avoid warming samples before measurement when possible.

2.3.8 Calibration

Turbidimeters must be properly calibrated with a primary standard. Hach recommends formazin or StablCal Stabilized Formazin for calibration. For U.S. Environmental Protection Agency (USEPA) reporting, calibrate at least as often as required by the appropriate regulatory agencies. The frequency of calibration depends on environmental conditions (humidity, temperature) and use. If necessary, calibrate more frequently.

Use secondary standards for periodic calibration checks. Please note that Gelex® standards must be assigned values after StablCal Stabilized Formazin calibration or formazin calibration and before use as secondary standards. Gelex standards must be recalibrated (values assigned) each time the instrument is calibrated with StablCal Stabilized Formazin or formazin. See *Section 3.6* on page *37* for detailed information on the use of StablCal Stabilized Formazin, formazin, and Gelex standards.

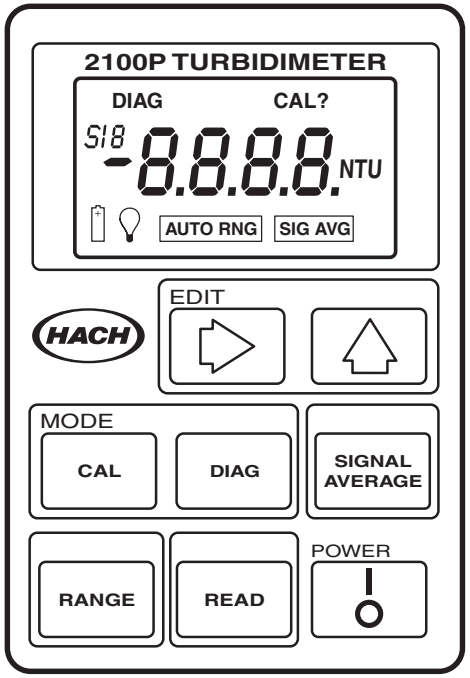
2.3.9 Representative Sampling

A representative sample accurately reflects the true condition of the water source from which the sample was taken. To ensure a representative sample, gently, but thoroughly, mix every sample before aliquots are taken. Do not allow the sample to settle.

When sampling from a tap in a distribution system or treatment plant, allow the water to run for at least five minutes before sampling. When sampling from a stream, reservoir, clarifier, or storage tank, collect at least one liter (l quart) and thoroughly mix before measurement. If the water source is not uniform, it may be necessary to sample several locations at varying depths and combine the samples into a single, well-mixed composite sample before measurement.

SECTION 3 OPERATION

3.1 Operational Controls and Indicators



Key	Description
	Power key to turn instrument on and off. If no keys are pressed for 5.5 minutes, the instrument turns off automatically.
READ	Depressed to perform a measurement. To conserve battery power, the lamp turns on only when **READ** is depressed. A reading is displayed about 12 seconds after the key is depressed. During the delay, a flashing **NTU** is displayed. After the reading is displayed, the lamp turns off and the reading continues to be displayed. Continuous readings may be done by holding this key if **not** in the Signal Averaging mode. After the initial delay, the reading is updated every 1.2 seconds.
CAL	Used to perform a calibration or review calibration data. Also terminates a calibration or calibration review and returns to the 2100P measurement mode.

Key	Description
	Edits a flashing digit in the calibration mode or sequences through the calibration standards (S0,S1, S2, S3) or diagnostic menu.
	Used to move the editing cursor to the digits being edited in the calibration mode or initiate editing of a standard value.
SIGNAL AVERAGE	Turns the signal averaging function on or off.
DIAG	Selects the diagnostic mode.
RANGE	Selects Auto Range or Manual Range (one of three manual modes).

Display Icon	Description
DIAG	Turns on after the **DIAG** is pressed to access the diagnostic mode. A number displayed under the **DIAG** icon (1-9) indicates which diagnostic function is active. See *Section 5.1* on page *67* for more information on diagnostic codes.
CAL	Turns on after the **CAL** key is pressed to access the calibration mode and remains on during the calibration.
CAL?	Appears after calibration if a value entered during calibration is outside an acceptable range. May indicate an operator error or possible instrument malfunction. Flashing **CAL?** indicates the default calibration coefficients are being used (even after a user-calibration has been done) or that no calibration data is currently stored.
S__	Displayed during calibration. The S is followed by a number to indicate which standard value is currently being edited or displayed. Flashing number is prompting user for measurement of **S0**, **S1**, **S2** or **S3** to establish a calibration. Steady number identifies which standard's value is being displayed.
	Flashes when the battery voltage drops to 4.4 volts as an indication to change batteries. At <4.0 volts, the instrument automatically shuts off.
	The lamp symbol is constantly on when the lamp is on and flashes after a reading if a marginal light level reaches the transmitted light detector. A flashing icon indicates the sample may be too turbid (not within measurement range) and needs dilution or the lamp needs replacing.

Display Icon	Description
SIGNAL AVERAGE	Indicates the signal averaging mode is on. The icon turns off if signal averaging is not selected.
AUTO RNG	Indicates instrument is in automatic range mode. The icon turns off when manual range mode is selected.
8888	The 4-digit display is active when the instrument is on (measurements are displayed to three digits). After the **READ** key is pressed **- - - -** is displayed during wait periods.
NTU	Identifies the measurement units- Nephelometric Turbidity Units. This icon is active during measurements and in the calibration mode.

3.2 Using the Read Key

To preserve battery power and prolong lamp life, the lamp turns on only after the **READ** key is pressed. Pressing the key turns the instrument lamp on; after about 12 seconds, the lamp turns off, but the measurement value continues to be displayed. After the first measurement, a four-second recovery time occurs before another measurement can be started. If **READ** is pressed during the recovery time, the display will begin flashing, but the lamp will not turn on until the full four seconds have passed. If no other key strokes occur within 5.5 minutes, the instrument turns off.

3.2.1 Continuous Reading

The instrument cannot be used in continuous read mode if the Signal Averaging mode is on.

The instrument will perform continuous readings if the **READ** key is pressed and held. As long as the key is held, the lamp remains on and the display is updated every 1.2 seconds.

3.3 Using the Signal Averaging Key

The signal averaging mode compensates for reading fluctuations caused by drifting of sample particles through the light path. Signal averaging is turned on or off by pressing the **SIGNAL AVERAGE** key. The **SIG AVG** icon is displayed when signal averaging is on.

Signal averaging measures and averages ten measurements while displaying intermediate results. The initial value is displayed after about

11 seconds and the display is updated every 1.2 seconds until all ten measurements are taken (about 22 seconds). After 22 seconds, the lamp turns off, but the final measured turbidity value continues to be displayed until another key is pressed.

When signal averaging is off, the instrument takes three measurements, the microprocessor averages them, then displays the average. If the **READ** key is held during measurement, the initial value is displayed in 12 seconds and is updated every 1.2 seconds as long as the **READ** key is held.

When the instrument is turned on, the instrument defaults to the signal averaging mode which was used during the last measurement.

3.4 Using the Range Selection Key

As shipped, the instrument defaults to automatic range mode. The first time the **RANGE** key is pressed, the instrument goes into manual range mode. The second, third, and fourth key strokes put the instrument in the 0.00-9.99, 10 to 99.9 or 100-1000 NTU range, respectively. Another key stroke brings the selection back to automatic range mode. When the automatic range mode is selected, the **AUTO RNG** icon is displayed. Range selection can be done any time except when a measurement or calibration is in progress.

When the instrument is turned on, the instrument defaults to the range mode and measurement range which was used during the last measurement.

3.5 Restoring the Default Calibration

To restore and use the default calibration, turn the instrument off. Press and hold **DIAG**, then press and release **I/O**. Release **DIAG** when the software version number disappears from the display. (For models with serial number less than 920300000800, **2100** disappears). This clears any user-entered calibration from memory; the 2100P will use the default calibration for measurement. **CAL?** will appear and continue to flash until a user-entered calibration is successfully completed.

For best results, a user-entered calibration should be done every three months.

3.6 Calibration

Calibration of the 2100P Turbidimeter is based on formazin, the primary standard for turbidity. The instrument's electronic and optical design provide long-term stability and minimize the need for frequent calibration. The two-detector ratioing system compensates for most fluctuations in lamp output. **A formazin recalibration should be performed at least once every three months,** more often if experience indicates the need. When calibration is necessary, use a primary standard such as StablCal™ Stabilized Standards or formazin standards.

Hach Company only recommends the use of StablCal® Stabilized Formazin or formazin standards for the calibration of Hach turbidimeters. Hach Company cannot guarantee the performance of the turbidimeter if calibrated with co-polymer styrene divinylbenzene beads or other suspensions.

Important Note: DO NOT calibrate with Gelex® Secondary Standards. Gelex standards are designed for instrument verification, not calibration.

3.6.1 StablCal Stabilized Formazin Standards*

Most consistent results will be achieved with the use of StablCal Stabilized Formazin Standards for calibration. Refer to *Section 3.6.1.2* and *Section 3.6.1.3* for information on preparing the standards for use.

Note: *Hach StablCal Stabilized Formazin in 20-, 100-, and 800-NTU values is packaged in convenient sets for calibration of the 2100P Turbidimeter. The set may be ordered in 500-mL size bottles by specifying Cat. No. 26594-00, in 100-mL size bottles by specifying Cat. No. 26594-10 or in sealed vials by ordering Cat. No. 26594-05. (See OPTIONAL ACCESSORIES AND REAGENTS on page 74.)*

3.6.1.1 Storing and Handling StablCal Stabilized Standards

For optimum results when using StablCal Stabilized Standards, adhere to the following recommendations:

* StablCal Stabilized Formazin is cited as a primary standard in Hach Method 8195, an acceptable version of USEPA Method 180.1.

- Do not transfer the standard to another container for storage.
- Do not return standard from the sample cell back into the its original container. Standard contamination will result.
- Store standards between 0 and 25 °C.
- For long-term storage, refrigeration at 5 °c is recommended. Do not store above 25 °C.
- Allow the standard to acclimate to ambient instrument conditions before use (not to exceed 40 °C).
- Store away from direct sunlight. Store vials in their respective kit or shipping box with the cover in place.

3.6.1.2 Preparing Bulk StablCal Stabilized Standards

Bulk standards that have been sitting undisturbed for longer than a month must be shaken to break the condensed suspension into its original particle size. Start at *step 1* for these standards. If the standards are used on at least a weekly interval, start at *step 3*.

Important Note: These instructions do not apply to <0.1-NTU* StablCal Standards; <0.1NTU StablCal Standards should not be shaken or inverted.

1. Shake the standard vigorously for 2-3 minutes to resuspend any particles.
2. Allow the standard to stand undisturbed for 5 minutes.
3. Gently invert the bottle of StablCal 5 to 7 times.
4. Prepare the sample cell for measurement using traditional preparation techniques. This usually consists of oiling the sample cell (see*Section 2.3.2* on page *23*) and marking the cell to maintain the same orientation in the sample cell compartment (see *Section 2.3.3* on page *24*). This step will eliminate any optical variations in the sample cell.

* Used in place of the dilution water standard when performing a calibration.

5. Rinse the sample cell at least one time with the standard and discard the rinse.

6. Immediately fill the sample cell with the standard. Cap the sample cell and let it stand for one minute. The standard is now ready for use in the calibration procedure, *Section 3.6.3*.

3.6.1.3 Preparing StablCal Stabilized Standards in Sealed Vials

Sealed vials that have been sitting undisturbed for longer than a month must be shaken to break the condensed suspension into its original particle size. Start at *step 1* for these standards. If the standards are used on at least a weekly interval, start at *step 3*

Important Note: These instructions do not apply to <0.1-NTU* StablCal Standards; <0.1NTU StablCal Standards should not be shaken or inverted.

1. Shake the standard vigorously for 2-3 minutes to resuspend any particles.

2. Allow the standard to stand undisturbed for 5 minutes.

3. Gently invert the vial of StablCal 5 to 7 times.

4. Prepare the vial for measurement using traditional preparation techniques. This usually consists of oiling the vial (see *Section 2.3.2* on page *23*) and marking the vial to maintain the same orientation in the sample cell compartment (see *Section 2.3.3* on page *24*). This step will eliminate any optical variations in the sample vial.

5. Let the vial stand for one minute. The standard is now ready for use in the calibration procedure, *Section 3.6.3*.

3.6.2 Formazin Primary Standards

Perform the procedure in *Section 3.6.2.1* to prepare a 4000-NTU standard. Alternately, order a 4000-NTU stock solution from Hach by specifying Cat. 2461-49. Prepare the dilutions from the 4000-NTU stock solution by following the instructions in *Section 3.6.2.4*.

3.6.2.1 Preparing Formazin Stock Solution

Dilute formazin standard solutions from a 4000 NTU stock solution equivalent to Hach Cat. No. 2461-49. The prepared stock solution is stable for up to one year when properly prepared. An alternative to purchasing the 4000 NTU stock solution is preparing a stock solution as follows:

1. Dissolve 5.000 grams of reagent grade hydrazine sulfate ($N_2H_4 \bullet H_2SO_4$) in 400 mL of distilled water.

2. Dissolve 50.000 grams of pure hexamethylenetetramine in 400 mL of distilled water.

3. Pour the two solutions into a 1000-mL volumetric flask and dilute to the mark with distilled water.

4. Let the solution stand for 48 hours at 25 °C (77 °F) to develop the 4000-NTU stock suspension. The standing temperature is critical for correct formation of formazin polymers.

5. Mix the 4000 NTU suspension for at least ten minutes before use. Then it can be diluted with distilled or demineralized water to achieve a solution of the desired NTU value.

Instead of diluting a formazin stock solution, StablCal Stabilized Formazin Standards may be used. Order the StablCal Calibration Set for the 2100P Turbidimeter, Cat.No. 26594-00 (500-mL bottles), Cat. No. 26594-10 (100 mL bottles), or Cat. No. 26594-05 (sealed vials). (See *OPTIONAL ACCESSORIES AND REAGENTS* on page *74*.)

3.6.2.2 Correcting for Turbidity of Dilution Water

The 2100P Turbidimeter automatically compensates for turbidity contributed by dilution water when calculating the true value of the lowest formazin standard. Use high quality distilled or deionized water less than 0.5 NTU. The instrument will display E 1 after calibration if

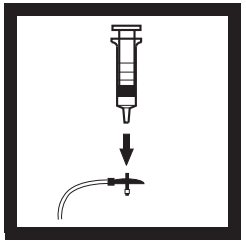
the dilution water turbidity is greater than 0.5 NTU. In this case, prepare the water as directed below.

The value of the dilution water can be arbitrarily forced to zero (see calibration procedure). This is not recommended for most applications and, if done, should be done only if the dilution water turbidity is less than 0.2 NTU.

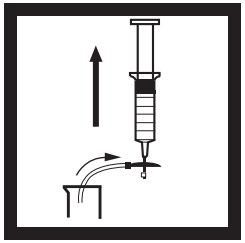
3.6.2.3 Preparing Dilution Water

Note: *Use the same dilution water for all dilutions and the sample blank.*

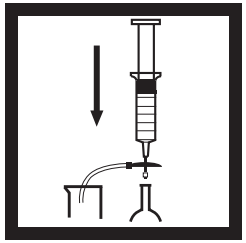
Collect at least 1000 mL of high quality dilution water (distilled or deionized water). The 2100P Turbidimeter, as received from the factory, is precalibrated and may be used to check the dilution water turbidity. If the turbidity is greater than 0.5 NTU, filter the water with the Sample Filtration and Degassing Kit (Cat. No. 43975-10) or equivalent. When measuring low range turbidity, clean all glassware with 1:1 hydrochloric acid and rinse several times with dilution water. If the glassware is not used immediately, use stoppers to prevent contamination from small particles.



1. Attach the syringe to the 3-way valve by gently twisting the square end into the syringe tip. Attach the connector, tubing and a 0.2 micron filter (clear part faces syringe) as shown. Be sure the connections are tight.



2. Fill a beaker or container with the water to be filtered. Insert the tubing into the container. Slowly draw the water into the syringe by pulling up on the syringe plunger.



3. Draw about 50 mL of sample into the syringe. Slowly push on the plunger to force the water through the filter and into a graduated cylinder or volumetric flask. Repeat Steps 2 and 3 until the desired amount of water is obtained.

Note: *As the filter clogs, it gets more difficult to push water through it. At this point, discard the filter and attach a new filter. Replacement filters are available in packages of 10 (Cat. No. 23238-10).*

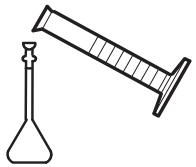
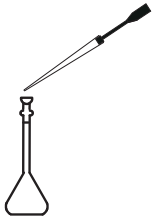
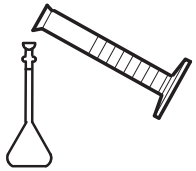
3.6.2.4 Preparing Formazin Dilutions (Factory recommended)

Hach Company recommends using 20, 100, and 800 NTU formazin standards for calibrating the 2100P Turbidimeter. Dilutions with other NTU values can be prepared and used (see *Section 3.6.3.1* on page *48*). If problems occur when using alternate solutions, use the dilutions specified here.

Prepare all formazin dilutions immediately before use and discard after calibration. The 4000 NTU solution is stable for up to a year, but dilutions deteriorate more rapidly. Use the same high quality water (turbidity <0.5 NTU) for the dilutions and the blank.

Preparing the 20, 100 and 800 NTU standards

Table 1 Formazin Standard Preparation

	Step 1	Step 2	Step 3
Standards			
20 NTU	Add 100 mL of dilution water to a clean **200-mL** class A volumetric flask.	With a TenSette* pipet, add 1.00 mL of well-mixed 4000 NTU Formazin stock solution to the 200-mL flask.	Dilute to the mark with dilution water. Stopper and mix.
100 NTU	Add 100 mL of dilution water to a clean **200-mL** class A volumetric flask.	With a TenSette pipet, add 5.00 mL of well-mixed 4000 NTU Formazin stock solution to the 200-mL flask.	Dilute to the mark with dilution water. Stopper and mix.
800 NTU	Add 50 mL of dilution water to a clean **100-mL** class A volumetric flask.	With a TenSette pipet, add 20.00 mL of well-mixed 4000 NTU Formazin stock solution to the 100-mL flask.	Dilute to the mark with dilution water. Stopper and mix.

* A class A volumetric pipet may be used in place of a TenSette Pipet.

3.6.3 Calibrating the Turbidimeter

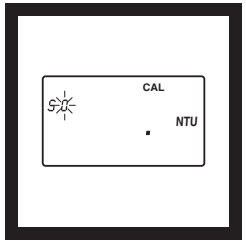
Note: *For best accuracy use the same sample cell or four matched sample cells for all measurements during calibration. Always insert the cell so the orientation mark placed on the cell during the matching procedure is correctly aligned. (See Section 2.3.4 on page 26 for matching sample cells).*

1. Rinse a clean sample cell with dilution water several times. Then fill the cell to the line (about 15 mL) with dilution water or use StablCal <0.1 NTU standard.

Note: *The same dilution water used for preparing the standards must be used in this step.*

2. Insert the sample cell in the cell compartment by aligning the orientation mark on the cell with the mark on the front of the cell compartment. Close the lid. Press **I/O**.

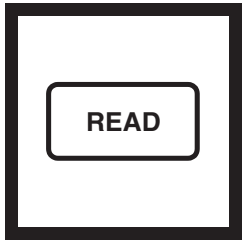
Note: *Choose signal average mode option (on or off) before pressing* **CAL** *– the* **SIGNAL AVERAGE** *key is not functional in calibration mode.*

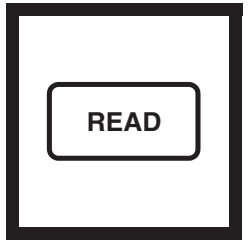


3. Press: **CAL**

The **CAL** and **S0** icons will be displayed (the **0** will flash). The 4-digit display will show the value of the S0 standard for the previous calibration. If the blank value was forced to 0.0, the display will be blank (as shown). Press → to get a numerical display.

Hach Company only recommends the use of StablCal® Stabilized Formazin or formazin standards for the calibration of Hach turbidimeters. Hach Company cannot guarantee the performance of the turbidimeter if calibrated with co-polymer styrene divinylbenzene beads or other suspensions. DO NOT calibrate with Gelex® Secondary Standards.





4. Press: **READ**

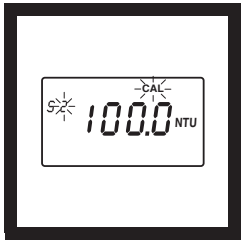
The instrument will count from 60 to 0, (67 to 0 if signal average is on), read the blank and use it to calculate a correction factor for the 20 NTU standard measurement. If the dilution water is ≥ 0.5 NTU, E 1 will appear when the calibration is calculated (See *Section 3.6.2.3* on page *41* for more dilution water information). The display will automatically increment to the next standard. Remove the sample cell from the cell compartment.

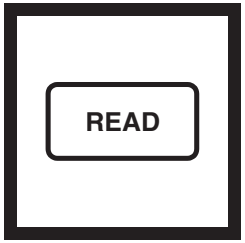
Note: *The turbidity of the dilution water can be "forced" to zero by pressing → rather than reading the dilution water. The display will show* **S0 NTU** *and the ↑ key must be pressed to continue with the next standard.*

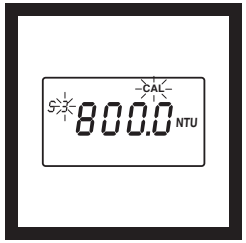
5. The display will show the **S1** (with the 1 flashing) and **20 NTU** or the value of the S1 standard for the previous calibration. If the value is incorrect, edit the value by pressing the → key until the number that needs editing flashes. Use the ↑ key to scroll to the correct number. After editing, fill a clean sample cell to the line with **well mixed** 20 NTU StablCal Standard or 20 NTU formazin standard. Insert the sample cell into the cell compartment by aligning the orientation mark on the cell with the mark on the front of the cell compartment. Close the lid.

6. Press: **READ**

The instrument will count from 60 to 0 (67 to 0 if signal average is on), measure the turbidity and store the value. The display will automatically increment to the next standard. Remove the sample cell from the cell compartment.





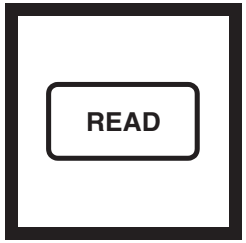


7. The display will show the **S2** (with the 2 flashing) and **100 NTU** or the value of the S2 standard for the previous calibration. If the value is incorrect, edit the value by pressing the → key until the number that needs editing flashes. Use the ↑ key to scroll to the correct number. After editing, fill a clean sample cell to the line with **well mixed** 100 NTU StablCal Standard or 100 NTU formazin standard. Insert the sample cell into the cell compartment by aligning the orientation mark on the cell with the mark on the front of the cell compartment. Close the lid.

8. Press: **READ**

The instrument will count from 60 to 0 (67 to 0 if signal average is on), measure the turbidity and store the value. Then, the display will automatically increment to the next standard. Remove the sample cell from the cell compartment.

9. The display will show the **S3** (with the 3 flashing) and **800 NTU** or the value of the S3 standard for the previous calibration. If the value is incorrect, edit the value by pressing the → key until the number that needs editing flashes. Use the ↑ key to scroll to the correct number. After editing, fill a clean sample cell to the line with **well mixed** 800 NTU StablCal Standard or 800 NTU formazin standard. Insert the sample cell into the cell compartment by aligning the orientation mark on the cell with the mark on the front of the cell compartment. Close the lid.



10. Press: **READ**

The instrument will count from 60 to 0 (67 to 0 if signal average is on), measure the turbidity and store the value. Then the display will increment back to the S0 display. Remove the sample cell from the cell compartment.

11. Press: **CAL** to accept the calibration. The instrument will return to measurement mode automatically.

Note: *Pressing* **CAL** *completes the calculation of the calibration coefficients. If calibration errors occurred during calibration, error messages will appear after* **CAL** *is pressed. If* **E 1** *or* **E 2** *appear, check the standard preparation and review the calibration; repeat the calibration if necessary. If* **CAL?** *appears, an error may have occurred during calibration. If* **CAL?** *is flashing, the instrument is using the default calibration.*

NOTES

- If the **I/O** key is pressed during calibration, the new calibration data is lost and the old calibration will be used for measurements. Once in calibration mode, only the **READ, I/O,** ↑, and → keys function. Signal averaging and range mode must be selected before entering the calibration mode.
- If **E 1** or **E 2** are displayed, an error occurred during calibration. Check the standard preparation and review the calibration; repeat the calibration if necessary. Press **DIAG** to cancel the error message (**E 1** or **E 2**). To continue without repeating the calibration, press **I/O** twice to restore the previous calibration. If **CAL?** is displayed, an error may have occurred during calibration. The previous calibration may not be restored. Either recalibrate or use the calibration as is.
- To review a calibration, press **CAL** and then ↑ to view the calibration standard values. As long as **READ** is never pressed and **CAL** is not flashing, the calibration will not be updated. Press **CAL** again to return to the measurement mode.

3.6.3.1 Preparing User-selected Formazin Dilutions

The formazin solutions should span the entire range of the instrument. Hach recommends preparing three standards:

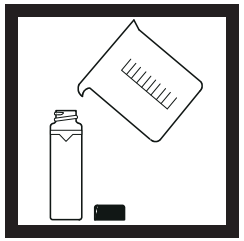
1. 10 to 30 NTU
2. 90 to 110 NTU
3. 700 to 900 NTU

The standards must have a difference of at least 60 NTU.
In addition, a blank made from the dilution water should be prepared.

Prepare the formazin standard solutions from the well mixed 4000 NTU stock solution as specified in *Section 3.6.2.4* on page *42* and dilution water as specified in *Section 3.6.2.2* and *Section 3.6.2.3* on page *41*. Make the standards **immediately** before use and discard them after calibration is done.

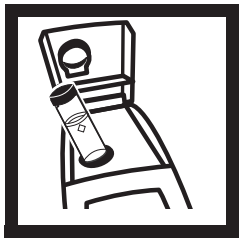
3.6.3.2 Calibrating with User-selected Standards

Note: *For best accuracy use the same sample cell or four matched sample cells for all measurements during calibration. Always insert the sample cell with the same orientation.*



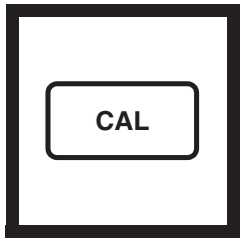
1. Fill a clean sample cell to the line (about 15 mL) with dilution water.

Note: *The same dilution water used for preparing the standards must be used in this step.*



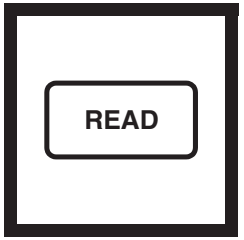
2. Insert the sample cell into the cell compartment and close the lid. Press **I/O**.

Note: *Choose signal average mode option (on or off) before pressing* **CAL** *– the* **SIGNAL AVERAGE** *key is not functional in calibration mode.*



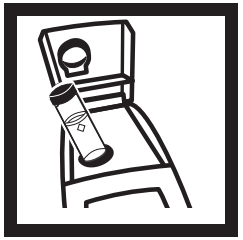
3. Press: **CAL**.

The **CAL** and **S0** icons will appear (the **0** will flash). The 4-digit display will show the value of the S0 standard for the previous calibration.

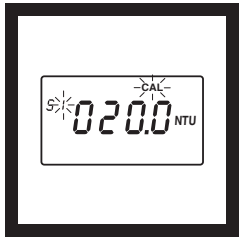


4. Press: **READ**.

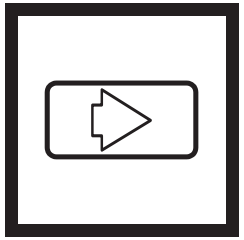
The instrument will count from 60 to 0 (67 to 0 if signal average is on), measure the blank and use it to calculate a correction factor for the lowest standard. If the dilution water is ≥0.5 NTU, **E 1** will appear (see *Section 3.6.2.3* on page *41* for more dilution water information). The display will automatically increment to the next standard. Remove the sample cell from the cell compartment.



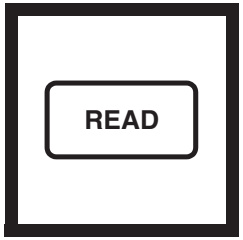
5. Thoroughly mix the 10 to 30 NTU range standard, then fill a clean sample cell to the line with the standard. Insert the sample cell into the cell compartment



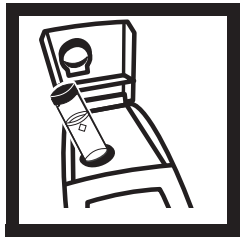
6. The display will show the **S1** icon (with the **1** flashing) and **20 NTU** or the value of the S1 standard for the previous calibration.



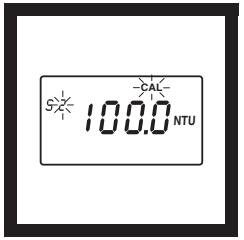
7. Edit the standard concentration by pressing →. The **1** will stop flashing and the left digit in the display will flash. Press ↑ to scroll the digit up to the appropriate number. Press → again to move the cursor to the next digit and edit it in the same manner.



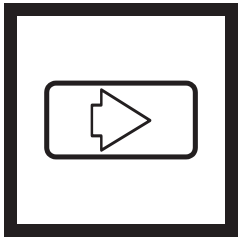
8. When all the digits show the appropriate value, press **READ**. The instrument will count from 60 to 0 (67 to 0 if signal average is on), measure the turbidity and store the value. The display will automatically increment to the next standard. Remove the sample cell from the cell compartment.



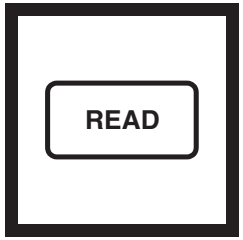
9. Thoroughly mix the 90 to 110 NTU standard, then fill a clean sample cell to the line with the standard. Insert the cell into the cell compartment.



10. The display will show the **S2** icon (with the **2** flashing) and **100 NTU** or the value of the S2 standard for the previous calibration.

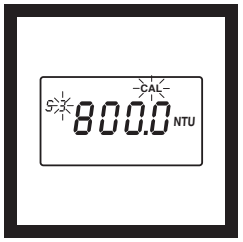


11. Edit the standard concentration by pressing →. The **2** will stop flashing and the left digit in the display will flash. Press ↑ to scroll the digit up to the appropriate number. Press → again to move the cursor to the next digit and edit it in the same manner.

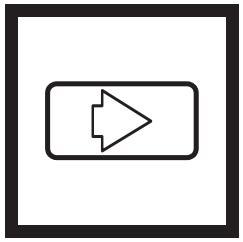


12. When all the digits show the appropriate value, press **READ**. The instrument will count from 60 to 0 (67 to 0 if signal average is on), measure the turbidity and store the value. Remove the sample cell from the cell compartment.

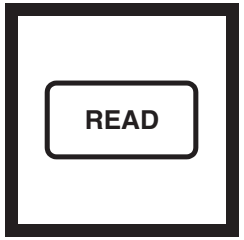
13. Thoroughly mix the 700 to 900 NTU standard, then fill a clean sample cell to the line with the standard. Insert the cell into the cell compartment.



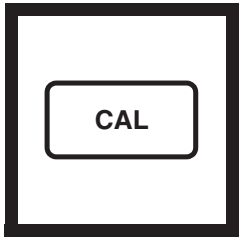
14. The display will show the **S3** icon (with the **3** flashing) and **800 NTU** or the value of the S3 standard for the previous



15. Edit the standard concentration by pressing →. The **3** will stop flashing and the left digit in the display will flash. Press ↑ to scroll the digit up to the appropriate number. Press → again to move the cursor to the next digit and edit it in the same manner.



16. When all the digits show the appropriate value, press **READ**. The instrument will count from 60 to 0 (67 to 0 if signal average is on), measure the turbidity and store the value. The instrument will increment back to **S0**. Remove the sample cell from the cell compartment.



17. Press: **CAL**.

The instrument will store the new calibration data and return the instrument to the measurement mode. It will use the new calibration to calculate turbidity for subsequent measurements.

Note: *Pressing* **CAL** *completes the calculation of the calibration coefficients. If calibration errors occurred during calibration, error messages will appear after* **CAL** *is pressed. If* **E 1** *or* **E 2** *appear, check the standard preparation and review the calibration; repeat the calibration if necessary. If* **CAL?** *appears, an error may have occurred during calibration. If* **CAL?** *is flashing, the instrument is using the default calibration.*

NOTES

- If the **I/O** key is pressed during calibration, the new calibration data is lost and the old calibration will be used for measurements. Once in calibration mode, only the **READ, I/O,** ↑, and → keys function. Signal averaging and range mode must be selected before entering the calibration mode.

- If **E 1** or **E 2** are displayed, an error occurred during calibration. Check the standard preparation and review the calibration; repeat the calibration if necessary. If the error messages recur, calibrate using the factory specified standards, *Section 3.6.2.4* on page *42* and *Section 3.6.3* on page *44*. Press **DIAG** to cancel the error message (**E 1** or **E 2**). To continue without repeating the calibration, press **I/O** twice to restore the previous calibration. If **CAL?** is displayed, an error may have occurred during calibration. The previous calibration may not be restored. Either recalibrate or use the calibration as is.

- To review a calibration, press **CAL** and then only ↑ to view the calibration standard values. As long as **READ** is never pressed and **CAL** isn't flashing, the calibration will not be updated. Press **CAL** again to return to the measurement mode.

3.6.4 Using Gelex® Secondary Turbidity Standards

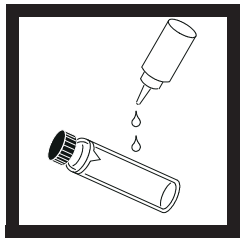
Note: *Store Gelex standards at room temperature. Do not allow to freeze or exceed 50 °C.*

The instrument comes with Gelex Secondary Standards which are particulate suspensions similar to formazin primary standards in light scattering characteristics. NTU values on the Gelex standards indicate the range for which they should be used. Due to minor variations in glass and individual instrument optical systems, the true value of the Gelex standards must be determined against formazin in the same instrument they will be used with for later calibration checks.

3.6.4.1 Assigning Values to Gelex Standards

1. Calibrate the instrument with formazin.

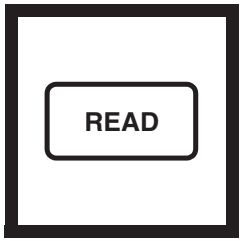
2. Select automatic range mode using the **RANGE** key.



3. Thoroughly clean the outside of the Gelex vials and apply a thin coating of silicone oil.

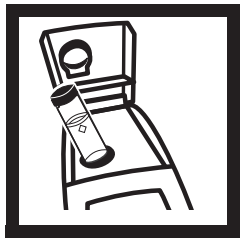
4. Place the 0-10 NTU Gelex standard in the cell compartment so the diamond on the vial aligns with the orientation mark on the instrument. Close the sample lid.

Note: *Correct cell orientation is essential to obtain accurate Gelex values. Always orient the cell so the diamond mark aligns with the orientation mark on the instrument.*

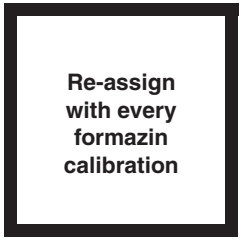


5. Press: **READ**.

Record the displayed value, remove the vial from the instrument and mark the value on the band near the top of the vial.



6. Repeat *step 3* through *step 5* for the other Gelex standards, being careful to orient the cells properly.



7. Re-assign values to the Gelex standards each time the instrument is calibrated with formazin.

3.6.4.2 Routine Calibration Check With Gelex Standards

The 2100P Turbidimeter does not require standardization before every measurement as some turbidimeters do. Periodically, as experience dictates, check the instrument calibration using the appropriate Gelex Secondary Standard. Be sure the Gelex standards are aligned correctly when inserting them (diamond aligns with orientation mark). If the reading is not within 5% of the previously established value, recalibrate the instrument with StablCal Stabilized Formazin Primary Standard or formazin primary standard (*Section 3.6.3* on page *44*).

Important Note: DO NOT calibrate with Gelex® Secondary Standards. Gelex standards are designed for instrument verification, not calibration.

MAINTENANCE

Some of the following manual sections contain information in the form of warnings, cautions and notes that require special attention. Read and follow these instructions carefully to avoid personal injury and damage to the instrument. Only personnel qualified to do so, should conduct the maintenance tasks described in this portion of the manual.

Certains des chapitres suivants de ce mode d'emploi contiennent des informations sous la forme d'avertissements, messages de prudence et notes qui demandent une attention particulière. Lire et suivre ces instructions attentivement pour éviter les risques de blessures des personnes et de détoriation de l'appareil. Les tâches d'entretien décrites dans cette partie du mode d'emploi doivent être seulement effectuées par le personnel qualifié pour le faire.

Algunos de los capítulos del manual que presentamos contienen muy importante información en forma de alertas, notas y precauciones a tomar. Lea y siga cuidadosamente estas instrucciones a fin de evitar accidentes personales y daños al instrumento. Las tareas de mantenimiento descritas en la presente sección deberán ser efectuadas únicamente por personas debidamente cualificadas.

Einige der folgenden Abschnitte dieses Handbuchs enthalten Informationen in Form von Warnungen, Vorsichtsmaßnahmen oder Anmerkungen, die besonders beachtet werden müssen. Lesen und befolgen Sie diese Instruktionen aufmerksam, um Verletzungen von Personen oder Schäden am Gerät zu vyyyermeiden. In diesem Abschnitt beschriebene Wartungsaufgaben dürfen nur von qualifiziertem Personal durchgeführt werden.

Algumas das seguintes secções do manual contêm informações em forma de advertências, precauções e notas que requerem especial atenção. Leia e siga atentamente as presentes instruções para evitar ferimentos pessoais e não danificar o instrumento. As tarefas de manutenção descritas nesta parte do manual só poderão ser executadas por pessoal qualificado.

SECTION 4 MAINTENANCE

4.1 Cleaning

Keep the turbidimeter and accessories as clean as possible and store the instrument in the carrying case when not in use. Avoid prolonged exposure to sunlight and ultraviolet light. Wipe spills up promptly. Wash sample cells with non-abrasive laboratory detergent, rinse with distilled or demineralized water, and air dry. Avoid scratching the cells and wipe all moisture and fingerprints off the cells before inserting them into the instrument. Failure to do so can give inaccurate readings. See *Section 2.3.1* on page *23* for more information about sample cell care.

4.2 Battery Replacement

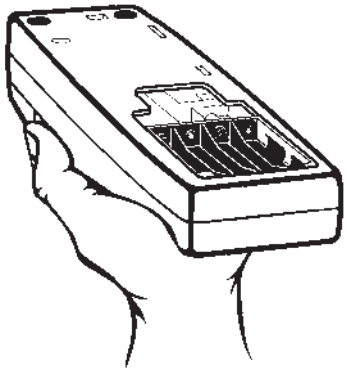
AA alkaline cells typically last for about 300 tests with the signal averaging mode off, about 180 tests if signal averaging is used. The “battery” icon flashes when battery replacement is needed. Refer to *Section 1.4.2* on page *15* for battery installation instructions. If the batteries are changed within 30 seconds, the instrument retains the latest range and signal average selections. If it takes more than 30 seconds, the instrument uses the default settings.

If, after changing batteries, the instrument will not turn off or on and the batteries are good, remove the batteries and reinstall them. If the instrument still won't function, contact Hach Service or the nearest authorized dealer.

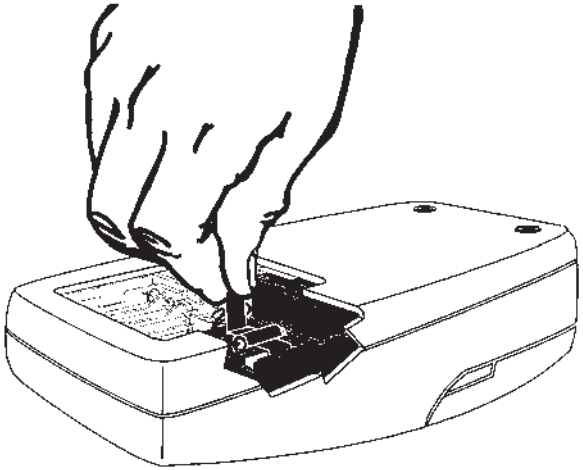
4.3 Lamp Replacement

The procedure below explains lamp installation and electrical connections. Use a small screwdriver to remove and install the lamp leads in the terminal block. The instrument requires calibration after lamp replacement.

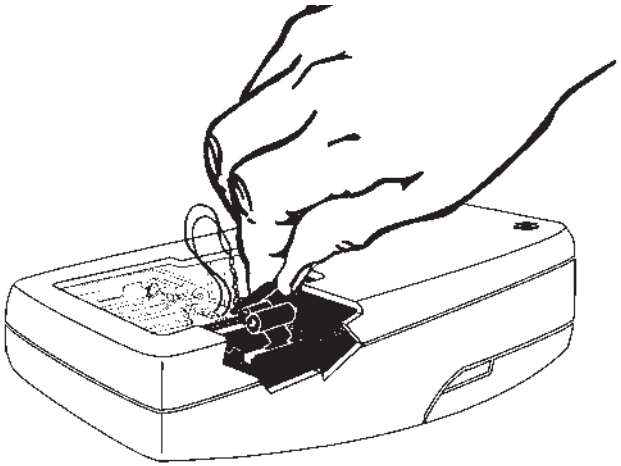
1. Orient the instrument so it is upside down and the top faces away from you. Remove the battery cover and at least one battery.



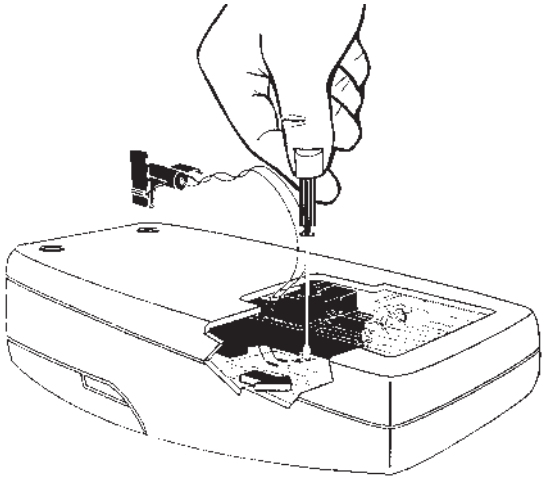
2. Remove the lamp assembly by grasping the tab on the left side of the assembly. Firmly, but gently, slide the assembly towards the rear of the instrument.



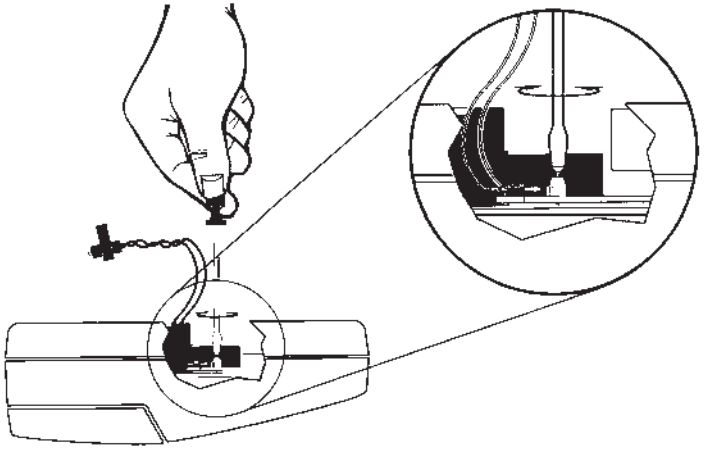
3. Rotate the tab towards the nearest outside edge. The assembly should release and slip out easily.



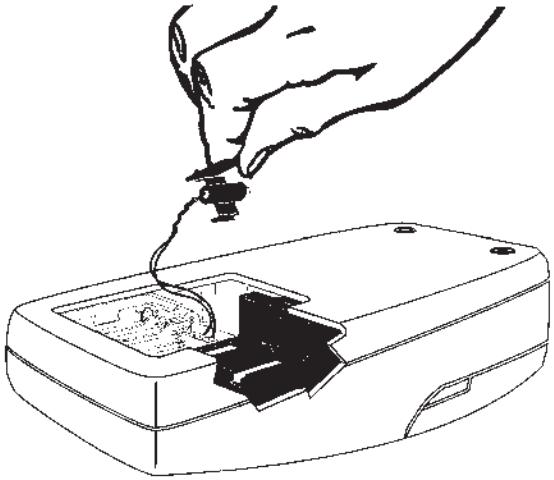
4. Back the terminal block screws **partially** out (1 to 2 turns) and remove the old lamp leads.



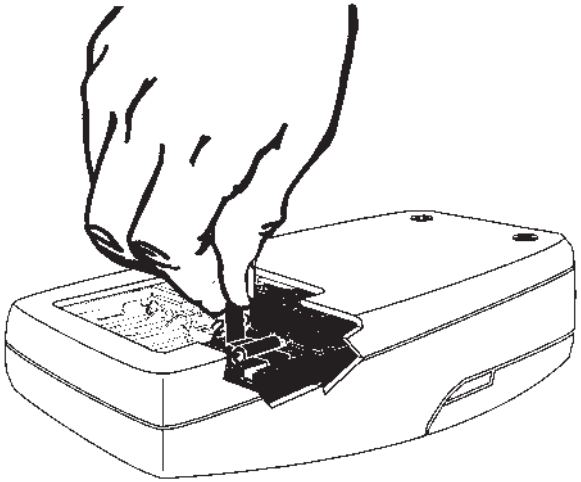
5. Gently bend the wires of the new lamp assembly into an “L” shape so they fit easily into the housing. Insert the leads into the terminal screws and tighten with clockwise turns. Gently tug on the wires to make sure they are connected to the terminal block.



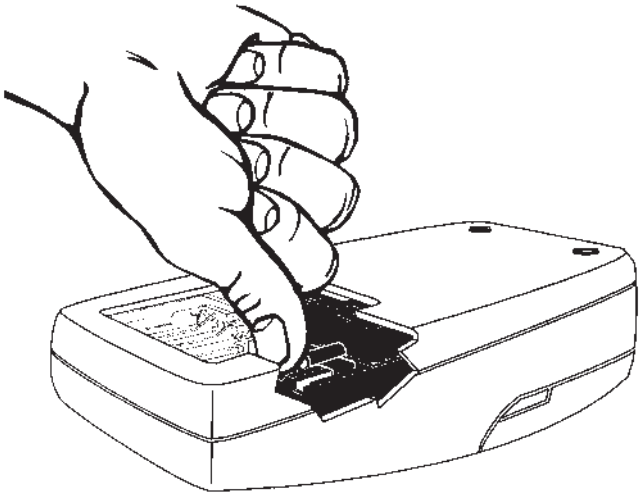
6. Hold the new lamp assembly by the tab with the lamp facing the tope (keyboard) of the instrument. Slide the small catch on the other side of the assembly into the black plastic slot (towards the nearest edge of the instrument).



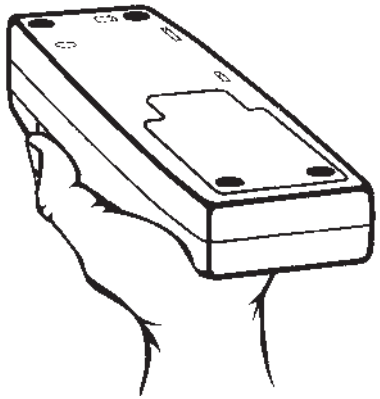
7. Snap the U-shaped bottom of the tab into the slot on the left side of the black plastic that holds the lamp assembly.



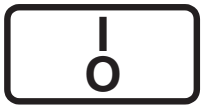
8. With your thumb, firmly slide the assembly forward until it stops. Again, push firmly against the tab to make sure the lamp is seated correctly.



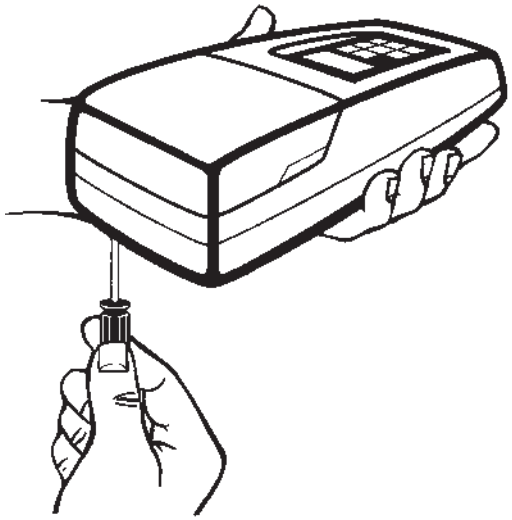
9. Replace the battery(s) and battery cover.



10. Insert the 800 NTU formazin standard into the sample cell. Press and hold **READ**. Then press **I/O**. Release the **READ** key after the software version number disappears from the display (for models with serial numbers less than 920300000800, **2100** disappears).



11. Adjust the scattered light amplifier output by inserting a small flat-bladed screwdriver into the trimpot hole (located on bottom). Adjust the display to read 2.5 ± 0.3 volts (2.0 volts for models that display **2100** when turned on).



12. Press **I/O** to exit gain adjust mode.

13. Perform a formazin calibration according to *Section 3.6.3* on page *44* or *Section 3.6.3.1* on page *48*.

SECTION 5 TROUBLESHOOTING

5.1 Using the Diagnostic Functions Key

Enter the diagnostic mode by pressing the **DIAG** key. Exit this mode at any time by pressing the key again. The diagnostic mode allows access to information about instrument function which may be useful for servicing and troubleshooting.

5.1.1 Basic Diagnostic Codes

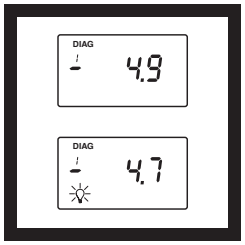
The diagnostic codes are:

Code	Description
1	Checks the battery voltage with the lamp on, then with the lamp off. This is a dual diagnostic code.
2	Displays calibration coefficient a_o
3	Displays calibration coefficient a_1
4	Displays calibration coefficient b_o
5	Displays calibration coefficient b_1
6	Displays the lamp voltage (about 3 volts)
7	Displays the dark voltage of the transmitted light detector amplifier with the lamp off and the detector amplifier voltage with the lamp on.
8	Displays the high gain dark voltage of the 90° detector amplifier with the lamp off and the detector amplifier voltage with the lamp on.*
9	Displays the low gain dark voltage of the 90° detector amplifier with the lamp off and the detector amplifier voltage with the lamp on.

* Samples with turbidity >10 NTU may display **- - -** for the lamp-on amplifier voltage.

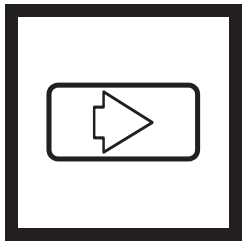
5.2 The Diagnostic Procedure

1. Fill a clean sample cell to the line with clear water, cap the cell and place it in the cell compartment. Press the **READ** key and wait until the reading is finished.

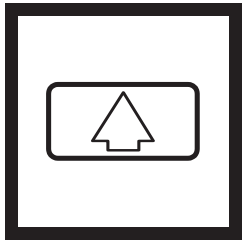


2. Press: **DIAG**

The **DIAG** icon will turn on and **1** will be displayed below the icon. The instrument will measure the battery voltage with the lamp off and display the result in volts (V). Then the lamp icon will turn on and the instrument will measure the voltage with the lamp on. The value is briefly displayed before defaulting to the lamp-off reading. To repeat the measurement, press **READ**.



3. To continuously display the lamp-on voltage, press →. The lamp icon will flash. Press → to turn the lamp icon off (the lamp is not on during this display).



4. Press the ↑ key to scroll through the other diagnostics. Each press of the key increments the digit in the small numerical display below the **DIAG** icon and the result of the diagnostic measurement is then displayed. Each press of the **READ** key updates the value. For measurements made with the lamp off and again with the lamp on, the measurement with the lamp off is displayed when the diagnostic is entered. To see the second measurement with the lamp on, press the → key (only works with diagnostic codes 1, 7, 8, & 9). The lamp icon will flash and the lamp-on measurement will be displayed in volts. Press → to turn the lamp icon off.

Note: *DIAG 8 will display* ***----*** *for the lamp-on voltage if a of >10 NTU is placed in the cell compartment.*

5.3 Other Instrument Diagnostics

5.3.1 Display Test

Pressing and holding the **I/O** key turns on all the display icons and elements so you can determine if all the elements and icons are functioning. The display test sequence will cycle as long as the key is held down.

5.4 Error Messages

Error messages indicate sample interferences and/or instrument malfunction.

5.4.1 Flashing Numeric Display

If the highest value in the range selected is flashing in the display, the sample is too turbid (or overrange) for the selected range. In automatic or manual range, **1000** flashes if the sample is over the instrument's range. In manual range mode, select the next higher range mode if **9.99** or **99.9** flashes. See *Section 2.3.6* on page *31* for measuring overrange samples. The display will stop flashing if a sample within range is inserted and read.

5.4.2 E Messages

An error message indicates either an instrument failure or an operation cannot be performed. **An error message can be cleared by pressing DIAG** (display will return to previous measurement or calibration value). The meter continues to operate as best it can. If the message occurs during a calibration, calibration can continue. If the error message occurs when a calibration is being calculated, the instrument will discard the new calibration and retain the old calibration. Error messages and corrective actions are listed below.

5.4.3 CAL?

A flashing **CAL?** appears when the instrument is using the default calibration programmed at the factory. It will appear if the analyst has erased the user-entered calibration using the procedure to restore the default calibration or after and E 4 error is cleared by pressing DIAG. Recalibrate as soon as possible when **CAL?** appears. **CAL?** (not flashing) appears when a calibration has questionable validity.

Message*	Probable Cause	Corrective Action
E1	Dilution water is ≥ 0.5 NTU.	Start calibration over with better quality dilution water or use a membrane filter to filter the water before use.
E2	Two standards have the same value or their difference is less than 60 NTU. Not all standards were read during the calibration. Standard 1 is too low (<10 NTU).	Recheck preparation of standards and repeat calibration.
E3	Low light error.	Re-read measurement. Check lamp** Check for obstructed light path. Dilution may be necessary.
E4	EEPROM malfunction.	Check sum failed. Press **I/O**. If E 4 reappears, call Hach service. If **CAL?** appears, recalibrate.
E5	A/D overrange.	Check for obstructed light path. Call Hach Service.
E6	A/D underrange.	Check for open lid during reading and re-read. Check for obstructed light path. If persists, call Hach Service.
E7	Light Leak.	Close lid before pressing **READ** key.
E8	Bad lamp circuit.	Reinsert lamp leads at terminal block-make sure the lead ends are not touching each other.If this fails, call Hach Service.

* Error messages 4, 5, and 6 may indicate a failure in the internal electronics.
** Check lamp by inserting a pencil or piece of paper into the cell compartment and pressing READ. Light should be visible on the inserted object.

GENERAL INFORMATION

At Hach Company, customer service is an important part of every product we make.

With that in mind, we have compiled the following information for your convenience.

Replacement Parts & Accessories

REPLACEMENT PARTS

Description	Cat. No.
StablCal Calibration Set for 2100P, Sealed Vials: <0.1 NTU, 20 NTU, 100 NTU, and 800 NTU	26594-05
AA Batteries, 4/pkg	19380-04
Battery Door	46005-00
Carrying Case	46506-00
Gelex® Standards, set (includes standards and 3 sample cells)	24641-05
Instrument Manual	46500-88
Lamp Assembly, with leads	46539-00
Mounting Feet, 4/pkg	41093-00
Oiling Cloth	47076-00
Sample Cells, 1 inch, with cap, 6/pkg	24347-06
Silicone Oil, 15 mL	1269-36

OPTIONAL ACCESSORIES AND REAGENTS

Deionized Water, 3.78 L	272-17
Bath, Ultrasonic, 2.8 L (0.75-gal), w/heater	24895-00
Battery Charger, 120 V	46479-00
Battery Charger, 230 V	46479-01
Battery Eliminator, 120 V	46079-00
Battery Eliminator, 230 V	46080-00
Filter, 0.2 micron, 10/pkg	23238-10
Formazin, 4000 NTU, 500 mL	2461-49
Formazin, 4000 NTU,100 mL	2461-42
Hexamethylenetetramine, 100 g	1878-26
Hexamethylenetetramine, 500 g	1878-34
Hydrazine Sulfate, 20 g	742-46
Hydrazine Sulfate, 100 g	742-26
NiCad Rechargeable Battery (4 required)	16077-00
Pipet, serologic, 1.00 mL	532-35

OPTIONAL ACCESSORIES AND REAGENTS, continued

Description	Cat. No.
Pipet, TenSette®*, 1-10 mL	19700-10
Pipet Tips, for 1-10 mL TenSette Pipet, 50/pkg	21997-96
Pipet Tips, for 1-10 mL TenSette Pipet, 1000/pkg	21997-28
Pipet, Volumetric, Class A, 1.00 mL	14515-35
Pipet, Volumetric, Class A, 5.00 mL	14515-37
Pump, Vacuum, Hand-Operated	14283-00
Pump, Vacuum, 115 V, 60 Hz	14697-00
Pump, Vacuum, 230 V, 50 Hz	14697-02
Sample Degassing Kit	43975-00
Sample Filtration and Degassing Kit	43975-10
StablCal® Calibration Set for 2100P Turbidimeter	
<0.1, 20, 100, 800 NTU, 500 mL each	26594-00
<0.1, 20, 100, 800 NTU, 100 mL each	26594-10
<0.1 NTU** StablCal®*** Stabilized Formazin Standard,100 mL	26597-42
20 NTU StablCal® Stabilized Formazin Standard, 100 mL	26601-42
100 NTU StablCal® Stabilized Formazin Standard, 100 mL	26602-42
800 NTU StablCal® Stabilized Formazin Standard, 100 mL	26605-42
Triton-X Solution, 118 mL (4 oz)	14096-32
Volumetric Flask, 100 mL	14574-42
Volumetric Flask, 200 mL	14574-45

* TenSette™ is a Hach Company trademark.

** <0.1 NTU StablCal® Standard is used in place of dilution water standard when performing a calibration.

*** StablCal® is a registered trademark of Hach Company.

HOW TO ORDER

By Telephone:

6:30 a.m. to 5:00 p.m. MST
Monday through Friday
(800) 227-HACH
(800-227-4224)
By FAX: (970) 669-2932

By Mail:

Hach Company
P.O. Box 389
Loveland, CO 80539-0389
U.S.A.

Ordering information by E-mail: orders@hach.com

Information Required

- Hach account number (if available)
- Your name and phone number
- Purchase order number
- Brief description or model number
- Billing address
- Shipping address
- Catalog number
- Quantity

Technical and Customer Service (U.S.A. only)

Hach Technical and Customer Service Department personnel are eager to answer questions about our products and their use. Specialists in analytical methods, they are happy to put their talents to work for you. Call **1-800-227-4224** or E-mail **techhelp@hach.com**.

International Customers

Hach maintains a worldwide network of dealers and distributors. To locate the representative nearest you, send E-mail to **intl@hach. com** or contact:

In Canada, Latin America, Africa, Asia, Pacific Rim:
Telephone: (970) 669-3050; FAX: (970) 669-2932

In Europe, the Middle East, or Mediterranean Africa:
HACH Company, c/o
Dr. Bruno Lange GmbH
Willstätterstr. 11
D-40549 Düsseldorf
Germany
Telephone: +49/[0]211.52.88.0
Fax: +49/[0]211.52.88.231

REPAIR SERVICE

Authorization must be obtained from Hach Company before sending any items for repair. Please contact the HACH Service Center serving your location.

In the United States:
Hach Company
100 Dayton Avenue
Ames, Iowa 50010
(800) 227-4224 (U.S.A. only)
Telephone: (515) 232-2533
FAX: (515) 232-1276

In Canada:
Hach Sales & Service Canada Ltd.
1313 Border Street, Unit 34
Winnipeg, Manitoba
R3H 0X4
(800) 665-7635 (Canada only)
Telephone: (204) 632-5598
FAX: (204) 694-5134
E-mail: canada@hach.com

In Latin America, the Caribbean, the Far East, the Indian Subcontinent, Africa, Europe, or the Middle East:
Hach Company World Headquarters
P.O. Box 389
Loveland, Colorado, 80539-0389
U.S.A.
Telephone: (970) 669-3050
FAX: (970) 669-2932
E-mail: intl@hach.com

WARRANTY

Hach warrants most products against defective materials or workmanship for at least one year from the date of shipment; longer warranties may apply to some items.

HACH WARRANTS TO THE ORIGINAL BUYER THAT HACH PRODUCTS WILL CONFORM TO ANY EXPRESS WRITTEN WARRANTY GIVEN BY HACH TO THE BUYER. EXCEPT AS EXPRESSLY SET FORTH IN THE PRECEDING SENTENCE, HACH MAKES NO WARRANTY OF ANY KIND WHATSOEVER WITH RESPECT TO ANY PRODUCTS. HACH EXPRESSLY DISCLAIMS ANY WARRANTIES IMPLIED BY LAW, INCLUDING BUT NOT BINDING TO ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

LIMITATION OF REMEDIES: Hach shall, at its option, replace or repair nonconforming products or refund all amounts paid by the buyer. **THIS IS THE EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.**

LIMITATION OF DAMAGES: IN NO EVENT SHALL HACH BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND FOR BREACH OF ANY WARRANTY, NEGLIGENCE, ON THE BASIS OF STRICT LIABILITY, OR OTHERWISE.

This warranty applies only to Hach products purchased and delivered in the United States.

Catalog descriptions, pictures and specification, although accurate to the best of our knowledge, are not a guarantee or warranty.

For a complete description of Hach Company's warranty policy, request a copy of our Terms and Conditions of Sale for U.S. Sales from our Customer Service Department.

YSI Environmental

Pure Data for a Healthy Planet.™

YSI 556 MPS
Multi Probe System

Operations Manual

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1. Safety

1.1 General Safety Information

Read all safety information in this manual carefully before using the YSI 556 Multi-Probe System (MPS). Reagents that are used to calibrate and check this instrument may be hazardous to your health. Take a moment to review *Appendix D Health and Safety*.

⚠ **WARNING**

Warnings are used in this manual when misuse of the instrument could result in death or serious injury to a person.

⚠ **CAUTION**

Cautions are used in this manual when misuse of the instrument could result in mild or serious injury to a person and/or damage to equipment.

⚠ **IMPORTANT SAFETY INSTRUCTIONS!**

⚠ **SAVE THESE INSTRUCTIONS!**

⚠ In essence, the most important safety rule for use of the YSI 556 MPS is to utilize the instrument ONLY for purposes documented in this manual. This is particularly true of the YSI 6117 rechargeable battery pack that contains nickel metal hydride (NiMH) batteries. The user should be certain to read all of the safety precautions outlined below before using the instrument.

⚠ YSI 6117 Rechargeable Battery Pack Safety Information

⚠ **Restrictions on Usage**

1. Never dispose of the battery pack in a fire.
2. Do not attempt to disassemble the YSI 6117 battery pack.
3. Do not tamper with any of the electronic components or the batteries within the battery pack. Tampering with either the electronic circuitry or the batteries will result in the voiding of the warranty and the compromising of the system performance, but, more importantly, can cause safety

hazards which result from overcharging such as overheating, venting of gas, and loss of corrosive electrolyte.

4. Do not charge the battery pack outside the 0–40°C temperature range.
5. Do not use or store the battery at high temperature, such as in strong direct sunlight, in cars during hot weather, or directly in front of heaters.
6. Do not expose the battery pack to water or allow the terminals to become damp.
7. Avoid striking or dropping the battery pack. If the pack appears to have sustained damage from these actions or malfunctions after an impact or drop, the user should not attempt to repair the unit. Instead, contact YSI Customer Service. Refer to *Appendix E Customer Service*.
8. If the battery pack is removed from the YSI 556 MPS, do not store it in pockets or packaging where metallic objects such as keys can short between the positive and negative terminals.

⚠ Precautions for Users with Small Children

Keep the battery pack out of reach of babies and small children.

⚠ Danger Notifications – Misuse creates a STRONG possibility of death or serious injury.

FAILURE TO CAREFULLY OBSERVE THE FOLLOWING PROCEDURES AND PRECAUTIONS CAN RESULT IN LEAKAGE OF BATTERY FLUID, HEAT GENERATION, BURSTING, AND SERIOUS PERSONAL INJURY.

1. Never dispose of the battery pack in a fire or heat it.
2. Never allow the positive and negative terminals of the battery pack to become shorted or connected with electrically conductive materials. When the battery pack has been removed from the YSI 556 MPS, store it in a heavy plastic bag to prevent accidental shorting of the terminals.

3. Never disassemble the battery pack and do not tamper with any of the electronic components or the batteries within the battery pack. The battery pack is equipped with a variety of safety features. Accidental deactivation of any of these safety features can cause a serious hazard to the user.
4. The NiMH batteries in the battery pack contain a strong alkaline solution (electrolyte). The alkaline solution is extremely corrosive and will cause damage to skin or other tissues. If any fluid from the battery pack comes in contact with a user's eyes, immediately flush with clean water and consult a physician immediately. The alkaline solution can damage eyes and lead to permanent loss of eyesight.

⚠ Warning Notifications – Misuse creates a possibility of death or serious injury

1. Do not allow the battery pack to contact freshwater, seawater, or other oxidizing reagents that might cause rust and result in heat generation. If a battery becomes rusted, the gas release vent may no longer operate and this failure can result in bursting.
2. If electrolyte from the battery pack contacts the skin or clothing, thoroughly wash the area immediately with clean water. The battery fluid can irritate the skin.

⚠ Caution Notifications – Misuse creates a possibility of mild or serious injury or damage to the equipment.

1. Do not strike or drop the battery pack. If any impact damage to the battery pack is suspected, contact YSI Customer Service. Refer to *Appendix E Customer Service*.
2. Store the battery pack out of reach of babies and small children.
3. Store the battery pack between the temperatures of -20 and 30°C.
4. Before using the battery pack, be sure to read the operation manual and all precautions carefully. Then store this information carefully to use as a reference when the need arises.

⚠ YSI 616 Cigarette Lighter Charger Safety Information

1. This section contains important safety and operating instructions for the YSI 556 MPS cigarette lighter battery charger (YSI 616; RadioShack Number 270-1533E). BE SURE TO SAVE THESE INSTRUCTIONS.
2. Before using the YSI 616 cigarette lighter charger, read all instructions and cautionary markings on battery charger, battery pack, and YSI 556 MPS.
3. Charge the YSI 6117 battery pack with the YSI 616 cigarette lighter charger ONLY when the YSI 6117 is installed in the YSI 556 MPS.
4. Do not expose charger to rain, moisture, or snow.
5. Use of an attachment not recommended or sold by the battery charger manufacturer may result in a risk of fire, electric shock, or injury to persons.
6. To reduce risk of damage to cigarette lighter and cord, pull by cigarette lighter rather than cord when disconnecting charger.
7. Make sure that the cord is located so that it will not be stepped on, tripped over, or otherwise subjected to damage or stress.
8. Do not operate charger with damaged cord or cigarette lighter connector – replace it immediately.
9. Do not operate charger if it has received a sharp blow, been dropped, or otherwise damaged in any way; contact YSI Customer Service. Refer to *Appendix E Customer Service*.
10. Do not disassemble charger other than to change the fuse as instructed. Replace the part or send it to YSI Product Service if repair is required (refer to *Appendix E Customer Service*). Incorrect reassembly may result in a risk of electric shock or fire.
11. To reduce risk of electric shock, unplug charger before attempting any maintenance or cleaning. Turning off controls will not reduce this risk.

⚠ YSI 556 MPS Water Leakage Safety Information

The YSI 556 MPS has been tested and shown to comply with IP67 criterion, i.e. submersion in 1 meter of water for 30 minutes with no leakage into either the battery compartment or the main case. However, if the instrument is submersed for periods of time in excess of 30 minutes, leakage may occur with subsequent damage to the batteries, the rechargeable battery pack circuitry, and/or the electronics in the main case.

If leakage into the battery compartment is observed when using alkaline C cells, remove batteries, dispose of batteries properly, and dry the battery compartment completely, ideally using compressed air. If corrosion is present on the battery terminals, contact YSI Customer Service for instructions. Refer to *Appendix E Customer Service*.

If leakage into the battery compartment is observed when using the YSI 6117 rechargeable battery pack, remove the battery assembly and set aside to dry. Return the battery pack to YSI Product Service for evaluation of possible damage. Finally dry the battery compartment completely, ideally using compressed air. If corrosion is present on the battery terminals, contact YSI Customer Service for instructions. Refer to *Appendix E Customer Service*.

⚠ **CAUTION:** If water has contacted the rechargeable battery pack, do not attempt to reuse it until it has been evaluated by YSI Product Service (refer to *Appendix E Customer Service*). Failure to follow this precaution can result in serious injury to the user.

If it is suspected that leakage into the main cavity of the case has occurred, remove the batteries immediately and return the instrument to YSI Product Service for damage assessment. Refer to *Appendix E Customer Service*.

⚠ **CAUTION:** Under no circumstances should the user attempt to open the main case.

2. General Information

2.1 Description

The rugged and reliable YSI 556 MPS (Multi-Probe System) combines the versatility of an easy-to-use, easy-to-read handheld unit with all the functionality of a multi-parameter system. Featuring a waterproof, impact-resistant case, the YSI 556 MPS simultaneously measures dissolved oxygen, conductivity, temperature, and optional pH and ORP. A simple cellular phone style keypad and large display make the instrument easy to use. The YSI 556 MPS is compatible with YSI EcoWatch™ for Windows™ software.

The YSI 556 MPS assists the user in conforming to Good Laboratory Practice (GLP) standards which help ensure that quality control/quality assurance methods are followed. Battery life is displayed with a fuel gauge, and the user can choose standard alkaline batteries or an optional rechargeable battery pack.

The 1.5 MB memory can store more than 49,000 data sets. Other options include a flow cell and barometer. The internal barometer can be user-calibrated and displayed along with other data, used in dissolved oxygen calibrations, and logged to memory for tracking changes in barometric pressure.

Features

- Waterproof - meets IP67 specifications
- Field-replaceable DO electrode module; pH and pH/ORP sensors
- Compatible with Ecowatch™ for Windows™ data analysis software
- Assists with Good Laboratory Practice Standards (GLP)
- Choice of DO membrane material for different applications
- Easy-to-use, screw-on cap DO membranes
- User-upgradable software from YSI website
- Three-year warranty on the instrument; one-year on the probe modules
- Available with 4,10, and 20 m cable lengths
- Stores over 49,000 data sets, time and date stamped
- Auto temperature compensating display contrast

- Optional barometer
- Optional rechargeable battery pack or standard alkaline batteries

2.2 Unpacking the Instrument

1. Remove the instrument from the shipping box. Note that the probe module and sensors are shipped in a separate box and will be unpacked later in Section *3.2 Unpacking the Probe Module*.

   NOTE: Do not discard any parts or supplies.

2. Use the packing list to ensure all items are present.

3. Visually inspect all components for damage.

   NOTE: If any parts are missing or damaged, contact your YSI Service Center immediately. Refer to *Appendix E Customer Service* or www.ysi.com.

2.3 Features of the YSI 556 Multi-Probe System

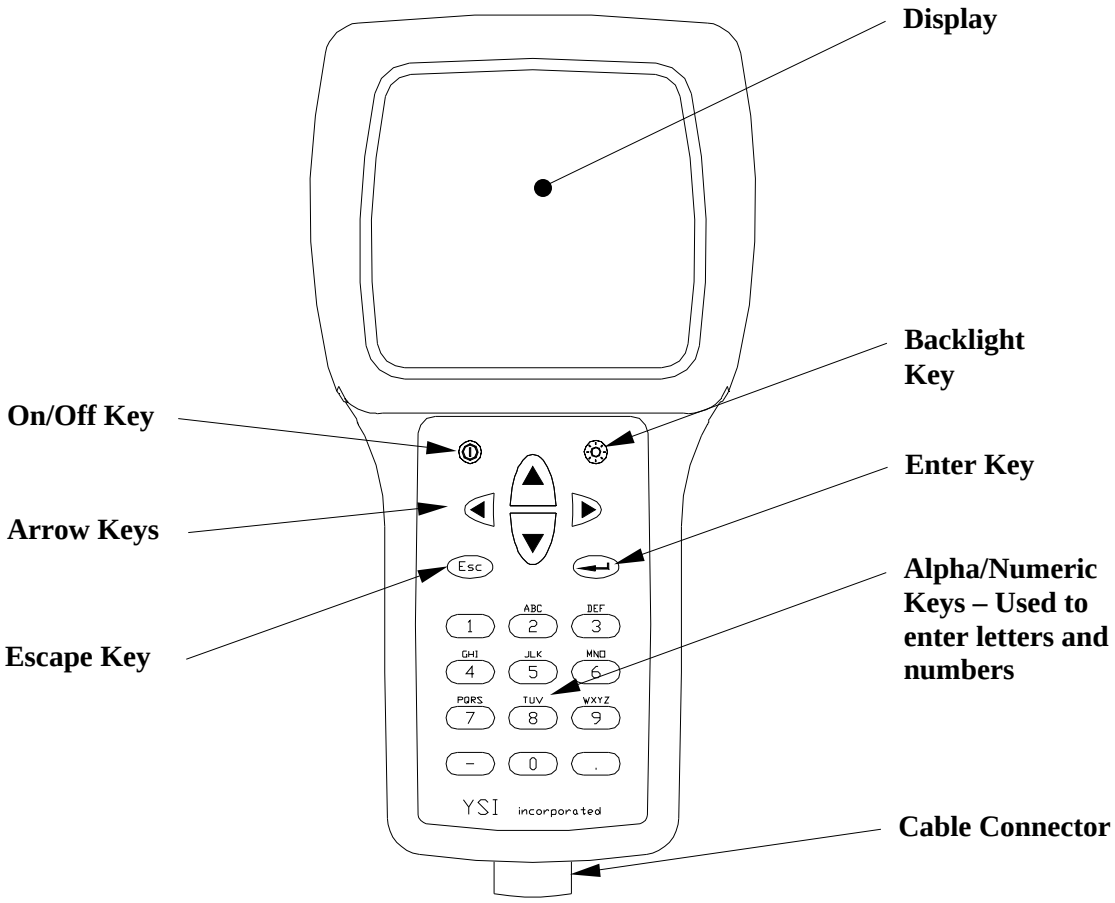


Figure 2.1 Front View of YSI 556 MPS

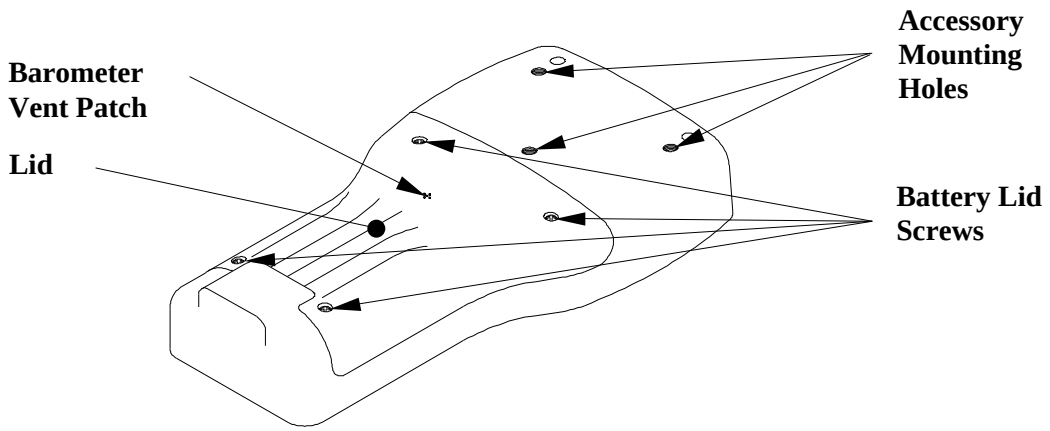


Figure 2.2 Back View of YSI 556 MPS

2.4 Batteries

2.4.1 Battery Life

Standard Alkaline Batteries

With the standard battery configuration of 4 alkaline C cells, the YSI 556 MPS will operate continuously for approximately 180 hours. Assuming a standard usage pattern when sampling of 3 hours of "on time" in a typical day, the alkaline cells will last approximately 60 days.

Optional Rechargeable Battery Pack

When fully charged, the optional rechargeable battery pack will provide approximately 50 hours of battery life.

2.4.2 Inserting 4 C Batteries

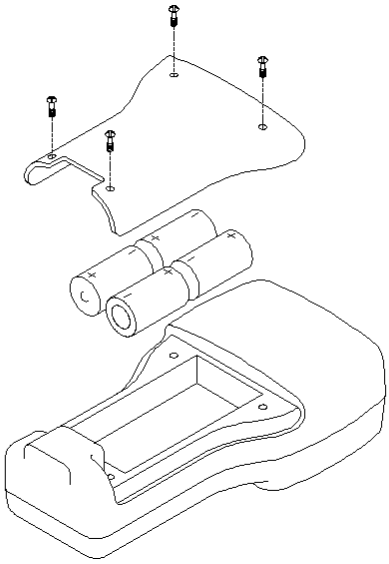


Figure 2.3 Inserting C Cells

⚠ **CAUTION: Install batteries properly to avoid damage to the instrument.**

1. Loosen the four screws in the battery lid on the back of the instrument using any screwdriver.

2. Remove the battery lid.

3. Insert four C batteries between the clips following the polarity (+ and -) labels on the bottom of the battery compartment.

4. Check gasket for proper placement on the battery lid.

5. Replace the battery lid and tighten the 4 screws securely and evenly.

   NOTE: Do not over-tighten the screws.

2.4.3 Inserting Optional Rechargeable Battery Pack

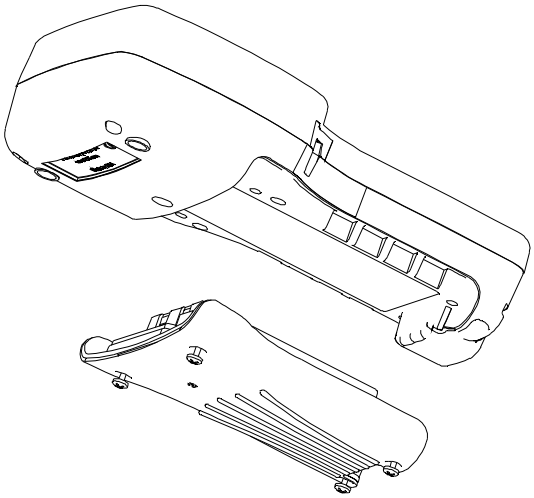


Figure 2.4 Inserting Battery Pack

⚠ **CAUTION: Read all cautions and warnings that come with the battery pack *before* using the battery pack.**

1. Loosen the four screws in the battery lid on the back of the instrument using any screwdriver.

2. Remove the C battery lid and store for future use. Remove C batteries, if installed.

3. Check for proper placement of gasket on the rechargeable battery pack and lid.

4. Install the rechargeable battery pack and lid and tighten the 4 screws securely and evenly.

   NOTE: Do not over tighten the screws.

2.4.4 Charging the Optional Rechargeable Battery Pack

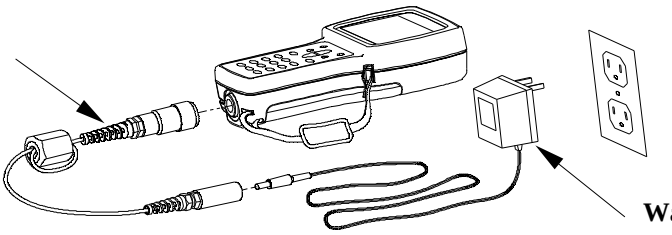


Figure 2.5 Charging the Battery Pack

⚠ **CAUTION: Do not use or store the battery pack at extreme temperatures such as in strong direct sunlight, in cars during hot weather or close to heaters.**

1. Install the rechargeable battery pack into the instrument as described in Section *2.4.3 Inserting Optional Rechargeable Battery Pack*.

2. Attach the charger adapter cable (YSI 6119) to the instrument.

   NOTE: Wall power supplies for use in countries outside the US and Canada can be found in *Appendix B Instrument Accessories*.

3. Insert the barrel connector of the wall power supply into the barrel of the adapter cable.

⚠ **CAUTION: Do not charge the battery pack continuously for more than 48 hours.**

⚠ **CAUTION: Do not drop or expose to water.**

⚠ **CAUTION: Do not charge the battery pack at temperatures below 0°C or above 40°C.**

4. Plug the wall power supply into an AC power outlet for approximately 2 hours to obtain an 80% to 90% charge and for 6 hours to get a full charge.

   NOTE: The battery pack can be recharged whether the instrument is on or off.

2.4.5 Storing the Battery Pack

Remove the battery pack from the instrument when the instrument will not be used for extended periods of time to prevent over discharge of the battery pack.

Store the battery pack in a heavy plastic bag to prevent accidental shorting of the terminals. Store between –20 and 30°C.

2.4.6 Optional Cigarette Lighter Charger

⚠ **CAUTION: Read all warnings and cautions that come with the charger before using the charger.**

⚠ **CAUTION: Only use cigarette lighter charger when *rechargeable* battery pack is inserted into instrument.**

⚠ **CAUTION: Do not mishandle cigarette lighter charger. Do not expose to moisture.**

1. Plug the barrel connector of the cigarette lighter charger into the mating end of the YSI 6119 Charger Adapter Cable.

2. Attach the MS-19 end of the YSI 6119 Charger Adapter Cable to the instrument.

3. Make one of the following modifications to the other end of the charger:

   Slide the adapter ring off the plug to use the device with an American or Japanese vehicle.

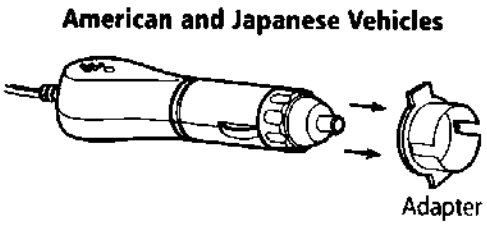


Figure 2.6 Charger Plug Adapter Use

Leave the adapter ring on the plug and position it so that the slots on the adapter ring line up with the plug's spring clips to use the device on a European vehicle.

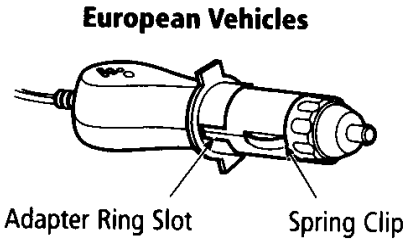


Figure 2.7 European Charger Plug Adapter Use

NOTE: If the charger stops working properly, refer to Section *13 Troubleshooting*.

2.5 Power On

Press and release the on/off button in the upper left corner of the instrument keypad to turn the instrument on or off. See Figure 2.1 Front View of YSI 556 MPS.

2.6 Setting Display Contrast

The display contrast automatically compensates for temperature changes. However, under extreme temperature conditions you may wish to optimize the display by manual adjustment as follows:

1. Press and *hold down* the backlight key in the upper right corner of the keypad and press the “up” arrow to increase (darken) the contrast.

2. Press and *hold down* the backlight key in the upper right corner of the keypad and press the “down” arrow to decrease (lighten) the contrast.

2.7 Backlight

Press and *release* the backlight key in the upper right corner of the keypad to turn the backlight on or off. See Figure 2.1 Front View of YSI 556 MPS.

NOTE: The backlight turns off automatically after two minutes of non-use.

2.8 General Screen Features

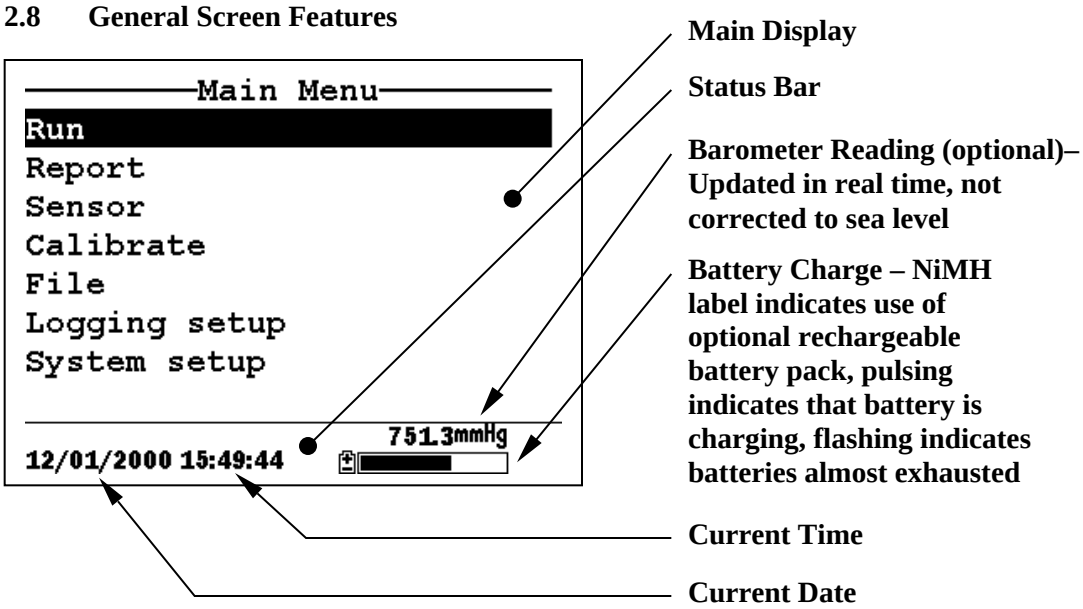


Figure 2.8 Main Menu Screen

2.9 Keypad Use

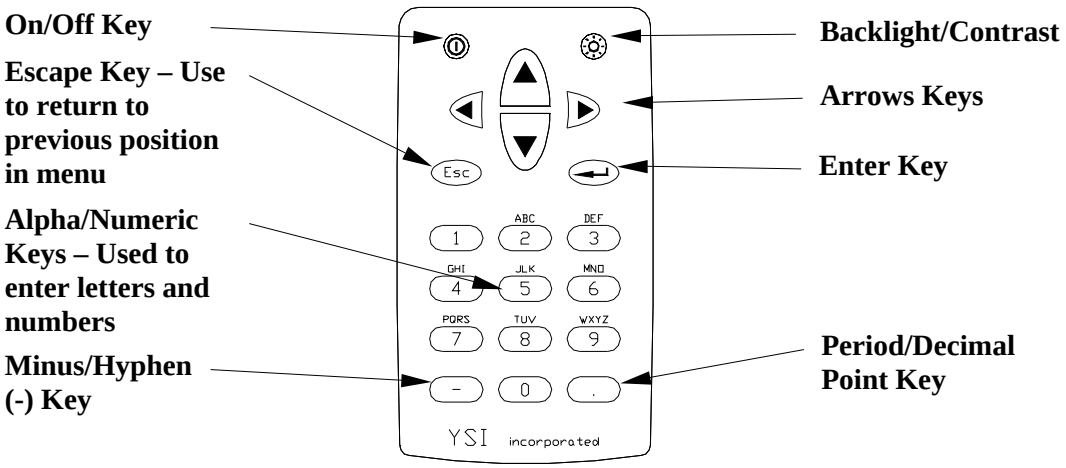


Figure 2.9 Keypad Features

KEY	LETTER/ NUMBER
1	1
2	ABC2abc3
3	DEF3def3
4	GHI4ghi4
5	JKL5jkl5
6	MNO6mno6
7	PQRS7pqrs7
8	TUV8tuv8
9	WXYZ9wxyz9
0	0

Figure 2.10 Keypad Letters & Numbers

1. See Figure 2.10 Keypad Letters & Numbers and press the appropriate key repeatedly until letter or number desired appears in display.

NOTE: Press the key repeatedly in rapid succession to get to the desired letter or number. If you pause for more than a

second, the cursor automatically scrolls to the right to prepare for the next input.

EXAMPLE 1: Press the **6** key *once* and *release* to display an uppercase "M."

EXAMPLE 2: Press the **6** key *four times* and *release* to display the number "6."

EXAMPLE 3: Press the **6** key *five times* and *stop* to display a lowercase "m."

2. Press the left arrow key to go back and reenter a number or letter that needs to be changed.

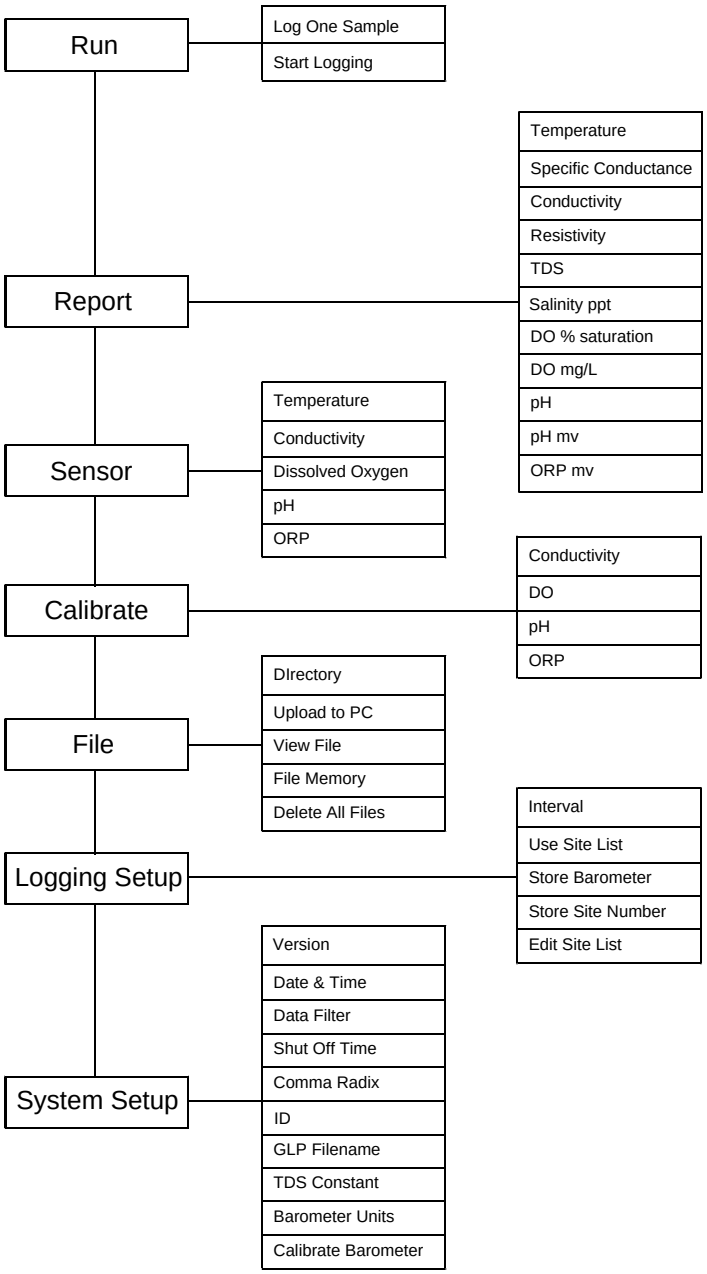
3. Press the **Enter** key when your entry is complete.

   NOTE: The instrument software permits only numeric entries in many instances, such as when setting the clock or entering calibration parameters.

2.10 Instrument Reset

The YSI 556 MPS is characterized by sophisticated software that should provided trouble-free operation. However as with all high-capability software packages, it is always possible that the user will encounter circumstances in which the instrument does not respond to keypad entry. If this occurs, the instrument function can easily be restored by removing and then reapplying battery power. Simply remove either your C-cells or rechargeable battery pack from the battery compartment, wait 30 seconds and then replace the batteries. See Section *2.4 Batteries* for battery removal/reinstallation instructions.

2.11 Menu Flowchart



3. Probe Module

3.1 Introduction

The YSI 5563 Probe module is used for measuring dissolved oxygen, temperature, conductivity, and optional pH and ORP. The probe module is rugged, with the sensors enclosed in a heavy duty probe sensor guard with attached sinking weight. A 4, 10 or 20 meter cable is directly connected to the probe module body making it waterproof. An MS-19 connector at the end of the cable makes the YSI 5563 fully compatible with the YSI 556 Multi-Probe System.

3.2 Unpacking the Probe Module

1. Remove the YSI 5563 Probe module from the shipping boxes.

   NOTE: Do not discard any parts or supplies.

2. Use the packing list to ensure all items are present.

3. Visually inspect all components for damage.

   NOTE: If any parts are missing or damaged, contact your YSI Service Center immediately. Refer to *Appendix E Customer Service* or www.ysi.com.

3.3 Features of the YSI 5563 Probe Module

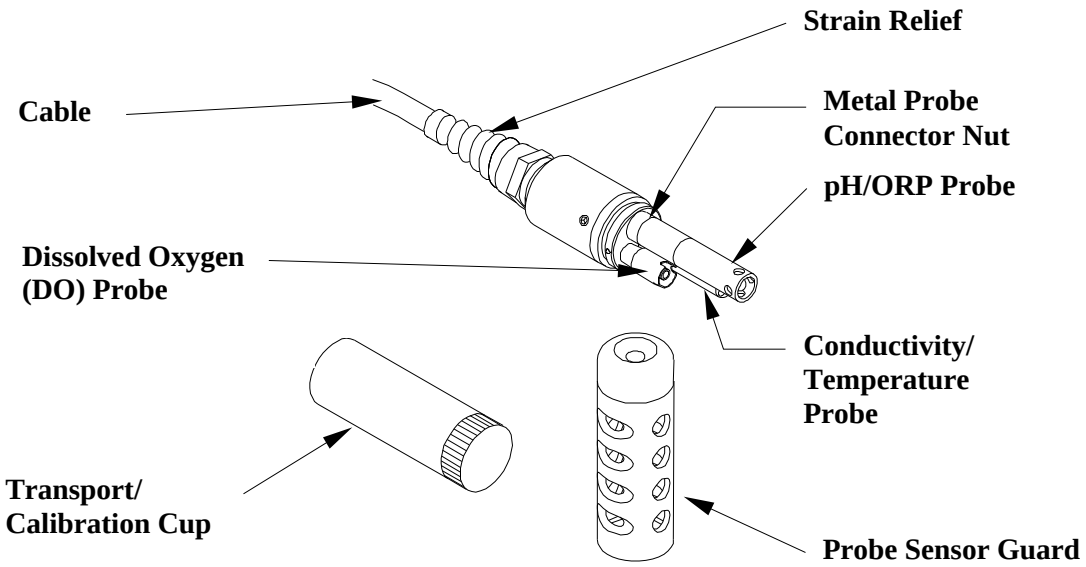


Figure 3.1 Probe Module

3.4 Preparing the Probe Module

To prepare the probe module for calibration and operation, you need to install the sensors into the connectors on the probe module bulkhead. In addition to sensor installation, you need to install a new DO membrane cap.

3.4.1 Sensor Installation

Whenever you install, remove or replace a sensor, it is extremely important that the entire probe module and all sensors be thoroughly dried prior to the removal of a sensor or a sensor port plug. This will prevent water from entering the port. Once you remove a sensor or plug, examine the connector inside the probe module sensor port. If any moisture is present, use compressed air to completely dry the connector. If the connector is corroded, return the probe module to your dealer or directly to YSI Customer Service. Refer to *Appendix E Customer Service*.

Conductivity/Temperature and pH, pH/ORP Sensor Installation

1. Unscrew and remove the probe sensor guard.

2. Using the sensor installation tool supplied in the YSI 5511 maintenance kit, unscrew and remove the sensor port plugs.

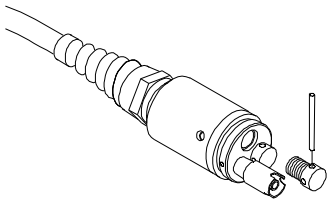


Figure 3.2 Port Plug Removal

3. Locate the port with the connector that corresponds to the sensor that is to be installed.

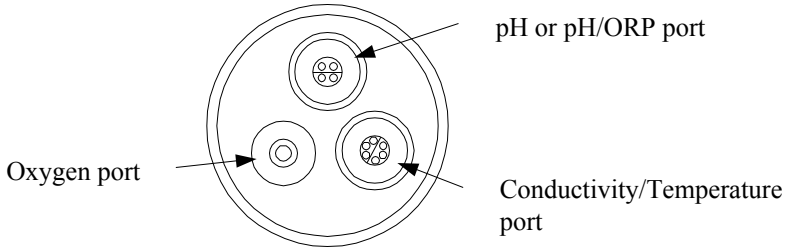


Figure 3.3 Sensor Port Identification

4. Apply a thin coat of o-ring lubricant (supplied in the YSI 5511 maintenance kit) to the o-rings on the connector side of the sensor (see Figure 3.4 O-Ring Lubrication).

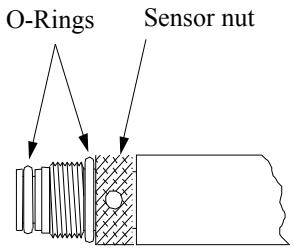


Figure 3.4 O-Ring Lubrication

⚠ **CAUTION:** Make sure that there are NO contaminants between the O-ring and the sensor. Contaminants that are present under the O-ring may cause the O-ring to leak.

5. Be sure the probe module sensor port is free of moisture and then insert the sensor into the correct port. Gently rotate the sensor until the two connectors align.

6. With connectors aligned, screw down the sensor nut using the sensor installation tool.

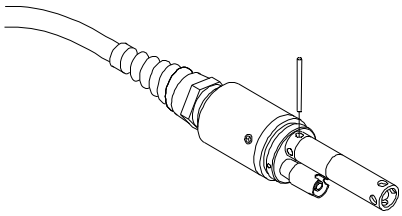


Figure 3.5 Sensor Installation

⚠ **CAUTION:** Do not cross thread the sensor nut. Tighten the nut until it is flush with the face of the probe module bulkhead. Do not over tighten.

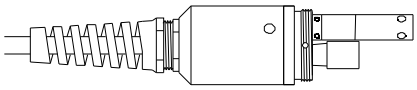


Figure 3.6 Bulkhead Seating

7. Repeat steps 3-6 for any other sensors.

8. Replace the probe sensor guard.

Dissolved Oxygen Sensor Installation

The YSI 5563 comes with the DO sensor already installed. Refer to Section *11.1.2 DO Sensor Replacement* for instructions on installing the YSI 558 Replaceable DO Module Kit.

3.4.2 Membrane Cap Selection

The YSI 5563 is shipped with a YSI 5909 kit that contains membrane caps made with 2 mil polyethylene (PE), a material which should be ideal for most field applications of the 556. However, YSI also offers membrane caps made with two other materials (1 mil polyethylene and 1 mil Teflon) which some users may also prefer. All membranes available for the 556/5563 system provide comparable accuracy if used properly. The difference between the two thicknesses of PE is found in the trade-off of flow dependence and response time as described below. Teflon is offered because some users may prefer to continue using the traditional membrane material used by YSI. To avoid confusion, the membrane caps are color coded as described below and can be ordered in kits as noted:

1 mil Teflon – Black Caps (Kit = YSI 5906)
1 mil Polyethylene (PE) – Yellow Caps (Kit = YSI 5908)
2 mil Polyethylene (PE) – Blue Caps (Kit = YSI 5909)

The 1 mil Teflon caps will offer traditional, reliable performance for most dissolved oxygen applications. The 1 mil PE caps will provide a significantly faster dissolved oxygen response (as long as your 556 Data Filter is set correctly as described below in Sections 10.2 and 10.3.1)) while also giving readings which are significantly less flow dependent than the 1 mil Teflon caps. Finally, 2 mil PE caps will show a large reduction in flow dependence over 1 mil Teflon while not significantly increasing the response time. Generally, one of the PE caps is likely to provide better performance for your application.

IMPORTANT: No matter which type of membrane cap you select, you will also have to confirm your selection in the 556

software from the Sensor menu as described in Section *4 Sensors*.

3.4.3 Membrane Cap Installation

NOTE: The YSI 5563 DO sensor (already installed in the probe module) was shipped dry. A shipping membrane was installed to protect the electrode. **A new membrane cap must be installed before the first use**.

1. Unscrew and remove the probe sensor guard.
2. Unscrew, remove, and discard the old membrane cap.
3. Thoroughly rinse the sensor tip with distilled water.
4. Prepare the electrolyte according to the directions on the electrolyte solution bottle.
5. Hold the new membrane cap and fill it at least 1/2 full with the electrolyte solution.
6. Screw the membrane cap onto the sensor moderately tight. A small amount of electrolyte should overflow.

⚠ **CAUTION:** Do not touch the membrane surface.

7. Screw the probe sensor guard on moderately tight.

3.5 Transport/Calibration Cup

The YSI 5563 Probe module has been supplied with a convenient transport/calibration cup. This cup is an ideal container for calibration of the different sensors, minimizing the amount of solution needed. Refer to Section *6 Calibrate*.

3.5.1 Transport/Calibration Cup Installation

1. Remove probe sensor guard, if already installed.

2. Ensure that an o-ring is installed in the o-ring groove on the threaded end of the probe module body.

3. Screw the transport/calibration cup on the threaded end of the probe module and securely tighten.

   NOTE: Do not overtighten as this could cause damage to the threaded portions.

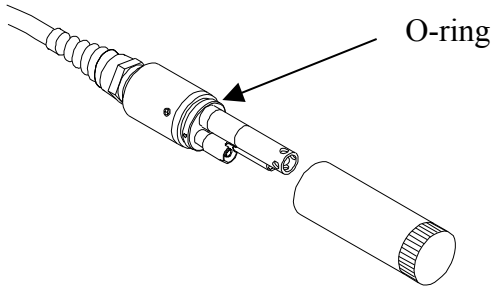


Figure 3.7 Transport/Calibration Cup Installation

3.6 Instrument/Cable Connection

Attach the cable to the instrument as follows:

1. Line up the pins and guides on the cable with the holes and indentations on the cable connector at the bottom of the YSI 556 instrument. See Figure 2.1 Front View of YSI 556 MPS.

2. Holding the cable firmly against the cable connector, turn the locking mechanism clockwise until it snaps into place.

Remove the cable from the instrument by turning the cable connector counterclockwise until the cable disengages from the instrument.

The Sensors Enabled screen allows the user to enable or disable each of the sensors and select which membrane material will be used for the dissolved oxygen sensor. Disabled sensors will not be displayed on the screen in real time or logged to files.

1. Press the **On/off** key to display the run screen.

2. Press the **Escape** key to display the main menu screen.

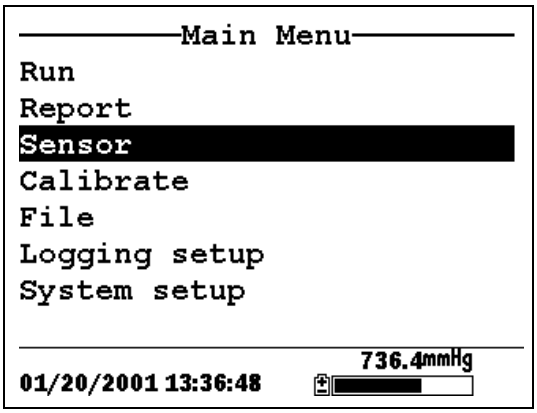


Figure 4.1 Main Menu Screen

3. Use the arrow keys to highlight the **Sensor** selection.

4. Press the **Enter** key to display the sensors enabled screen.

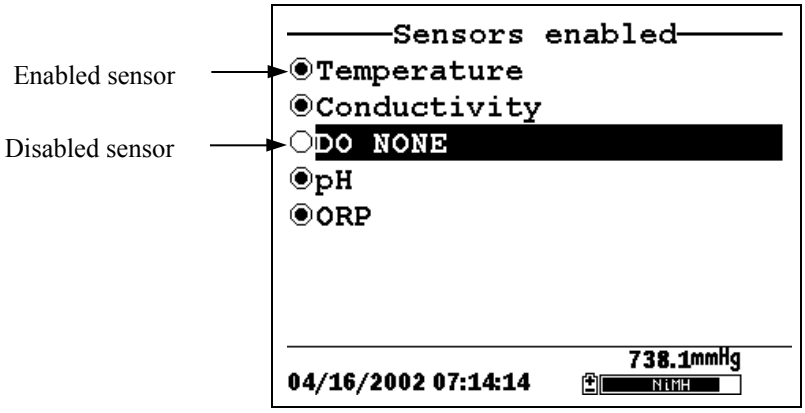


Figure 4.2 Sensors Enabled Screen Before DO Membrane Selection

A black dot to the left of a sensor indicates that sensor is enabled. Sensors with an empty circle are disabled.

Highlight the "DO None" entry as shown above and press **Enter** to display the membrane choice screen. Consult Section *3.4.2 Membrane Cap Selection* for information on the advantages of each type of membrane material. Blue membrane caps using 2 mil polyethylene (PE) were shipped with your YSI 5563 and are likely to be the best choice for most 556 field applications.

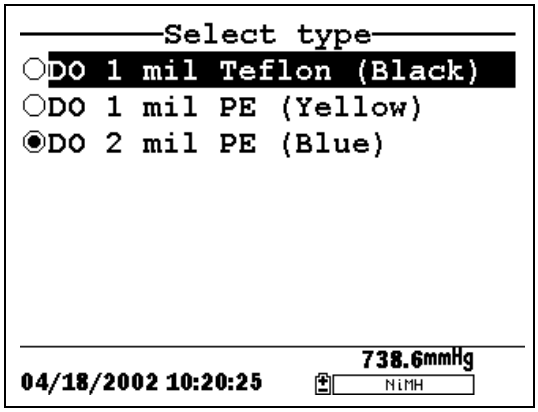


Figure 4.3 Membrane Selection Screen

Highlight the desired membrane choice – in this case, 2 mil PE -- and press Enter to activate your selection with a dot to the left of the screen. Then press **Escape** to return to the Sensor menu that now shows your DO membrane selection.

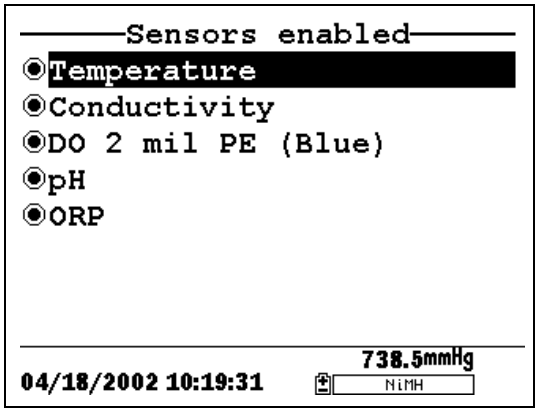


Figure 4.4 Sensors Enabled Screen After DO Membrane Selection

NOTE: The Temperature sensor cannot be disabled. Most other sensors require temperature compensation for accurate readings. In addition, the conductivity sensor must be activated in order to obtain accurate dissolved oxygen mg/L readings.

5. Use the arrow keys to highlight the sensor you want to change, then press the **Enter** key to enable or disable it.

6. Repeat step 5 for each sensor you want to change.

7. Press the **Escape** key to return to the main menu screen.

5. Report

The Report Setup screen allows the user to select which sample parameters and units the YSI 556 MPS will display on the screen. It does NOT determine which parameters are logged to memory. Refer to Section *4 Sensors*.

1. Press the **On/off** key to display the run screen.

2. Press the **Escape** key to display the main menu screen.

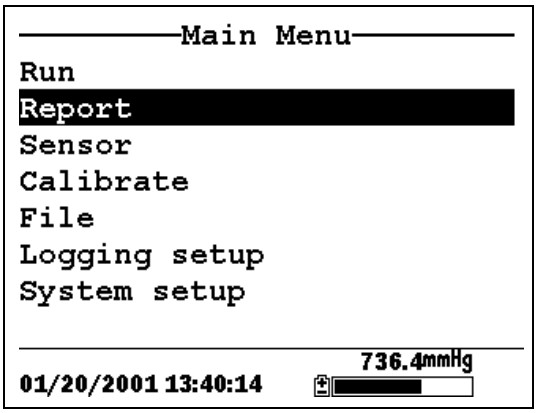


Figure 5.1 Main Menu

3. Use the arrow keys to highlight the **Report** selection.

4. Press the **Enter** key to display the report setup screen.

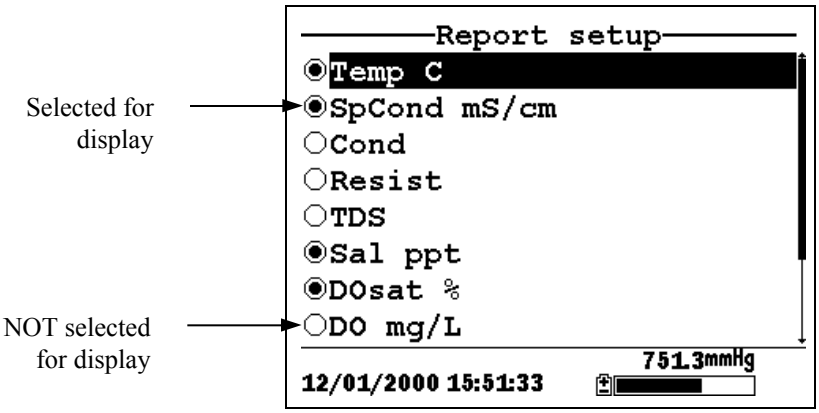


Figure 5.2 Report Setup Screen

NOTE: A black dot to the left of a parameter indicates that parameter is selected for display. Parameters with an empty circle will not be displayed.

NOTE: You may have to scroll down past the bottom of the screen to see all the parameters.

5. Use the arrow keys to highlight the parameter you want to change, then press the **Enter** key. If you can't find the parameter you want, even after scrolling down past the bottom of the screen, the sensor used for that parameter is disabled. Refer to Section *4 Sensors*.

6. If you selected Temperature, Specific Conductivity, Conductivity, Resistance or Total Dissolved Solids, the Units screen will appear.

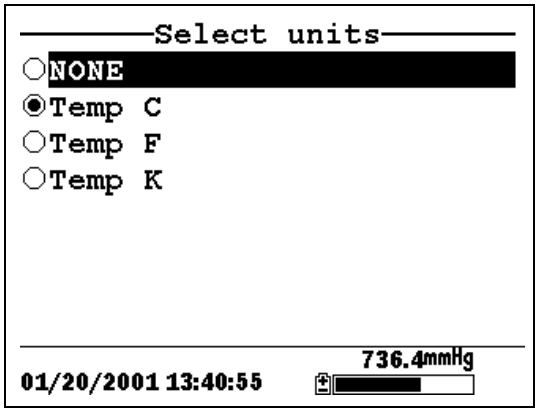


Figure 5.3 Units Screen

7. Use the arrow keys to select the units desired, then press the **Enter** key to return to the report setup screen.

   If you selected Salinity, Dissolved Oxygen %, Dissolved Oxygen mg/L, pH, pH mv or ORP mv, the selection dot will simply toggle on or off.

8. Repeat steps 5 and 6 for each parameter you want to change.

NOTE: All parameters may be enabled at the same time.

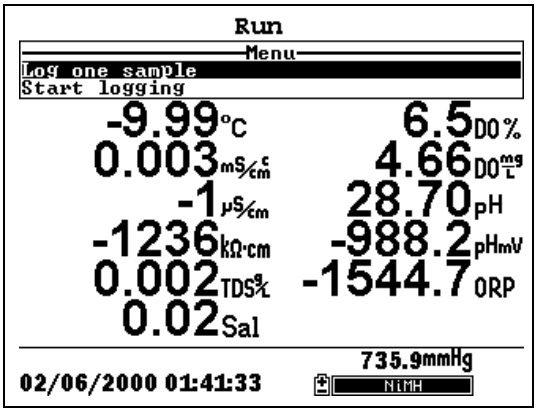


Figure 5.4 All Parameters Displayed

9. Press the **Escape** key to return to the Main menu screen.

6. Calibrate

All of the sensors, except temperature, require periodic calibration to assure high performance. You will find specific calibration procedures for all sensors that require calibration in the following sections. If a sensor listed is not installed in your probe module, skip that section and proceed to the next sensor until the calibration is complete.

⚠ **CAUTION:** Reagents that are used to calibrate and check this instrument may be hazardous to your health. Take a moment to review *Appendix D Health and Safety*. Some calibration standard solutions may require special handling.

6.1 Getting Ready to Calibrate

6.1.1 Containers Needed to Calibrate the Probe Module

The transport/calibration cup that comes with your probe module serves as a calibration chamber for all calibrations and minimizes the volume of calibration reagents required.

Instead of the transport/calibration cup, you may use laboratory glassware to perform calibrations. If you do not use the transport/calibration cup that is designed for the probe module, you are cautioned to do the following:

- Perform all calibrations with the Probe Sensor Guard installed. This protects the sensors from possible physical damage.
- Use a ring stand and clamp to secure the probe module body to prevent the module from falling over. Most laboratory glassware has convex bottoms.
- Ensure that all sensors are immersed in calibration solutions. Many of the calibrations factor in readings from other sensors (e.g., temperature sensor). The top vent hole of the conductivity sensor must also be immersed during some calibrations.

6.1.2 Calibration Tips

1. If you use the Transport/Calibration Cup for dissolved oxygen (DO) calibration, make certain to loosen the seal to allow pressure equilibration before calibration. The DO calibration is a water-saturated air calibration.
2. The key to successful calibration is to ensure that the sensors are completely submersed when calibration values are entered. Use recommended volumes when performing calibrations.
3. For maximum accuracy, use a small amount of previously used calibration solution to pre-rinse the probe module. You may wish to save old calibration standards for this purpose.
4. Fill a bucket with ambient temperature water to rinse the probe module between calibration solutions.
5. Have several clean, absorbent paper towels or cotton cloths available to dry the probe module between rinses and calibration solutions. Shake the excess rinse water off of the probe module, especially when the probe sensor guard is installed. Dry off the outside of the probe module and probe sensor guard. Making sure that the probe module is dry reduces carry-over contamination of calibrator solutions and increases the accuracy of the calibration.
6. If you are using laboratory glassware for calibration, you do not need to remove the probe sensor guard to rinse and dry the sensors between calibration solutions. The inaccuracy resulting from simply rinsing the sensor compartment and drying the outside of the guard is minimal.
7. If you are using laboratory glassware, remove the stainless steel weight from the bottom of the probe sensor guard by turning the weight counterclockwise. When the weight is removed, the calibration solutions have access to the sensors without displacing a lot of fluid. This also reduces the amount of liquid that is carried between calibrations.
8. Make certain that port plugs are installed in all ports where sensors are not installed. It is extremely important to keep these electrical connectors dry.

6.1.3 Recommended Volumes

Follow these instructions to use the transport/calibration cup for calibration procedures.

- Ensure that an o-ring is installed in the o-ring groove of the transport/calibration cup bottom cap, and that the bottom cap is securely tightened.

  NOTE: Do not over-tighten as this could cause damage to the threaded portions.

- Remove the probe sensor guard, if it is installed.
- Remove the o-ring, if installed, from the probe module and inspect the installed o-ring on the probe module for obvious defects and, if necessary, replace it with the extra o-ring supplied.
- Some calibrations can be accomplished with the probe module upright or upside down. A separate clamp and stand, such as a ring stand, is required to support the probe module in the inverted position.
- To calibrate, follow the procedures in the next section, Calibration Procedures. The approximate volumes of the reagents are specified below for both the upright and upside down orientations.
- When using the Transport/Calibration Cup for dissolved oxygen % saturation calibration, make certain that the vessel is vented to the atmosphere by loosening the bottom cap or cup assembly and that approximately 1/8” of water is present in the cup.

Sensor to Calibrate	Upright	Upside Down
Conductivity	55ml	55ml
pH/ORP	30ml	60ml

Table 6.1 Calibration Volumes

6.2 Calibration Procedures

6.2.1 Accessing the Calibrate Screen

1. Press the **On/off** key to display the run screen.
2. Press the **Escape** key to display the main menu screen.
3. Use the arrow keys to highlight the **Calibrate** selection.

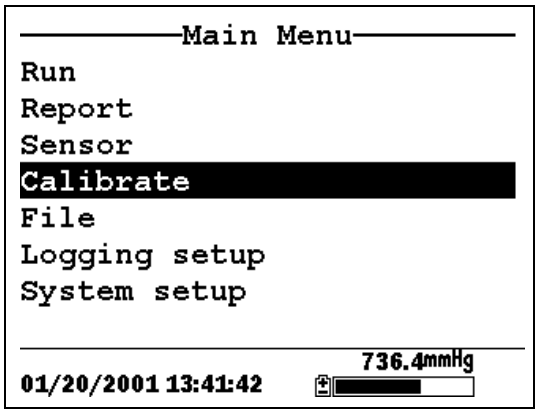


Figure 6.1 Main Menu

4. Press the **Enter** key. The Calibrate screen is displayed.

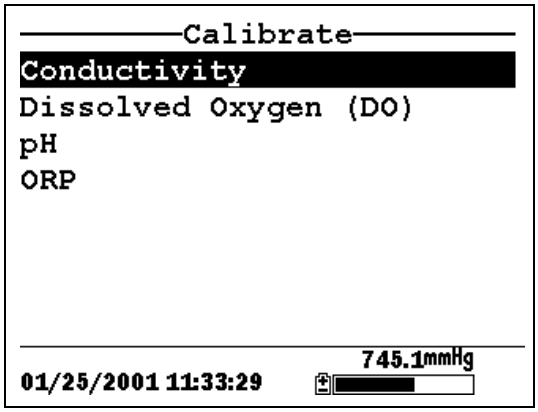


Figure 6.2 Calibrate Screen

6.2.2 Conductivity Calibration

This procedure calibrates specific conductance (recommended), conductivity and salinity. Calibrating any one option automatically calibrates the other two.

1. Go to the calibrate screen as described in Section 6.2.1 Accessing the Calibrate Screen.

2. Use the arrow keys to highlight the **Conductivity** selection. See Figure 6.2 Calibrate Screen.

3. Press **Enter.** The Conductivity Calibration Selection Screen is displayed.

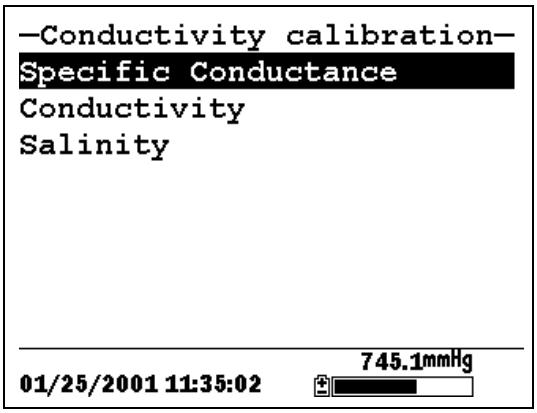


Figure 6.3 Conductivity Calibration Selection Screen

4. Use the arrow keys to highlight the Specific Conductance selection.

5. Press **Enter.** The Conductivity Calibration Entry Screen is displayed.

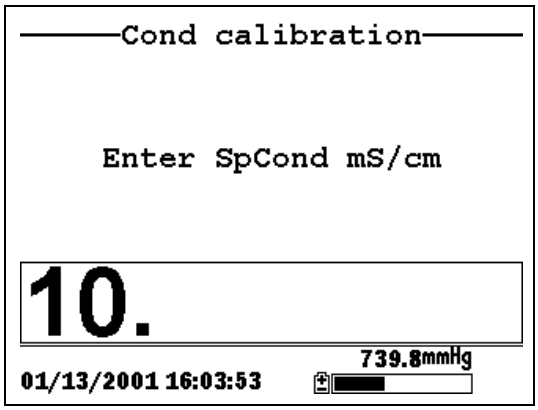


Figure 6.4 Conductivity Calibration Entry Screen

6. Place the correct amount of conductivity standard (see Table 6.1 Calibration Volumes) into a clean, dry or pre-rinsed transport/calibration cup.

⚠ **WARNING**: Calibration reagents may be hazardous to your health. See *Appendix D Health and Safety* for more information.

NOTE: For maximum accuracy, the conductivity standard you choose should be within the same conductivity range as the samples you are preparing to measure. However, we do not recommend using standards less than 1 mS/cm. For example:

- For fresh water use a 1 mS/cm conductivity standard.
- For brackish water use a 10 mS/cm conductivity standard.
- For seawater use a 50 mS/cm conductivity standard.

NOTE: Before proceeding, ensure that the sensor is as dry as possible. Ideally, rinse the conductivity sensor with a small amount of standard that can be discarded. Be certain that you avoid cross-contamination of solutions. Make certain that there are no salt deposits around the oxygen and pH/ORP sensors, particularly if you are employing standards of low conductivity.

7. Carefully immerse the sensor end of the probe module into the solution.

8. Gently rotate and/or move the probe module up and down to remove any bubbles from the conductivity cell.

   NOTE: The sensor must be completely immersed past its vent hole. Using the recommended volumes from Table 6.1 Calibration Volumes, should ensure that the vent hole is covered.

9. Screw the transport/calibration cup on the threaded end of the probe module and securely tighten.

   NOTE: Do not overtighten as this could cause damage to the threaded portions.

10. Use the keypad to enter the calibration value of the standard you are using.

    NOTE: Be sure to enter the value in **mS/cm at 25°C**.

11. Press **Enter**. The Conductivity Calibration Screen is displayed.

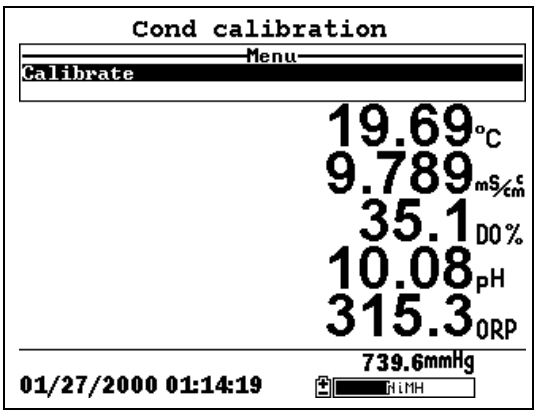


Figure 6.5 Conductivity Calibration Screen

12. Allow at least one minute for temperature equilibration before proceeding. The current values of all enabled sensors

will appear on the screen and will change with time as they stabilize.

13. Observe the reading under Specific Conductance. When the reading shows no significant change for approximately 30 seconds, press **Enter**. The screen will indicate that the calibration has been accepted and prompt you to press **Enter** again to Continue.

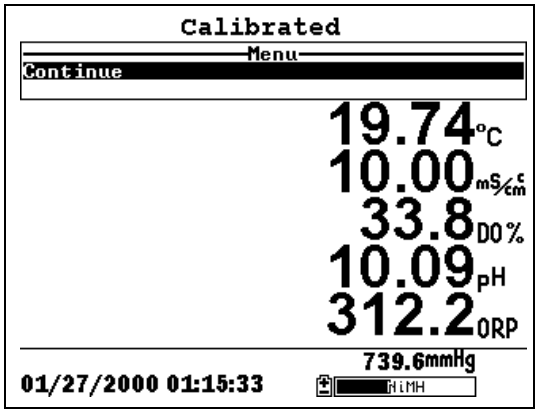


Figure 6.6 Calibrated

14. Press **Enter**. This returns you to the Conductivity Calibrate Selection Screen, See Figure 6.3 Conductivity Calibration Selection Screen.

15. Press **Escape** to return to the calibrate menu. See Figure 6.2 Calibrate Screen.

16. Rinse the probe module and sensors in tap or purified water and dry.

6.2.3 Dissolved Oxygen Calibration

This procedure calibrates dissolved oxygen. Calibrating any one option (% or mg/L) automatically calibrates the other.

1. Go to the calibrate screen as described in Section *6.2.1 Accessing the Calibrate Screen*.

NOTE: The instrument must be on for at least 20 minutes to polarize the DO sensor before calibrating.

2. Use the arrow keys to highlight the **Dissolved Oxygen** selection. See Figure 6.2 Calibrate Screen.
3. Press **Enter**. The dissolved oxygen calibration screen is displayed.

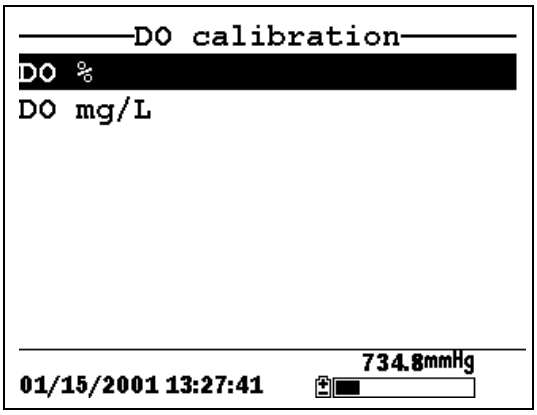


Figure 6.7 DO Calibration Screen

DO Calibration in % Saturation

1. Use the arrow keys to highlight the DO% selection.
2. Press **Enter**. The DO Barometric Pressure Entry Screen is displayed.

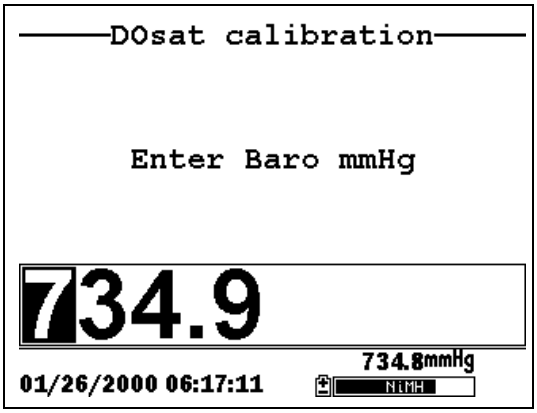


Figure 6.8 DO Barometric Pressure Entry Screen

3. Place approximately 3 mm (1/8 inch) of water in the bottom of the transport/calibration cup.

4. Place the probe module into the transport/calibration cup.

   NOTE: Make sure that the DO and temperature sensors are **not** immersed in the water.

5. Engage only 1 or 2 threads of the transport/calibration cup to ensure the DO sensor is vented to the atmosphere.

6. Use the keypad to enter the current local barometric pressure.

   NOTE: If the unit has the optional barometer, no entry is required.

   NOTE: Barometer readings that appear in meteorological reports are generally corrected to sea level and must be uncorrected before use (refer to Section *10.10 Calibrate Barometer, Step 2*).

7. Press **Enter**. The DO% saturation calibration screen is displayed.

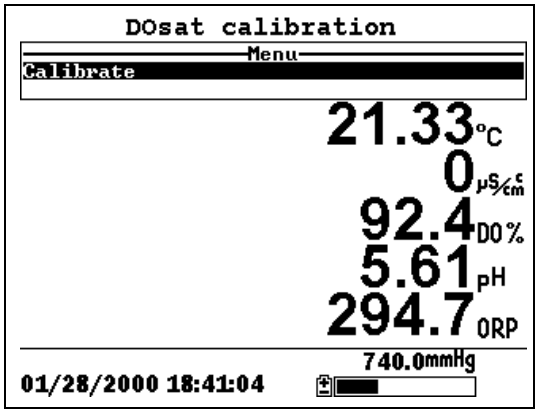


Figure 6.9 DO Sat Calibration Screen

8. Allow approximately ten minutes for the air in the transport/calibration cup to become water saturated and for

the temperature to equilibrate before proceeding. The current values of all enabled sensors will appear on the screen and will change with time as they stabilize.

9. Observe the reading under DO %. When the reading shows no significant change for approximately 30 seconds, press **Enter**. The screen will indicate that the calibration has been accepted and prompt you to press **Enter** again to Continue. See Figure 6.6 Calibrated.

10. Press **Enter**. This returns you to the DO calibration screen, See Figure 6.7 DO Calibration Screen.

11. Press **Escape** to return to the calibrate menu. See Figure 6.2 Calibrate Screen.

12. Rinse the probe module and sensors in tap or purified water and dry.

DO Calibration in mg/L

DO calibration in mg/L is carried out in a water sample which has a known concentration of dissolved oxygen (usually determined by a Winkler titration).

1. Go to the DO calibrate screen as described in Section *6.2.3 Dissolved Oxygen Calibration*, steps 1 through 3.

2. Use the arrow keys to highlight the **DO mg/L** selection.

3. Press **Enter**. The DO mg/L Entry Screen is displayed.

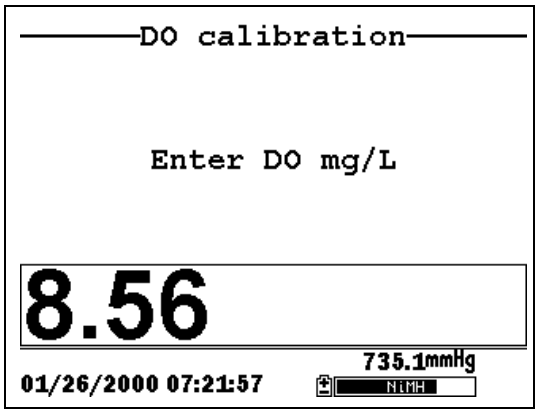


Figure 6.10 DO mg/L Entry Screen

4. Place the probe module in water with a known DO concentration.

   NOTE: Be sure to completely immerse all the sensors.

5. Use the keypad to enter the known DO concentration of the water.

6. Press **Enter**. The Dissolved Oxygen mg/L Calibration Screen is displayed.

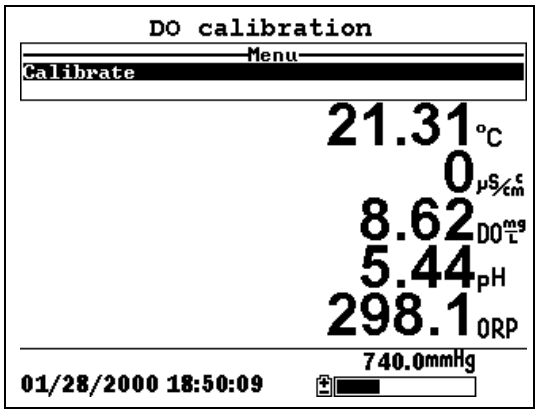


Figure 6.11 DO mg/L Calibration Screen

7. Stir the water with a stir bar, or by rapidly moving the probe module, to provide fresh sample to the DO sensor.

8. Allow at least one minute for temperature equilibration before proceeding. The current values of all enabled sensors will appear on the screen and will change with time as they stabilize.

9. Observe the DO mg/L reading, when the reading is stable (shows no significant change for approximately 30 seconds), press **Enter**. The screen will indicate that the calibration has been accepted and prompt you to press **Enter** again to Continue.

10. Press **Enter**. This returns you to the DO calibration screen. See Figure 6.7 DO Calibration Screen.

11. Press **Escape** to return to the calibrate menu. See Figure 6.2 Calibrate Screen.

12. Rinse the probe module and sensors in tap or purified water and dry.

6.2.4 pH Calibration

1. Go to the calibrate screen as described in *Section 6.2.1 Accessing the Calibrate Screen*.

2. Use the arrow keys to highlight the **pH** selection. See Figure 6.2 Calibrate Screen.

3. Press **Enter**. The pH calibration screen is displayed.

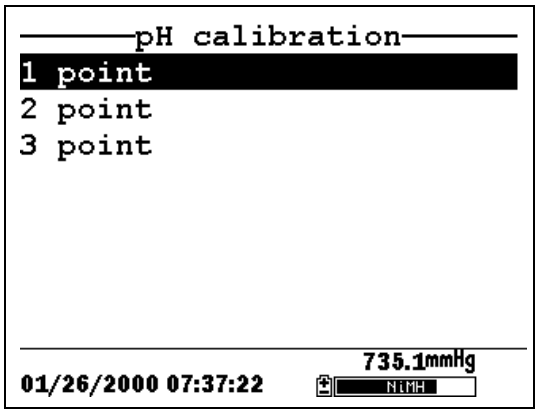


Figure 6.12 pH Calibration Screen

- Select the **1-point** option only if you are adjusting a previous calibration. If a 2-point or 3-point calibration has been performed previously, you can adjust the calibration by carrying out a one point calibration. The procedure for this calibration is the same as for a 2-point calibration, but the software will prompt you to select only one pH buffer.
- Select the **2-point** option to calibrate the pH sensor using only two calibration standards. Use this option if the media being monitored is known to be either basic or acidic. For example, if the pH of a pond is known to vary between 5.5 and 7, a two-point calibration with pH 7 and pH 4 buffers is sufficient. A three point calibration with an additional pH 10 buffer will not increase the accuracy of this measurement since the pH is not within this higher range.
- Select the **3-point** option to calibrate the pH sensor using three calibration solutions. In this procedure, the pH sensor is calibrated with a pH 7 buffer and two additional buffers. The 3-point calibration method assures maximum accuracy when the pH of the media to be monitored cannot be anticipated. The procedure for this calibration is the same as for a 2-point calibration, but the software will prompt you to select a third pH buffer.

4. Use the arrow keys to highlight the **2-point** selection.

5. Press **Enter**. The pH Entry Screen is displayed.

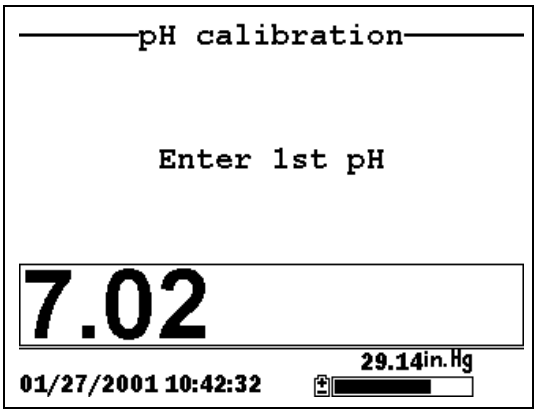


Figure 6.13 pH Entry Screen

6. Place the correct amount (see Table 6.1 Calibration Volumes) of pH buffer into a clean, dry or pre-rinsed transport/calibration cup.

⚠ **WARNING**: Calibration reagents may be hazardous to your health. See *Appendix D Health and Safety* for more information.

NOTE: For maximum accuracy, the pH buffers you choose should be within the same pH range as the water you are preparing to sample.

NOTE: Before proceeding, ensure that the sensor is as dry as possible. Ideally, rinse the pH sensor with a small amount of buffer that can be discarded. Be certain that you avoid cross-contamination of buffers with other solutions.

7. Carefully immerse the sensor end of the probe module into the solution.

8. Gently rotate and/or move the probe module up and down to remove any bubbles from the pH sensor.

NOTE: The sensor must be completely immersed. Using the recommended volumes from Table 6.1 Calibration Volumes, should ensure that the sensor is covered.

9. Screw the transport/calibration cup on the threaded end of the probe module and securely tighten.

   NOTE: Do not overtighten as this could cause damage to the threaded portions.

10. Use the keypad to enter the calibration value of the buffer you are using **at the current temperature**.

    NOTE: pH vs. temperature values are printed on the labels of all YSI pH buffers.

11. Press **Enter**. The pH calibration screen is displayed.

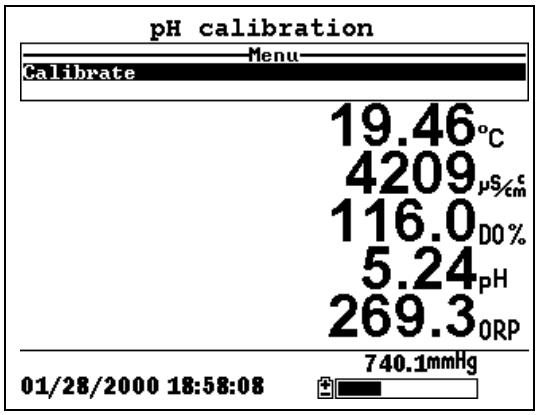


Figure 6.14 pH Calibration Screen

12. Allow at least one minute for temperature equilibration before proceeding. The current values of all enabled sensors will appear on the screen and will change with time as they stabilize.

13. Observe the reading under pH, when the reading shows no significant change for approximately 30 seconds, press **Enter**. The screen will indicate that the calibration has been accepted and prompt you to press **Enter** again to Continue.

14. Press **Enter**. This returns you to the Specified pH Calibration Screen, See Figure 6.13 pH Entry Screen.

15. Rinse the probe module, transport/calibration cup and sensors in tap or purified water and dry.

16. Repeat steps 6 through 13 above using a second pH buffer.

17. Press **Enter**. This returns you to the pH Calibration Screen, See Figure 6.12 pH Calibration Screen.

18. Press **Escape** to return to the calibrate menu. See Figure 6.2 Calibrate Screen.

19. Rinse the probe module and sensors in tap or purified water and dry.

6.2.5 ORP Calibration

1. Go to the calibrate screen as described in Section *6.2.1 Accessing the Calibrate Screen*.

2. Use the arrow keys to highlight the **ORP** selection. See Figure 6.2 Calibrate Screen.

3. Press **Enter**. The ORP calibration screen is displayed.

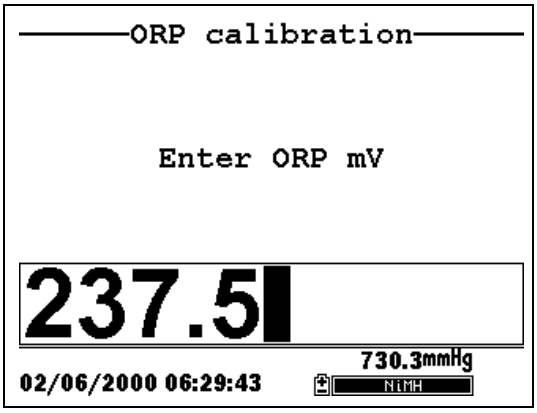


Figure 6.15 Specified ORP Calibration Screen

4. Place the correct amount (see Table 6.1 Calibration Volumes) of a known ORP solution (we recommend Zobell solution) into a clean, dry or pre-rinsed transport/calibration cup.

⚠ **WARNING**: Calibration reagents may be hazardous to your health. See *Appendix D Health and Safety* for more information.

NOTE: Before proceeding, ensure that the sensor is as dry as possible. Ideally, rinse the ORP sensor with a small amount of solution that can be discarded. Be certain that you avoid cross-contamination with other solutions.

5. Carefully immerse the sensor end of the probe module into the solution.

6. Gently rotate and/or move the probe module up and down to remove any bubbles from the ORP sensor.

   NOTE: The sensor must be completely immersed. Using the recommended volumes from Table 6.1 Calibration Volumes should ensure that the sensor is covered.

7. Screw the transport/calibration cup on the threaded end of the probe module and securely tighten.

   NOTE: Do not overtighten as this could cause damage to the threaded portions.

8. Use the keypad to enter the correct value of the calibration solution you are using at the current temperature. Refer to Table 6.2 Zobel Solution Values.

Temperature °C	Zobell Solution Value, mV
-5	270.0
0	263.5
5	257.0
10	250.5
15	244.0
20	237.5
25	231.0
30	224.5
35	218.0
40	211.5
45	205.0
50	198.5

Table 6.2 Zobel Solution Values

9. Press **Enter**. The ORP calibration screen is displayed.

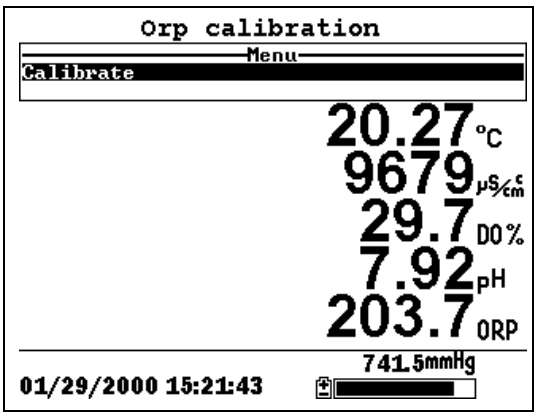


Figure 6.16 ORP Calibration Screen

10. Allow at least one minute for temperature equilibration before proceeding. The current values of all enabled sensors will appear on the screen and will change with time as they stabilize.

NOTE: Verify that the temperature reading matches the value you used in Table 6.2 Zobel Solution Values.

11. Observe the reading under ORP, when the reading shows no significant change for approximately 30 seconds, press **Enter**. The screen will indicate that the calibration has been accepted and prompt you to press **Enter** again to Continue.

12. Press **Enter**. This returns you to the Calibrate Screen. See Figure 6.2 Calibrate Screen.

13. Rinse the probe module and sensors in tap or purified water and dry.

6.3 Return to Factory Settings

1. Go to the calibrate screen as described in Section *6.2.1 Accessing the Calibrate Screen*.

2. Use the arrow keys to highlight the **Conductivity** selection. See Figure 6.2 Calibrate Screen.

   NOTE: We will use the Conductivity sensor as an example; however, this process will work for any sensor.

3. Press **Enter.** The Conductivity Calibration Selection Screen is displayed. See Figure 6.3 Conductivity Calibration Selection Screen.

4. Use the arrow keys to highlight the **Specific Conductance** selection.

5. Press **Enter.** The Conductivity Calibration Entry Screen is displayed. See Figure 6.4 Conductivity Calibration Entry Screen.

6. Press and hold the **Enter** key down and press the **Escape** key.

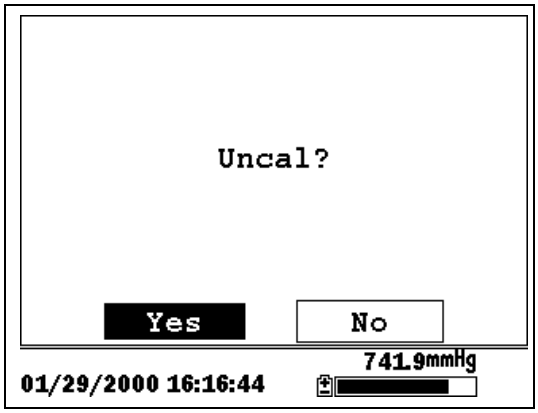


Figure 6.17 ORP Calibration Screen

7. Use the arrow keys to highlight the **YES** selection.

CAUTION: This returns a sensor to the factory settings. For example, in selecting to return specific conductance to the factory setting, salinity and conductivity will automatically return to their factory settings.

8. Press **Enter**. This returns you to the Conductivity Calibrate Selection Screen, See Figure 6.3 Conductivity Calibration Selection Screen.

9. Press **Escape** to return to the calibrate menu. See Figure 6.2 Calibrate Screen.

7. Run

The Run screen displays data from the sensors in real-time and allows the user to log sample data to memory for later analysis. Refer to Section *9 Logging* for details on logging sample data.

7.1 Real-Time Data

NOTE: Before measuring samples you must prepare the probe module (refer to Section *3.4 Preparing the Probe Module*), attach the probe module to the instrument (refer to Section *3.6 Instrument/Cable Connection*) and calibrate the sensors (refer to Section *6 Calibrate*).

1. Press the **On/off** key.

OR select Run from the main menu to display the run screen.

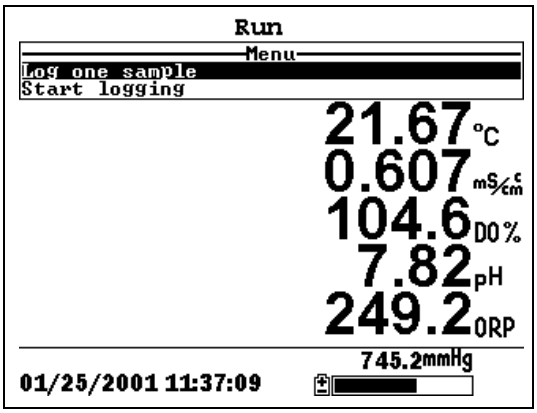


Figure 7.1 Run Screen

2. Make sure the probe sensor guard is installed.

3. Place the probe module in the sample. Be sure to completely immerse all the sensors.

4. Rapidly move the probe module through the sample to provide fresh sample to the DO sensor.

5. Watch the readings on the display until they are stable.

6. Refer to Section *9 Logging* for instructions on logging sample data.

8. File

The File menu allows the user to view, upload or delete sample data and calibration record files stored in the YSI 556 MPS.

8.1 Accessing the File Screen

1. Press the **On/off** key to display the run screen.

2. Press the **Escape** key to display the main menu screen.

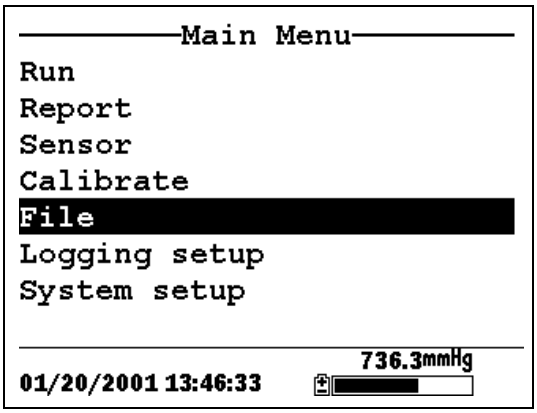


Figure 8.1 Main Menu Screen

3. Use the arrow keys to highlight the **File** selection.

4. Press the **Enter** key. The file screen is displayed.

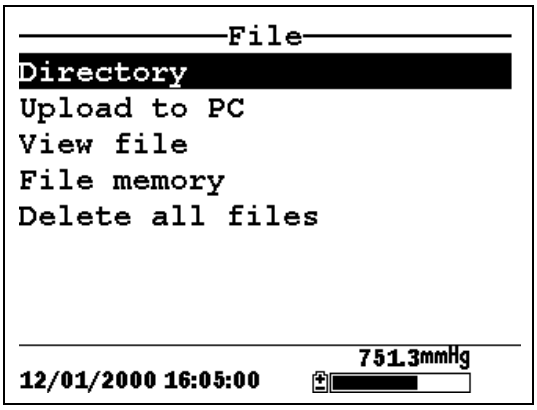


Figure 8.2 File Screen

8.2 Directory

1. Go to the file screen as described in Section *8.1 Accessing the File Screen*.

2. Use the arrow keys to highlight the **Directory** selection. See Figure 8.2 File Screen.

3. Press the **Enter** key. The file list screen is displayed.

   NOTE: Files are listed in the order in which they are logged to memory. Sample Data files have the file extension **.dat**, while Calibration Record files have the file extension **.glp**.

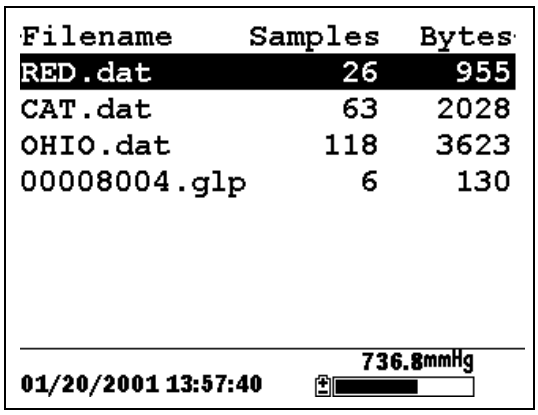


Figure 8.3 File List Screen

4. Use the arrow keys to highlight a file.

5. Press the **Enter** key. The file details screen is displayed.

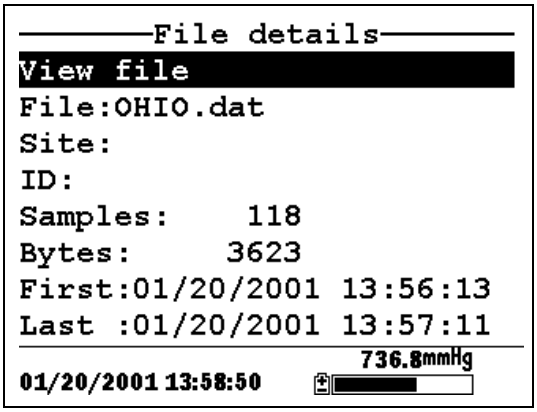


Figure 8.4 File Details Screen

6. Press the **Enter** key to view the file data. Refer to Section *8.3 View File* for details.

7. Press the **Escape** key repeatedly to return to the main menu screen.

8.3 View File

1. Go to the file screen as described in Section *8.1 Accessing the File Screen*. See Figure 8.2 File Screen.

2. Use the arrow keys to highlight the **View file** selection.

3. Press the **Enter** key. A list of files is displayed. See Figure 8.3 File List Screen.

4. Use the arrow keys to highlight an individual file.

   NOTE: You may have to scroll down to see all the files.

5. Press the **Enter** key. The file data is displayed with the file name at the top of the display.

   NOTE: If no file name was specified, the data is stored under the default name NONAME1.dat.

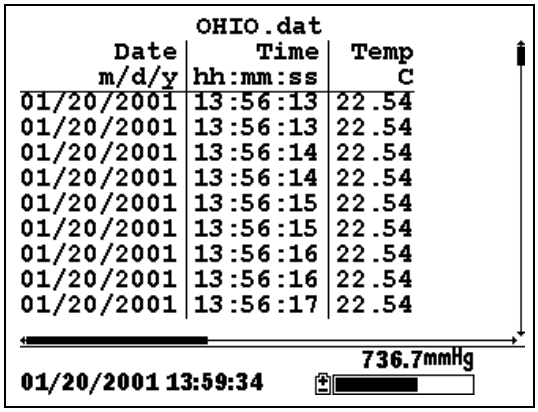


Figure 8.5 File Data Screen

6. Use the arrow keys to scroll horizontally and/or vertically to view all the data.

7. Press the **Escape** key repeatedly to return to the main menu screen.

8.4 Upload to PC

EcoWatch™ for Windows™must be used as the PC software interface to the YSI 556 MPS. Refer to *Appendix G EcoWatch* for more information. EcoWatch for Windows is available at no cost via a download from the YSI Web Site (www.ysi.com) or by contacting YSI Customer Support. Refer to *Appendix E Customer Service.*

8.4.1 Upload Setup

1. Disconnect the YSI 5563 Probe Module from the YSI 556 MPS instrument.

2. Connect the YSI 556 MPS to a serial (Comm) port of your computer via the 655173 PC Interface cable as shown in the following diagram:

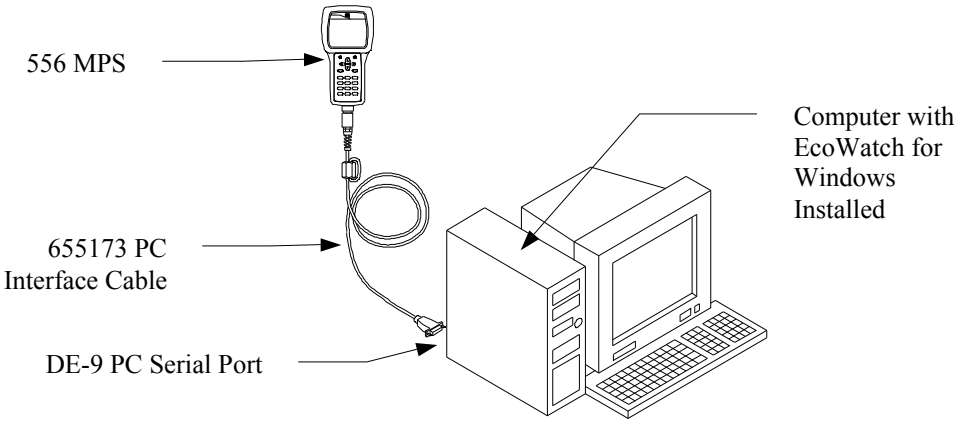


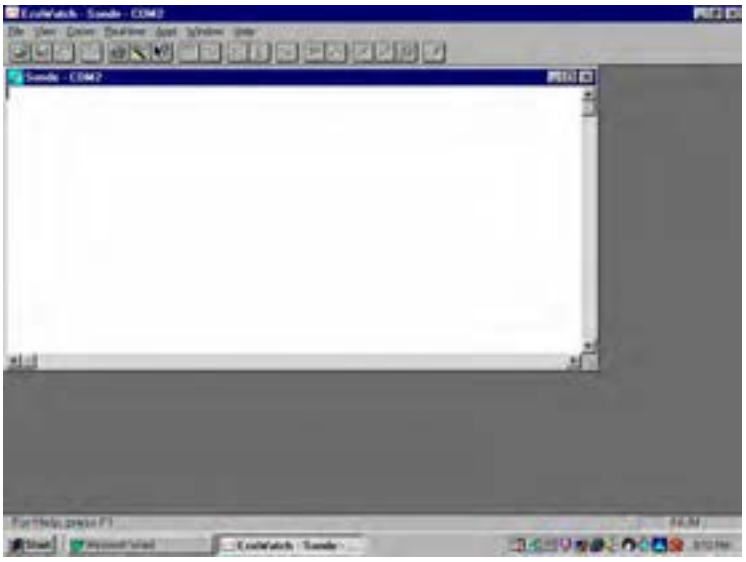
Figure 8.6 Computer/Instrument Interface

3. Open EcoWatch for Windows on your computer.

NOTE: See *Appendix G EcoWatch* for installation instructions.

4. Click on the sonde/probe icon in the upper toolbar.

5. Set the Comm port number to match the port the YSI 556 MPS is connected to. After this setup procedure, the following screen will be present on your PC monitor:



8.4.2 Uploading a .DAT File

1. Setup the instrument as described in Section *8.4.1 Upload Setup*.

2. Go to the YSI 556 MPS file screen as described in Section *8.1 Accessing the File Screen.*

3. Use the arrow keys to highlight the **Upload to PC** selection. See Figure 8.2 File Screen.

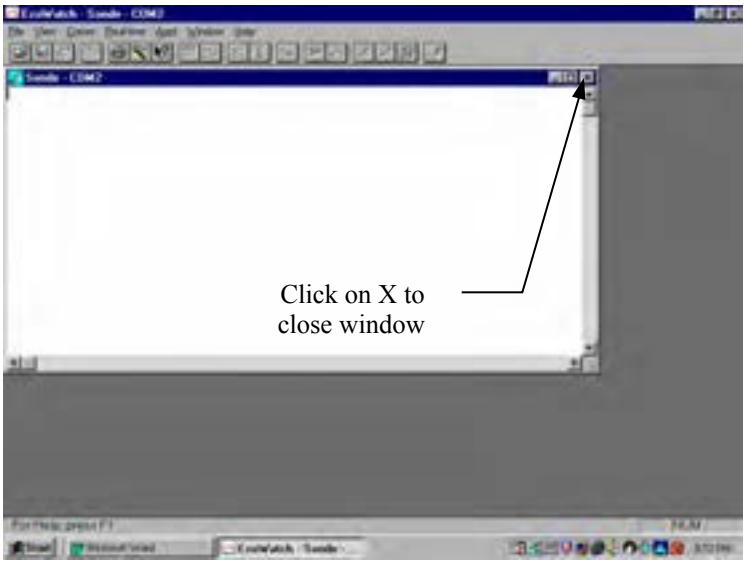
4. Press the **Enter** key. The file list screen is displayed. See Figure 8.3 File List Screen.

5. Use the arrow keys to highlight the DAT file that you wish to transfer and press **Enter**, both the YSI 556 MPS and PC displays show the progress of the file transfer.

Figure 8.7 File Transfer Progress Screen

NOTE: After transfer, the file will be located in the C:\ECOWWIN\DATA folder of your PC, designated with a .DAT extension.

6. After the file transfer is complete, close the terminal window (small window on the PC) by clicking on the "X" at its upper right corner.



7. Press the **Escape** key on the YSI 556 MPS repeatedly to return to the main menu screen.

8.4.3 Uploading a Calibration Record (.glp) File

For more information on the calibration record, Refer to *Appendix H Calibration Record Information.*

1. Setup up the instrument as described in Section *8.4.1 Upload Setup*.

2. Go to the YSI 556 MPS file screen as described in Section *8.1 Accessing the File Screen.*

3. Use the arrow keys to highlight the **Upload to PC** selection. See Figure 8.2 File Screen.

4. Press the **Enter** key. The file list screen is displayed. See Figure 8.3 File List Screen.

5. Use the arrow keys to highlight the calibration record file that you wish to transfer and press **Enter.**

6. You will then be given a choice of uploading the file in three formats; **Binary, Comma & “” Delimited, and ASCII Text**.

   NOTE: The binary format is reserved for future YSI software packages.

7. Choose an option and press **Enter,** both the YSI 556 and PC displays show the progress of the file transfer.

   NOTE: After transfer, the file will be located in the C:\ECOWWIN\DATA folder of your PC, designated with the appropriate file extension.

   NOTE: To view the Calibration Record data after upload, simply open the .txt file in a general text editor such as Wordpad or Notepad.

8. After the file transfer is complete, close the terminal window (small window on the PC) by clicking on the “X” at its upper right corner.

9. Press the **Escape** key repeatedly to return to the main menu screen.

8.5 File Memory

1. Go to the file screen as described in Section *8.1 Accessing the File Screen*.

2. Use the arrow keys to highlight the **File memory** selection. See Figure 8.2 File Screen.

3. Press the **Enter** key. The file bytes used screen is displayed.

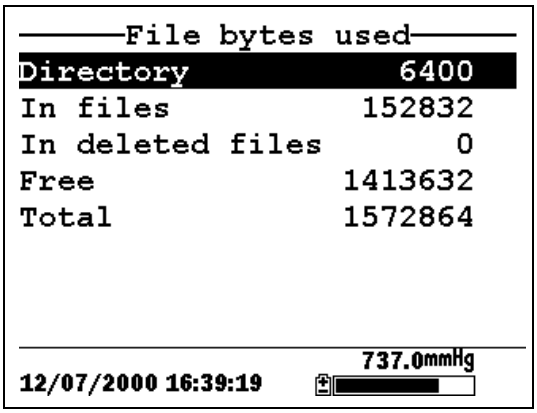


Figure 8.8 File Bytes Used Screen

4. The amount of free memory is listed in line 4 of the file bytes used screen.

   NOTE: If the amount of free memory is low, it may be time to delete all files (after first uploading all data to a PC). Refer to Section *8.6 Delete All Files*.

5. Press the **Escape** key repeatedly to return to the main menu screen.

8.6 Delete All Files

NOTE: It is not possible to delete individual files in order to free up memory. The only way to free up memory is to delete ALL files present. Take care to transfer all files to your computer (refer to Section *8.4 Upload to PC*) *before* deleting them.

1. Go to the file screen as described in Section *8.1 Accessing the File Screen*.

2. Use the arrow keys to highlight the **Delete all files** selection. See Figure 8.2 File Screen.

3. Press the **Enter** key. The Delete all Files screen is displayed.

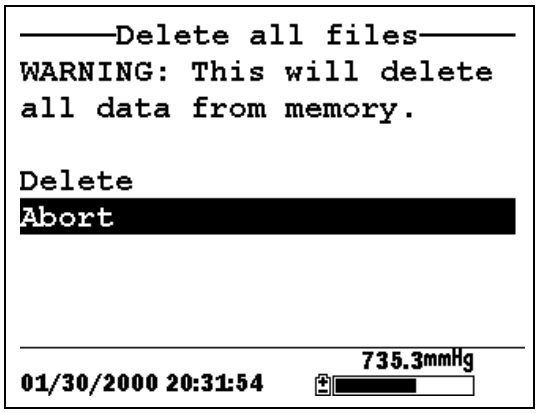


Figure 8.9 Delete All Files Screen

4. Use the arrow keys to highlight the **Delete** selection.

5. Press the **Enter** key.

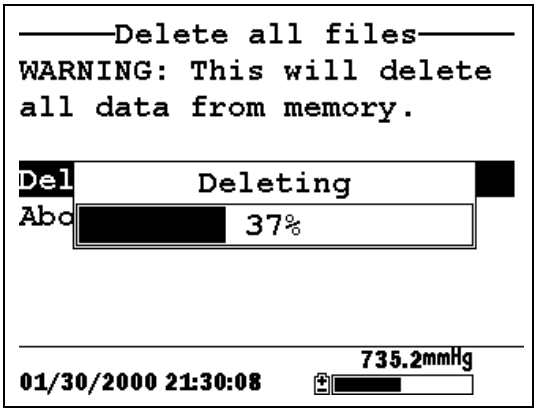


Figure 8.10 Deleting

The progress of file deletion is displayed in bar graph format.

NOTE: Deleting all files in the directory will not change any information in the site list.

6. Press the **Escape** key repeatedly to return to the main menu screen.

9. Logging

9.1 Accessing the Logging Setup Screen

1. Press the **On/off** key to display the run screen.

2. Press the **Escape** key to display the main menu screen.

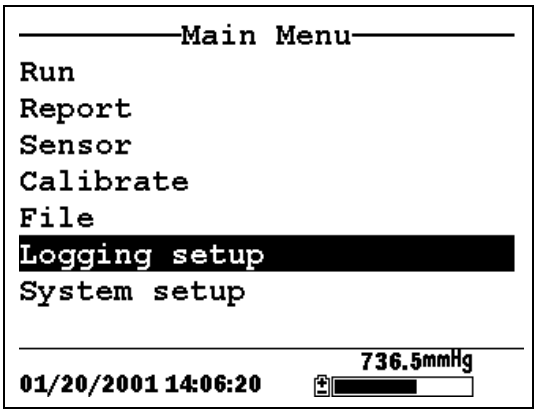


Figure 9.1 Main Menu

3. Use the arrow keys to highlight the **Logging setup** selection.

4. Press the **Enter** key. The logging setup screen is displayed.

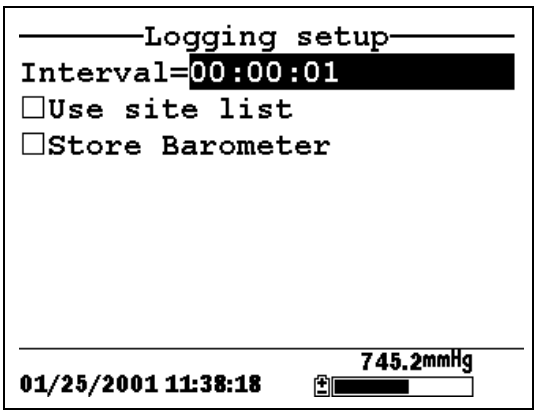


Figure 9.2 Logging Setup Screen

9.2 Setting Logging Interval

Follow steps below to set the interval for logging a data stream.

NOTE: If you do not specify an interval, the instrument will use a default interval setting of 1 second.

NOTE: It is not necessary to set a logging interval when logging a single sample.

1. Go to the logging setup screen as described in Section *9.1 Accessing the Logging Setup Screen*.

2. Use the keypad to enter an interval between 1 second and 15 minutes. Refer to Section *2.9 Keypad Use*.

   NOTE: The interval field has hour, minute and second entry fields. Any entry over 15 minutes will change automatically to a 15-minute setting.

3. Press the **Enter** key. The data stream interval is set.

4. Press the **Escape** key repeatedly to return to the main menu screen.

9.3 Storing Barometer Readings

NOTE: The **Store barometer** option is only available on instruments that are equipped with the optional barometer.

1. Go to the logging setup screen as described in Section *9.1 Accessing the Logging Setup Screen*.

2. Use the arrow keys to highlight the **Store barometer** selection. See Figure 9.2 Logging Setup Screen.

3. Press the **Enter** key until a check mark is entered in the box next to the store barometer selection if you want to log barometric readings.

   OR press the **Enter** key until the box next to the barometer selection is empty if you do not want to log barometric readings.

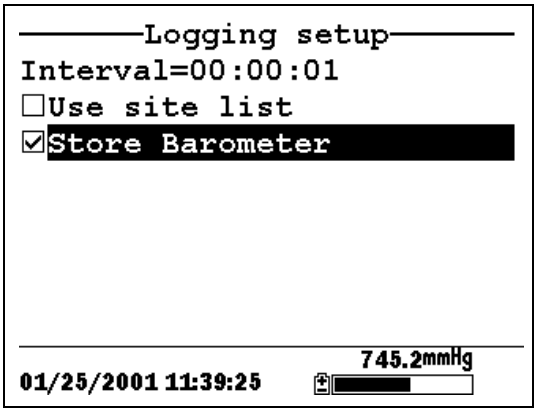


Figure 9.3 Store Barometer

4. Press the **Escape** key repeatedly to return to the main menu screen.

9.4 Creating a Site List

The site list option allows you to define file and site descriptions in the office or laboratory before moving to field logging studies. This is usually more convenient than entering the information at the site and is particularly valuable if you are visiting certain sites on a regular basis. The following section describes how to set up site lists which contain entries designated "Site Descriptions" that will be instantly available to the user in the field to facilitate the logging of data with pre-established naming of files and sites. There are two kinds of **Site Descriptions** available for use in Site lists:

- **Site Descriptions** associated with applications where data from a single site is always logged to a single file. This type is referred to as a "Single-Site Description" and is characterized by two parameters – a file name and a site name. Files logged to YSI 556 MPS memory under a **Single-Site Description** will be characterized primarily by the file name, but will also have the Site name attached, so that it is viewable in either the YSI 556 MPS **File directory** or in EcoWatch for Windows after upload to a PC
- **Site Descriptions** associated with applications where data from multiple sites are logged to a single file. This type is

referred to as a “Multi-site Description” and is characterized by three parameters – a file name, a site name, and a site number. Files logged to YSI 556 MPS memory under a **Multi-site Description** are characterized by a file name, but not a site name, since multiple sites are involved. However, each data point has a Site Number attached to it so that the user can easily determine the sampling site when viewing the data from the YSI 556 MPS **File** menu or processing the data in EcoWatch for Windows after upload to a PC.

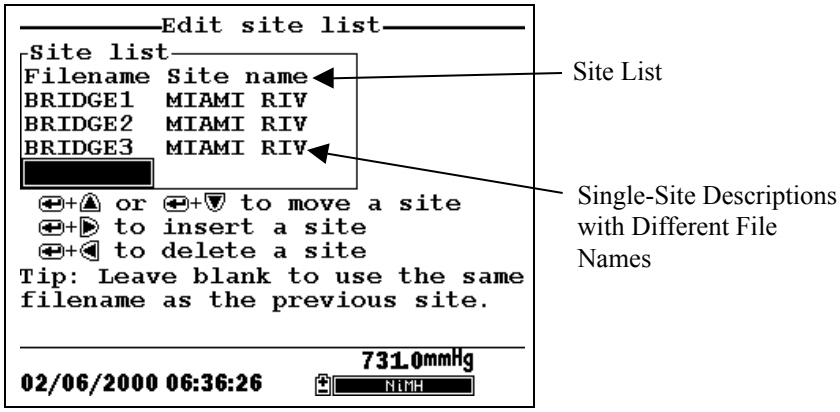


Figure 9.4 Single-Site Descriptions

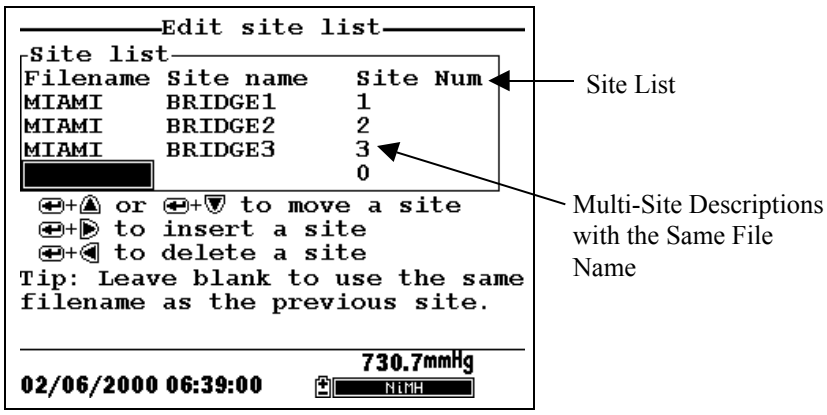


Figure 9.5 Multiple-Site Descriptions

NOTE: Site lists containing Single Site Descriptions are usually input with the designation **Store Site Number** INACTIVE in the YSI 556 MPS **Logging setup** menu. Thus, no site numbers

appear in the first **Site list** example. Conversely, **Site lists** containing **Multi-Site Descriptions** MUST be input with the **Store Site Number** selection ACTIVE as shown in the second example.

To create a site list:

1. Go to the logging setup screen as described in Section *9.1 Accessing the Logging Setup Screen*.

2. Use the arrow keys to highlight the **Use site list** selection.

3. Press the **Enter** key. A check mark is entered in the box next to the use site list selection *and* two new entries appear on the logging setup screen. See Figure 9.6 Logging Setup Screen.

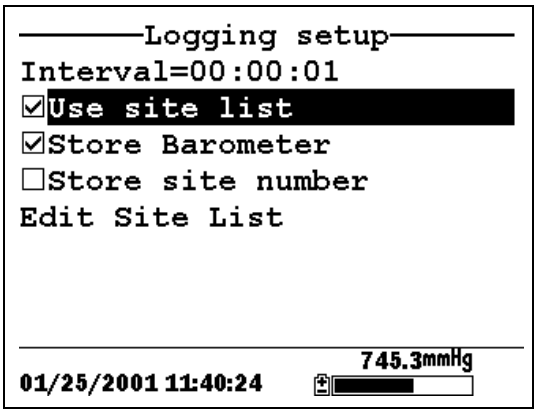


Figure 9.6 Logging Setup Screen

4. Use the arrow keys to highlight the **Store site number** selection.

5. If you are creating Multi-Site Descriptions (which require that the site **number** be stored in your data files), press the **Enter** key until a check mark appears in the box next to the store site number selection.

   OR Press the **Enter** key until the box next to the store site number selection is empty, to create Single-Site

Descriptions. The site **name** will be stored in the header of your data files.

6. Use the arrow keys to highlight the **Edit site list** selection.

7. Press the **Enter** key. The edit site list screen is displayed. See Figure 9.7 Edit Site List Screen. The **Filename** field is ready for input.

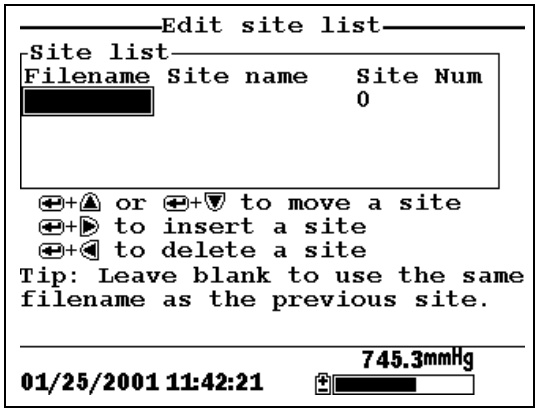


Figure 9.7 Edit Site List Screen

8. Use the keypad to enter a filename up to 8 characters in length. Refer to Section *2.9 Keypad Use*.

9. Press the **Enter** key. The cursor moves to the right for the entry of a **Site name**.

10. Use the keypad to enter a site name up to 11 characters in length. Refer to Section *2.9 Keypad Use*.

    NOTE: If the store site number selection is *not* checked, skip to Step 13.

11. Press the **Enter** key. The cursor moves to the site number entry position.

12. Use the keypad to enter a site number up to 7 characters in length. Refer to Section *2.9 Keypad Use*.

13. Press **Enter**. The cursor moves to the next filename entry position.

14. Repeat Steps 8 to 13 until all filenames and sites have been entered.

15. Press **Escape** repeatedly to return to the main menu screen.

9.5 Editing a Site List

1. Go to the logging setup screen as described in Section *9.1 Accessing the Logging Setup Screen*.

2. Use the arrow keys to highlight the **Edit Site List** selection. See Figure 9.6 Logging Setup Screen.

3. Press the **Enter** key. The edit site list screen is displayed.

4. Edit the site list using the keystrokes described below.

   NOTE: Editing the site list will not have any effect on files stored in the instrument memory.

<u>To MOVE a site:</u> **Use the arrow keys to highlight a site. Press the Up or Down arrow key while holding down the Enter key.**

<u>To INSERT a site above another site:</u> **Use the arrow keys to highlight the site. Press the** Right **arrow key while holding down the** Enter **key. Use keypad to input letters. Refer to Section *2.9 Keypad Use*.**

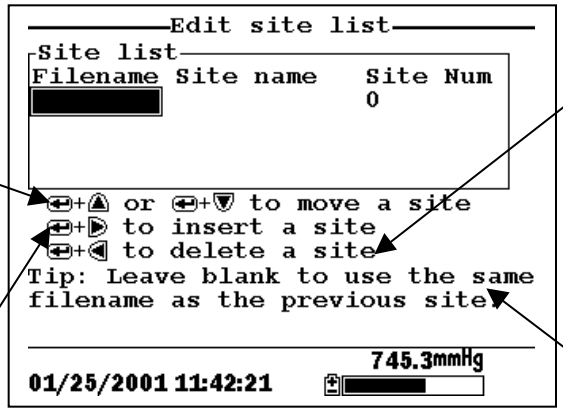


Figure 9.8 Keystrokes for Editing Site List

<u>To DELETE a site:</u> **Use the arrow keys to highlight a site. Press the Left arrow key while holding down the Enter key.**

<u>To use the same file name as the previous site:</u> Leave the filename blank.

9.6 Logging Data Without a Site List

1. Follow Steps 1 through 5 in Section 7.1 Real-Time Data.

2. Use the arrow keys to highlight the **Log one sample** selection on the run screen if only a single sample is being logged.

   OR Use the arrow keys to highlight the **Start logging** selection on the run screen if a data stream is being logged.

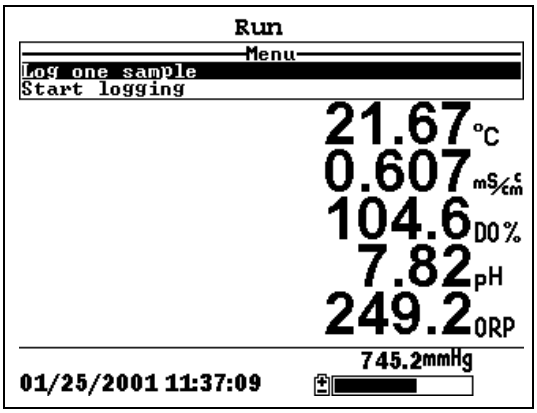


Figure 9.9 Run Screen

3. Press the **Enter** key. The Enter information screen is displayed.

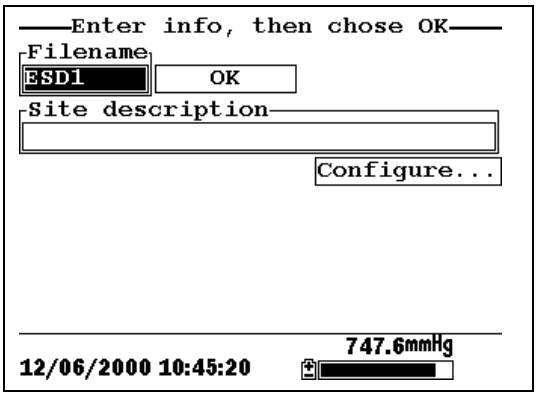


Figure 9.10 Enter Information Screen

NOTE: The last filename used will be displayed.

4. Use the keypad to enter a file name. Refer to Section *2.9 Keypad Use*.

   NOTE: The instrument will assign a default file name of NONAME if no file name is specified.

5. Press the **Enter** key to input the file name.

6. Use the arrow keys to highlight the **Site description** field in the enter information screen.

   NOTE: Entering a Site Description is optional. You may leave the Site Description blank and skip to Step 9.

7. Use the keypad to enter a site description name. Refer to Section *2.9 Keypad Use*.

8. Press the **Enter** key to input the site description.

   NOTE: If you want to change the logging setup, such as sampling interval or storing the barometer reading, use the arrow keys to highlight the **Configure** field, press the **Enter** key, then refer to Section *9.2 Setting Logging Interval* or *9.3 Storing Barometer Readings* for details.

9. Use the arrow keys to highlight the **OK** field in the center of the information screen.

10. Press the **Enter** key to start logging.

    NOTE: If the parameter mismatch screen is displayed, refer to Section *9.8 Adding Data to Existing Files*.

11. If a single point is being logged, the header on the run screen changes momentarily from **Menu** to **Sample logged** to confirm that the point was successfully logged. Skip to Step 13.

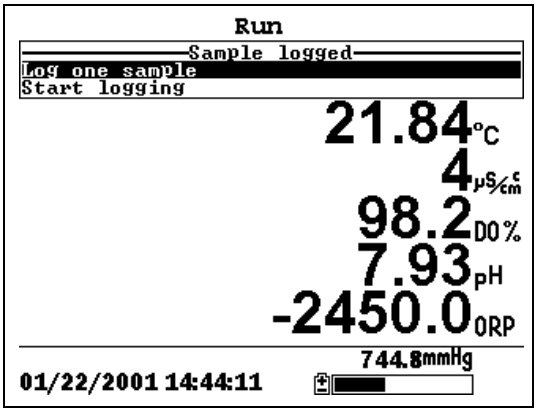


Figure 9.11 Sample Logged Screen

If a continuous stream of points is being logged, the start logging entry in the run screen changes from **Start logging** to **Stop logging**.

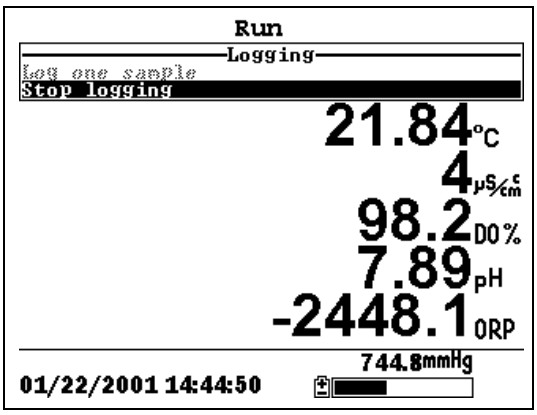


Figure 9.12 Logging Screen

12. At the end of the logging interval, press **Enter** to stop logging.

13. Refer to Section *8.3 View File* to view the data on the instrument display.

9.7 Logging Data With a Site List

1. If you have not already created a site list, refer to Section *9.4 Creating a Site List*.

2. Follow Steps 1 through 5 in Section 7.1 Real-Time Data.

3. Use the arrow keys to highlight the **Log one sample** selection on the run screen if only a single sample is being logged.

   OR Use the arrow keys to highlight the **Start logging** selection on the run screen if a data stream is being logged. See Figure 9.9 Run Screen.

4. Press the **Enter** key. The Pick a site screen is displayed.

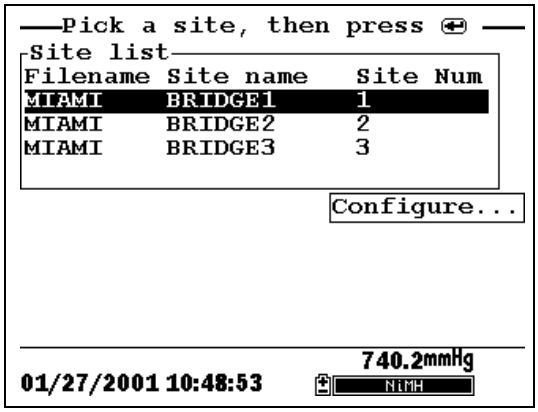


Figure 9.13 Pick a Site Screen

5. Use the arrow keys to highlight the **site** of your choice.

   NOTE: If the site of your choice is grayed out in the site list, refer to Section *9.8 Adding Data to Existing Files*.

   NOTE: Refer to Section *9.5 Editing a Site List* if you want to edit the site list.

6. Press the **Enter** key to start logging.

NOTE: If the parameter mismatch screen is displayed, refer to Section *9.8 Adding Data to Existing Files*.

7. If a single point is being logged, the header on the run screen changes momentarily from **Menu** to **Sample logged** to confirm that the point was successfully logged. See Figure 9.11 Sample Logged Screen. Skip to Step 9.

   If a continuous stream of points is being logged, the start logging entry in the run screen changes from **Start logging** to **Stop logging**. See Figure 9.12 Logging Screen.

8. At the end of the logging interval, press **Enter** to stop logging.

9. Refer to Section *8.3 View File* to view the data on the instrument display.

9.8 Adding Data to Existing Files

In order to add new data to an existing file, the current logging and sensor setup must be *exactly* the same as when the file was created. The following settings must be the same:

- **Sensors enabled** (refer to Section *4 Sensors*)
- **Store Barometer** (refer to Section *9.3 Storing Barometer Readings*)
- **Store Site Number** (refer to Section *9.4 Creating a Site List*)

If the current logging setup is not exactly the same as when the file was created, a parameter mismatch screen is displayed.

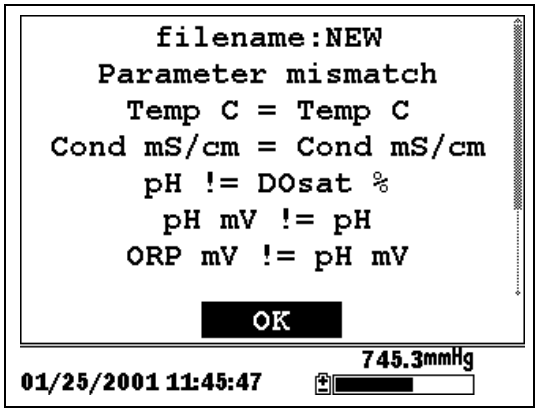


Figure 9.14 Parameter Mismatch Screen

NOTE: The right column shows parameters used when the file was created. The left column shows current parameters.

1. Press the **Down Arrow** key to scroll down and find the mismatch(es).

2. Use the following chart to resolve the mismatch(es).

Mismatch	Action	Reference
Sensor(s) missing from left column	Enable the missing sensor(s)	Section *4 Sensors*
Extra sensor(s) listed in left column	Disable the extra sensor(s)	Section *4 Sensors*
Barometer missing from left column, but present in right column	Enable the Store Barometer setting	Section *9.3 Storing Barometer Readings*
Barometer present in left column, but missing from right column	Disable the Store Barometer setting	Section *9.3 Storing Barometer Readings*
Store Site Number missing from left column, but present in right column	Enable the Store Site Number setting	Section *9.4 Creating a Site List*
Store Site Number present in left column, but missing from right column	Disable the Store Site Number setting	Section *9.4 Creating a Site List*

3. Return to Section *9.6 Logging Data Without a Site List* or *9.7 Logging Data With a Site List*.

10.System Setup

The YSI 556 MPS has a number of features that are user-selectable or can be configured to meet the user's preferences. Most of these choices are found in the **System setup** menu.

10.1 Accessing the System Setup Screen

1. Press the **On/off** key to display the run screen. See Figure 2.1 Front View of YSI 556 MPS.

2. Press the **Escape** key to display the main menu screen.

3. Use the arrow keys to highlight the **System setup** selection.

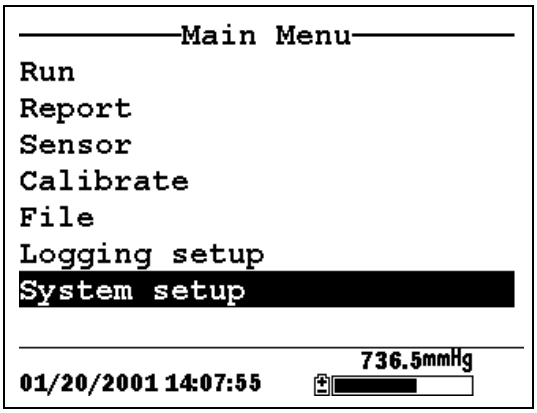


Figure 10.1 Main Menu

4. Press the **Enter** key. The system setup screen is displayed.

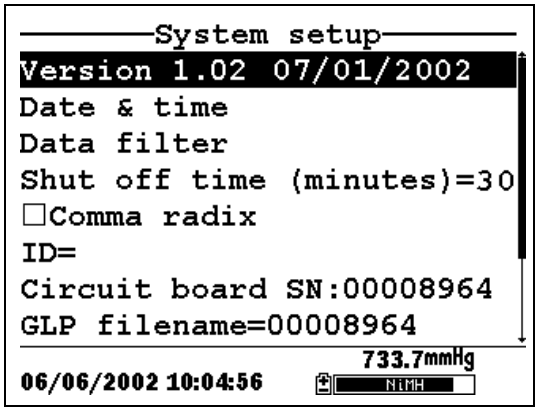


Figure 10.2 System Setup Screen

NOTE: The first line of the **System setup** menu shows the current software version of your YSI 556 MPS. As software enhancements are introduced, you will be able to upgrade your YSI 556 MPS from the YSI Web site. Refer to Section *11.2 Upgrading YSI 556 MPS* Software for details.

10.2 Date and Time Setup

1. Go to the system setup screen as described in Section *10.1 Accessing the System Setup Screen*.

2. Use the arrow keys to highlight the **Date & time** selection on the system setup screen. See Figure 10.2 System Setup Screen.

3. Press **Enter**. The date and time setup screen is displayed.

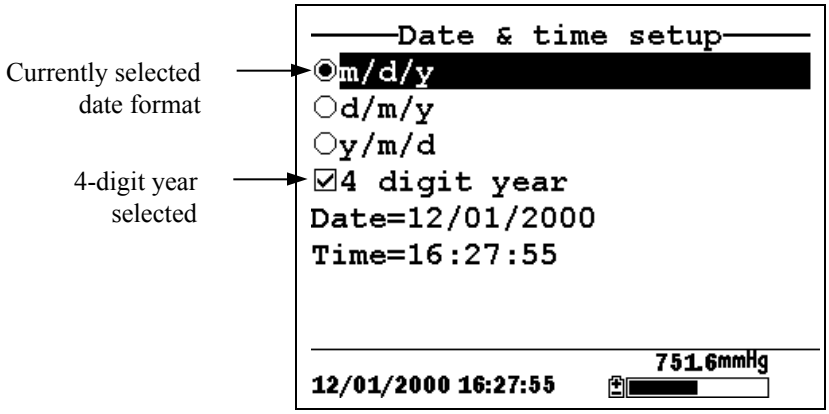


Figure 10.3 Date Setup Screen

NOTE: A black dot to the left of a date format indicates that format is selected.

4. Use the arrow keys to highlight your desired date format.

5. Press **Enter**.

6. Use the arrow keys to highlight the 4-digit year selection.

7. Press **Enter**. A check mark appears in the check box next to the 4-digit year selection.

   NOTE: If unchecked, a 2-digit year is used.

8. Use the arrow keys to highlight the **Date** selection.

9. Press **Enter**. A cursor appears over the first number in the date.

10. Enter the proper number from the keypad for the highlighted date digit. The cursor moves automatically to the next date digit. Refer to Section *2.9 Keypad Use* for more keypad information.

11. Repeat Step 10 until all date digits are correct.

12. Press **Enter** to input the specified date.

13. Use the arrow keys to highlight the **Time** selection.

14. Press **Enter**. A cursor appears over the first number in the time selection.

15. Enter the proper number from the keypad for the highlighted time digit. The cursor moves automatically to the next time digit.

    NOTE: Use military format when entering time. For example, 2:00 PM is entered as 14:00.

16. Repeat Step 15 until all time digits are correct.

17. Press **Enter** to input the correct time.

18. Press the **Escape** key repeatedly to return to the Main menu screen.

10.3 Data Filter

The Data Filter is a software filter that eliminates sensor noise and provides more stable readings.

NOTE: YSI recommends using the default values for the data filter for most field applications.

However, users who are primarily interested in a fast response from their dissolved oxygen sensor should consider a change of the default time constant setting of 8 seconds to one of 2 seconds. This change can be made according to the instructions in Section *10.3.1 Changing the Data Filter Settings* below. The disadvantage of lowering the time constant is that field pH readings may appear somewhat noisy if the cable is in motion.

10.3.1 Changing the Data Filter Settings

1. Go to the system setup screen as described in Section *10.1 Accessing the System Setup Screen*.

2. Use the arrow keys to highlight the **Data filter** selection. See Figure 10.1 Main Menu.

3. Press the **Enter** key. The Data filter setup screen is displayed.

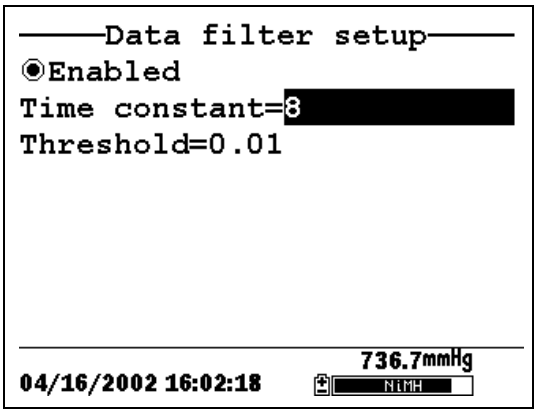


Figure 10.4 Data Filter Screen

4. With Enabled highlighted, press the **Enter** key to Enable or Disable the data filter. A black dot to the left of the selection indicates the data filter is enabled.

5. Use the arrow keys to highlight the **Time constant** field.

   NOTE: This value is the time constant in seconds for the software data filter. Increasing the time constant will result in greater filtering of the data, but will also slow down the apparent response of the sensors.

6. Use the keypad to enter a value. The default value is 8 and this value is ideal for most 556 field applications. As described in Section *10.3 Data Filter* above, users who wish to decrease the response time of the DO readings at the expense of some noise for the pH readings determined concurrently, should change the Time Constant to a value of 2.

7. Press the **Enter** key to enter the time constant.

8. Use the arrow keys to highlight the **Threshold** field.

   NOTE: This value determines when the software data filter will engage/disengage, speeding the response to large changes in a reading. When the difference between two consecutive readings is larger than the threshold, then the reading is displayed unfiltered. When the difference between two consecutive readings drops below the threshold, readings will be filtered again.

9. Use the keypad to enter a value. The default value is 0.01.

10. Press the **Enter** key to enter the threshold.

11. Press the **Escape** key repeatedly to return to the Main menu screen.

10.4 Shutoff Time

The YSI 556 MPS shuts off automatically after 30 minutes of inactivity. The shut off time may be changed as described below.

1. Go to the system setup screen as described in Section *10.1 Accessing the System Setup Screen*.

2. Use the arrow keys to highlight the **Shutoff time** selection on the system setup screen. See Figure 10.2 System Setup Screen.

3. Use the keypad to enter a value from 0 to 60 minutes. The default value is 30.

   NOTE: To disable the automatic shutoff feature, enter a zero (0).

4. Press the **Enter** key to enter the correct shutoff time.

5. Press the **Escape** key repeatedly to return to the main menu screen.

10.5 Comma Radix

The user can toggle between a period (default) and comma for the radix mark by selecting this item and pressing the **Enter** key as follows:

1. Go to the system setup screen as described in Section *10.1 Accessing the System Setup Screen*.
2. Use the arrow keys to highlight the **Comma radix** selection on the system setup screen. See Figure 10.2 System Setup Screen.
3. Press the **Enter** key. A check mark appears in the check box next to the comma radix selection indicating that the radix mark is a comma.

10.6 ID

This selection allows you to enter an identification name/number for your YSI 556 MPS. This ID name/number is logged in the header of each file.

1. Go to the system setup screen as described in Section *10.1 Accessing the System Setup Screen*.
2. Use the arrow keys to highlight the **ID** selection. See Figure 10.1 Main Menu.
3. Use the keypad to enter an alphanumeric ID up to 15 characters in length. Refer to Section *2.9 Keypad Use*.
4. Press the **Enter** key to enter the ID.
5. Press the **Escape** key repeatedly to return to the main menu screen.

10.7 GLP Filename

This selection allows you to enter a different filename for the YSI 556 MPS Calibration Record file.

NOTE: The default filename is the "556 PC board Serial Number.glp."

6. Go to the system setup screen as described in Section *10.1 Accessing the System Setup Screen*.

7. Use the arrow keys to highlight the **GLP Filename** selection. See Figure 10.1 Main Menu.

8. Use the keypad to enter a filename up to 8 characters in length. Refer to Section *2.9 Keypad Use*.

9. Press the **Enter** key to enter the new filename.

Press the **Escape** key repeatedly to return to the main menu screen.

10.8 TDS Constant

This selection allows you to set the constant used to calculate Total Dissolved Solids (TDS). TDS in g/L is calculated by multiplying this constant times the specific conductance in mS/cm.

10.8.1 Changing the TDS Constant

1. Go to the system setup screen as described in Section *10.1 Accessing the System Setup Screen*.

2. Use the arrow keys to highlight the **TDS Constant** selection. See Figure 10.1 Main Menu.

3. Use the keypad to enter a value. Refer to Section *2.9 Keypad Use*. The default value is 0.65.

4. Press the **Enter** key to enter the correct TDS constant.

5. Press the **Escape** key repeatedly to return to the main menu screen.

10.9 Barometer Units

The following information is only for instruments with the barometer option.

1. Go to the system setup screen as described in Section *10.1 Accessing the System Setup Screen*.

2. Use the arrow keys to highlight the **Barometer units** selection on the system setup screen. See Figure 10.2 System Setup Screen.

3. Press the **Enter** key. The Barometer units screen will appear.

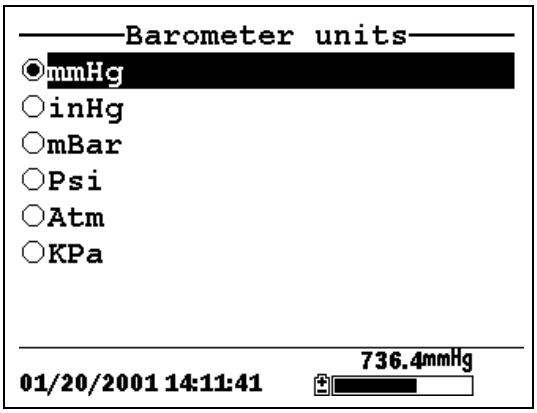


Figure 10.5 Barometer Units Screen

A black dot indicates the currently selected units.

4. Use the arrow keys to highlight your desired barometric unit.

5. Press the **Enter** key to select your choice. A black dot will appear in the circle next to your selected units.

6. Press the **Escape** key repeatedly to return to the main menu screen.

10.10 Calibrate Barometer

The optional barometer has been factory calibrated to provide accurate readings. However, some sensor drift may occur over time, requiring occasional calibration by the user, as follows:

1. Determine your local barometric pressure from an independent laboratory barometer or from your local weather service.

2. If the barometric pressure (BP) reading is from your local weather station, reverse the equation that corrects it to sea level.

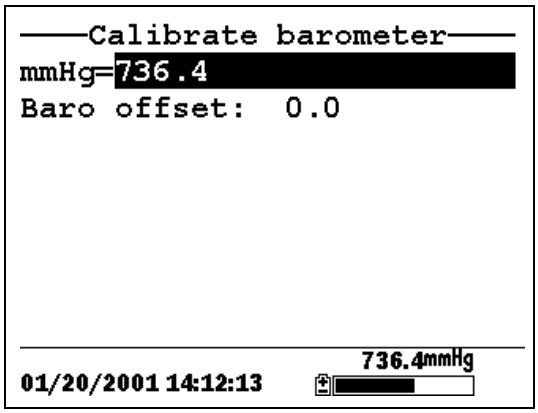
   NOTE: For this equation to be accurate, the barometric pressure units must be in mm Hg.

   True BP = (Corrected BP) – [2.5 * (Local Altitude/100)]

3. Go to the system setup screen as described in Section *10.1 Accessing the System Setup Screen*.

4. Use the arrow keys to highlight the **Calibrate barometer** selection on the system setup screen. See Figure 10.2 System Setup Screen.

5. Press the **Enter** key. The Calibrate Barometer screen is displayed.



6. Use the keypad to input the known barometric pressure value as determined in Step 2.

7. Press the **Enter** key. The new barometer reading is displayed as well as the approximate offset from the factory reading.

   NOTE: To return the sensor to the factory setting, subtract the offset amount from the current setting and repeat Steps 5 to 7.

8. Press the **Escape** key repeatedly to return to the main menu screen.

11.Maintenance

11.1 Sensor Care and Maintenance

Once the sensors have been properly installed, remember that periodic cleaning and DO membrane changes are required.

11.1.1 DO Sensor

For best results, we recommend that the KCl solution and the membrane cap be changed at least once every 30 days.

1. It is important to recognize that oxygen dissolved in the sample is consumed during sensor operation. It is therefore essential that the sample be continuously stirred at the sensor tip. If stagnation occurs, your readings will be artificially low. Stirring may be accomplished by mechanically moving the sample around the sensor tip, or by rapidly moving the sensor through the sample. The rate of stirring should be at least 1 foot per second.

2. Membrane life depends on usage. Membranes will last a long time if installed properly and treated with care. Erratic readings are a result of loose, wrinkled, damaged, or fouled membranes, or from large (more than 1/8" diameter) bubbles in the electrolyte reservoir. If erratic readings or evidence of membrane damage occurs, you should replace the membrane and the electrolyte solution. The average replacement interval is two to four weeks.

3. If the membrane is coated with oxygen consuming (e.g. bacteria) or oxygen producing organisms (e.g. algae), erroneous readings may occur.

4. Chlorine, sulfur dioxide, nitric oxide, and nitrous oxide can affect readings by behaving like oxygen at the sensor. If you suspect erroneous readings, it may be necessary to determine if these gases are the cause.

5. Avoid any environment that contains substances that may attack the probe module and sensor materials. Some of these substances are concentrated acids, caustics, and strong solvents. The sensor materials that come in contact with the

sample include FEP Teflon, acrylic plastic, EPR rubber, stainless steel, epoxy, polyetherimide and the PVC cable covering.

6. It is possible for the silver anode, which is the entire silver body of the sensor, to become contaminated. This will prevent successful calibration. To restore the anode, refer to Section *11.1.1 DO Sensor, Silver Anode Cleaning.*

7. For correct sensor operation, the gold cathode must always be bright. If it is tarnished (which can result from contact with certain gases), or plated with silver (which can result from extended use with a loose or wrinkled membrane), the gold surface must be restored. To restore the cathode, refer to Section *11.1.1 DO Sensor, Gold Cathode Cleaning.*

8. To keep the electrolyte from drying out, store the sensor in the transport/calibration cup with at least 1/8″ of water.

Silver Anode Cleaning

After extended use, a thick layer of AgCl builds up on the silver anode reducing the sensitivity of the sensor. The anode must be cleaned to remove this layer and restore proper performance. The cleaning can be chemical or mechanical:

Chemical Cleaning: Remove the membrane cap and soak the entire anode section in a 14% ammonium hydroxide solution for 2 to 3 minutes, followed by a thorough rinsing with distilled or deionized water. The anode should then be thoroughly wiped with a wet paper towel to remove the residual layer from the anode.

Mechanical Cleaning: Sand off the dark layer from the silver anode with 400 grit wet/dry sandpaper. Wrap the sandpaper around the anode and twist the sensor. Rinse the anode with clean water after sanding, followed by wiping thoroughly with a wet paper towel.

NOTE: After cleaning, a new membrane cap must be installed. Refer to Section *3.4.3 Membrane Cap Installation***.**

Turn the instrument on and allow the system to stabilize for at least 30 minutes. If, after several hours, you are still unable to calibrate, contact your dealer or YSI Customer Service. Refer to *Appendix E Customer Service*.

Gold Cathode Cleaning

For correct sensor operation, the gold cathode must be textured properly. It can become tarnished or plated with silver after extended use. The gold cathode can be cleaned by using the adhesive backed sanding disc and tool provided in the YSI 5238 Probe Reconditioning Kit.

Using the sanding paper provided in the YSI 5238 Probe Reconditioning Kit, wet sand the gold with a twisting motion about 3 times or until all silver deposits are removed and the gold appears to have a matte finish. Rinse the cathode with clean water after sanding, followed by wiping thoroughly with a wet paper towel. If the cathode remains tarnished, contact your dealer or YSI Customer Service. Refer to *Appendix E Customer Service*.

NOTE: After cleaning, a new membrane cap must be installed. Refer to Section *3.4.3 Membrane Cap Installation***.**

11.1.2 DO Sensor Replacement

1. Remove the probe sensor guard.

⚠ **CAUTION:** Thoroughly dry the sensor so that no water enters the probe module sensor port when the sensor is removed.

2. Insert the long end of the hex key wrench into the small hole in the side of the probe module bulkhead. Turn the wrench counterclockwise and remove the screw. (You do not have to remove the screw all the way to release the sensor.)

3. Pull the old DO sensor module straight out of the probe module body.

   NOTE: The DO sensor is not threaded, it is keyed, so it cannot be removed by twisting.

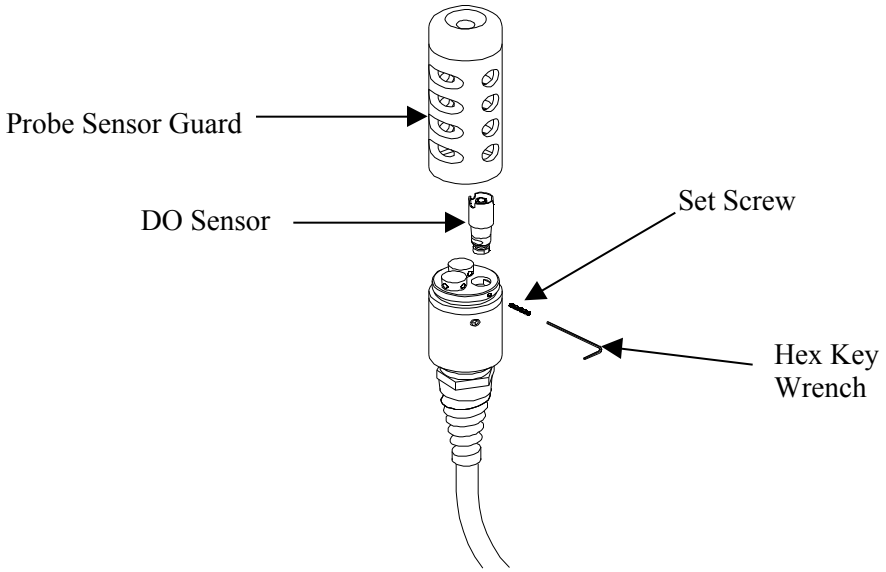


Figure 11.1 DO Sensor Replacement

4. Insert the new DO sensor module. Make sure that the inside of the probe module sensor port and the o-ring on the sensor are clean, with no contaminants, such as grease, dirt, or hair. The DO sensor is keyed, or has a flat side, so that it cannot be aligned improperly.

NOTE: Make sure the DO sensor bottoms out before the set screw is inserted.

5. Insert the set screw into the small hole in the side of the probe module bulkhead, and turn clockwise to rethread.

⚠ **CAUTION:** Make sure that you do not cross-thread the set screw. Use the hex key wrench to tighten the screw in properly, making sure that the screw does not stick out of the side of the probe module bulkhead. The probe sensor guard will not thread

on properly and damage may result if the screw is allowed to stick out.

NOTE: The YSI 5563 DO sensor is shipped dry. A shipping membrane was installed to protect the electrode. A new membrane cap must be installed before the first use. Refer to Section *3.4.1 Sensor Installation.*

11.1.3 YSI 5564 pH and 5565 Combination pH/ORP Sensor Cleaning

Cleaning is required whenever deposits or contaminants appear on the glass and/or platinum surfaces of these sensors or when the response of the sensor becomes slow.

1. Remove the sensor from the probe module.

2. Initially, simply use clean water and a soft clean cloth, lens cleaning tissue, or cotton swab to remove all foreign material from the glass bulb (YSI 5564 and YSI 5565) and platinum button (YSI 5565). Then use a moistened cotton swab to carefully remove any material that may be blocking the reference electrode junction of the sensor.

⚠ **CAUTION:** When using a cotton swab with the YSI 5564 or YSI 5565, be careful NOT to wedge the swab tip between the guard and the glass sensor. If necessary, remove cotton from the swab tip, so that the cotton can reach all parts of the sensor tip without stress.

NOTE: If good pH and/or ORP response is not restored by the above procedure, perform the following additional procedure:

1. Soak the sensor for 10-15 minutes in clean water containing a few drops of commercial dishwashing liquid.

2. GENTLY clean the glass bulb and platinum button by rubbing with a cotton swab soaked in the cleaning solution.

3. Rinse the sensor in clean water, wipe with a cotton swab saturated with clean water, and then re-rinse with clean water.

NOTE: If good pH and/or ORP response is still not restored by the above procedure, perform the following additional procedure:

1. Soak the sensor for 30-60 minutes in one molar (1 M) hydrochloric acid (HCl). This reagent can be purchased from most distributors. Be sure to follow the safety instructions included with the acid.

2. GENTLY clean the glass bulb and platinum button by rubbing with a cotton swab soaked in the acid.

3. Rinse the sensor in clean water, wipe with a cotton swab saturated with clean water, and then re-rinse with clean water. To be certain that all traces of the acid are removed from the sensor crevices, soak the sensor in clean water for about an hour with occasional stirring.

NOTE: If biological contamination of the reference junction is suspected or if good response is not restored by the above procedures, perform the following additional cleaning step:

1. Soak the sensor for approximately 1 hour in a 1 to 1 dilution of commercially available chlorine bleach.

2. Rinse the sensor with clean water and then soak for at least 1 hour in clean water with occasional stirring to remove residual bleach from the junction. (If possible, soak the sensor for period of time longer than 1 hour in order to be certain that all traces of chlorine bleach are removed.) Then re-rinse the sensor with clean water and retest.`

11.1.4 Temperature/Conductivity Sensor Cleaning

The single most important requirement for accurate and reproducible results in conductivity measurement is a clean cell. A dirty cell will change the conductivity of a solution by contaminating it. The small cleaning brush included in the YSI 5511 Maintenance Kit is ideal for this purpose.

To clean the conductivity cell:

1. Dip the brush in clean water and insert it into each hole 15-20 times.

2. Rinse the cell thoroughly in deionized or clean tap water.

NOTE: In the event that deposits have formed on the electrodes, perform the following additional procedure:

1. Use a mild detergent solution in combination with the brush. Dip the brush in the solution and insert it into each hole 15-20 times.

2. Rinse the cell thoroughly in deionized or clean tap water.

   NOTE: After cleaning, check the response and accuracy of the conductivity cell with a calibration standard.

   NOTE: If this procedure is unsuccessful, or if sensor performance is impaired, it may be necessary to return the sensor to a YSI authorized service center for service, Refer to *Appendix E Customer Service*.

   The temperature portion of the sensor requires no maintenance.

11.2 Upgrading YSI 556 MPS Software

1. Access the YSI Environmental Software Downloads page as described in *Appendix G EcoWatch* Step 1 through 3.

2. Click on the **YSI Instruments Software Updates** link (or scroll down until you see YSI 556 MPS).

3. Click on the file icon to the right of the **YSI 556 MPS** listing and save the file to a temporary directory on your computer.

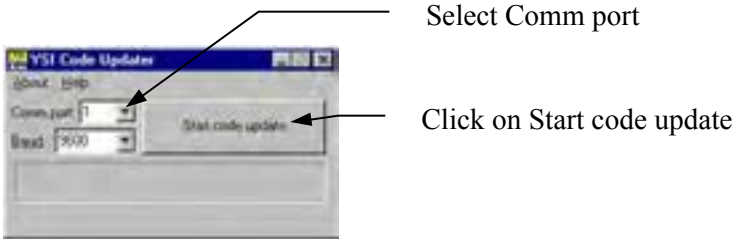
4. After the download is complete, run the file (that you just downloaded) and follow the on screen instructions to install the YSI Code Updater on your computer. If you encounter difficulties, contact YSI customer service for advice. Refer to *Appendix E Customer Service*.

5. If necessary, disconnect the YSI 5563 Probe Module from the YSI 556 MPS instrument.

6. Connect the YSI 556 MPS to a serial port of your computer via the 655173 PC interface cable. See Figure 8.6 Computer/Instrument Interface.

7. Press the **On/off** key on the YSI 556 MPS to display the run screen.

8. Run the YSI Code Updater software that you just installed on your computer. The following window will be displayed:



9. Set the Comm port number to match the port that you connected the 655173 PC Interface Cable to, then click on the **Start Code Update button**.

The YSI 556 MPS screen will blank out and a progress indicator will be displayed on the PC.

When the update is finished (indicated on the PC screen), the YSI 556 MPS will return to the Run screen. See Figure 7.1 Run Screen.

10. Close the YSI Code Updater window (on the PC) by clicking on the "X" in the upper right corner of the window.

11. Disconnect the YSI 556 MPS from the 655173 PC interface cable and reconnect it to the YSI 5563 Probe Module. Refer to Section *3.6 Instrument/Cable Connection*.

12.Storage

Proper storage between periods of usage will not only extend the life of the sensors, but will also ensure that the unit will be ready to use as quickly as possible in your next application.

12.1 General Recommendations for Short Term Storage

No matter what sensors are installed in the instrument, it is important to keep them moist without actually immersing them in liquid. Immersing them could cause some of them to drift or result in a shorter lifetime.

YSI recommends that short term storage of all multi-parameter instruments be done by placing approximately 1/2 inch of tap water in the transport/calibration cup that was supplied with the instrument, and by placing the probe module with all of the sensors installed into the cup. The use of a moist sponge instead of a 1/2 inch of tap water is also acceptable, as long as its presence does not compromise the attachment of the cup to the probe module. The transport/calibration cup should be sealed to prevent evaporation.

NOTE: Ensure that an o-ring is installed in the o-ring groove on the threaded end of the probe module body. See Figure 3.7 Transport/Calibration Cup Installation.

⚠ **CAUTION:** The water level has to be low enough so that none of the sensors are actually under water. Check the transport/calibration cup periodically to make certain that the water is still present or the sponge is still moist.

NOTE: If the storage water (tap water) is accidentally lost during field use, environmental water can be used.

12.2 General Recommendations for Long Term Storage

12.2.1 Probe Module Storage

1. Remove the pH or pH/ORP sensor from the probe module and store according to the individual sensor storage instructions found in Section *12.2.2 Sensor Storage*.

2. Seal the empty port with the provided port plug.

NOTE: Leave the conductivity/temperature sensor and dissolved oxygen sensor, with membrane cap still on, in the probe module.

3. Place 1/2″ of water, deionized, distilled or tap, in the transport/calibration cup.

⚠ **CAUTION:** The water level has to be low enough so that none of the sensors are actually under water. Check the transport/calibration cup periodically to make certain that the water is still present or the sponge is still moist.

4. Insert the probe module into the cup.

NOTE: Ensure that an o-ring is installed in the o-ring groove on the threaded end of the probe module body. See Figure 3.7 Transport/Calibration Cup Installation.

12.2.2 Sensor Storage

Temperature/Conductivity Sensor

No special precautions are required. Sensor can be stored dry or wet, as long as solutions in contact with the thermistor and conductivity electrodes are not corrosive (for example, chlorine bleach). However, it is recommended that the sensor be cleaned with the provided brush prior to long term storage. Refer to Section *11.1.4 Temperature/Conductivity Sensor Cleaning.*

pH and Combination pH/ORP Sensor

The key to sensor storage is to make certain that the reference electrode junction does not dry out. Junctions which have been allowed to dry out due to improper storage procedures can usually be rehydrated by soaking the sensor for several hours (overnight is recommended) in a solution which is 2 molar in potassium chloride. If potassium chloride solution is not available, soaking the sensor in tap water or commercial pH buffers may restore sensor function. However in some cases the sensor may have been irreparably damaged by the dehydration and will require replacement.

⚠ **CAUTION:** Do not store the sensor in distilled or deionized water as the glass sensor may be damaged by exposure to this medium.

1. Remove the pH or pH/ORP sensor from the probe module.

2. Seal the empty port with the provided port plug.

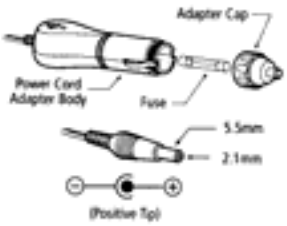
3. Place the sensor in the storage vessel (plastic boot or bottle) which was on the sensor at delivery. The vessel should contain a solution which is 2 molar in potassium chloride.

   NOTE: Make certain that the vessel is sealed to prevent evaporation of the storage solution.

13.Troubleshooting

The following sections describe problems you may encounter when using the YSI 556 MPS and provides suggestions to overcome the symptom.

PROBLEM	POSSIBLE SOLUTION
Display Problems	
No display is visible after pressing the on/off key.	If C cells are used, make certain that they are installed properly with regard to polarity and that good batteries are used. If a rechargeable battery pack is used, place the pack in the instrument and charge for 30 minutes.
Instrument software appears to be locked up as evidenced by no response to keypad entries or display not changing.	First, attempt to reset the instrument by simply turning off and then on again. If this fails, remove battery power from the instrument for 30 seconds and then reapply power. When using C cells, remove the battery lid and one of the batteries; when using the rechargeable battery pack, remove the pack completely from the instrument. After 30 seconds replace the battery or battery pack and check for instrument function.
The 556 display flashes and the instrument speaker makes a continuous clicking sound.	The battery voltage is low. Change to new C cells or recharge the 6117 battery pack.
Water Damage to Instrument	
Leakage detected in battery compartment when using C cells	Dispose of batteries properly. Dry the battery compartment using compressed air if possible. If corrosion is present on battery terminals, contact YSI Customer Service.
Water has contacted rechargeable battery pack	Remove battery pack immediately. Send battery pack to YSI Product Service for evaluation. **CAUTION**: DO NOT REUSE BATTERY PACK UNTIL YSI PRODUCT SERVICE HAS EVALUATED IT.
Leakage suspected into the main cavity of the instrument case	Remove the batteries immediately. Return the instrument to YSI Product Service.

PROBLEM	POSSIBLE SOLUTION
Optional Cigarette Lighter Charger	
Power cord fuse blown 	1. Unscrew adapter's cap, remove tip and pull out fuse. 2. Replace fuse with a new 2-amp fast-blow fuse from an electronics store such as Radio Shack. 3. Reassemble the adapter and securely screw the cap back onto the adapter body.
File Problems	
Upload of files from YSI 556 MPS to PC fails	1. Make sure that cable is connected properly to both 556 and PC. 2. Make certain that the proper Comm port is selected in EcoWatch for Windows.
Barometer data is not stored with sensor data file.	Make sure **Store barometer** is active in the 556 **Logging setup** menu.
Site Descriptions in the **Site List** are "grayed-out" and not available for appending files with additional data.	There is a parameter mismatch between the current 556 setup and that initially used. Change the current logging and sensor setup to match the setup that was initially used to create the file.
Sensor Problems	
Dissolved Oxygen reading unstable or inaccurate. Out of Range message appears during calibration.	Sensor not properly calibrated. Follow DO cal procedures.
	Membrane not properly installed or may be punctured. Replace membrane cap.
	DO sensor electrodes require cleaning. Follow DO cleaning procedure. Use 5511 Maintenance kit.
	Water in sensor connector. Dry connector; reinstall sensor.
	Algae or other contaminant clinging to DO sensor. Rinse DO sensor with clean water.
	Barometric pressure entry is incorrect. Repeat DO cal procedure.
	Calibrated at extreme temperature. Recalibrate at (or near) sample temperature.
	DO sensor has been damaged. Replace sensor.
	Internal failure. Return probe module for service.

PROBLEM	POSSIBLE SOLUTION
Sensor Problems	
pH or ORP readings are unstable or inaccurate. Out of Range message appears during calibration.	Sensor requires cleaning. Follow sensor cleaning procedure.
	Sensor requires calibration. Follow cal procedures.
	pH sensor reference junction has dried out from improper storage. Soak sensor in tap water or buffer until readings become stable.
	Water in sensor connector. Dry connector; reinstall sensor.
	Sensor has been damaged. Replace sensor.
	Calibration solutions out of spec or contaminated with other solution. Use new calibration solutions.
	ORP fails Zobell check. Take into account temperature dependence of Zobell solution readings.
	Internal failure. Return probe module for service.
Conductivity unstable or inaccurate. Out of Range message appears during calibration.	Conductivity improperly calibrated. Follow calibration procedure.
	Conductivity sensor requires cleaning. Follow cleaning procedure.
	Conductivity sensor damaged. Replace sensor.
	Calibration solution out of spec or contaminated. Use new calibration solution.
	Internal failure. Return probe module for service.
	Calibration solution or sample does not cover entire sensor. Immerse sensor fully.
Temperature, unstable or inaccurate	Water in connector. Dry connector; reinstall sensor.
	Sensor has been damaged. Replace the 5560 sensor.
Installed sensor has no reading	The sensor has been disabled. Enable sensor.
	Water in sensor connector. Dry connector; reinstall sensor.
	Sensor has been damaged. Replace the sensor.
	Report output improperly set up. Set up report output.
	Internal failure. Return probe module for service.

If these guidelines and tips fail to correct your problem or if any other symptoms occur, contact YSI Customer Service for Advice. Refer to *Appendix E Customer Service*.

14. Appendix A YSI 556 MPS Specifications

14.1 Sensor Specifications

Dissolved Oxygen		
Sensor Type		Steady state polarographic
Range:	*% air sat'n*	_ 0 to 500% air saturation
	mg/L	_ 0 to 50 mg/L
Accuracy:	*% air sat'n*	_ 0 to 200% air saturation: ±2% of the reading or 2% air saturation; whichever is greater
		_ 200 to 500% air saturation: ±6% of the reading
	mg/L	_ 0 to 20 mg/L: ±2% of the reading or 0.2 mg/L; whichever is greater
		_ 20 to 50 mg/L: ±6% of the reading
Resolution:	*% air sat'n*	_ 0.1% air saturation
	mg/L	_ 0.01 mg/L
Temperature		
Sensor Type:		YSI Precision™ thermistor
Range:		-5 to 45°C
Accuracy:		±0.15°C
Resolution:		0.01°C
Conductivity		
Sensor Type:		4-electrode cell with auto-ranging
Range:		0 to 200 mS/cm
Accuracy:		±0.5% of reading or ±0.001 mS/cm; whichever is greater–4 meter cable ±1.0% of reading or ±0.001 mS/cm; whichever is greater–20 meter cable
Resolution:		0.001 mS/cm to 0.1 mS/cm (range-dependent)
Salinity		
Sensor Type:		Calculated from conductivity and temperature
Range:		0 to 70 ppt
Accuracy:		±1.0% of reading or 0.1 ppt; whichever is greater
Resolution:		0.01 ppt

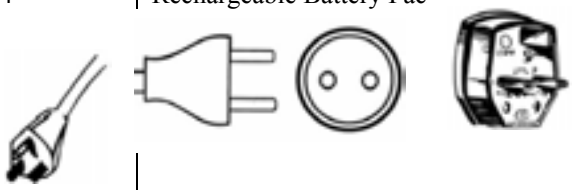
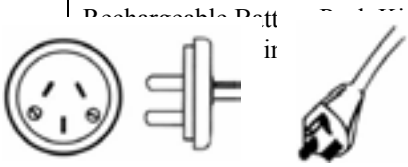
pH (optional)	
Sensor Type:	Glass combination electrode
Range:	0 to 14 units
Accuracy:	±0.2 units
Resolution:	0.01 units
ORP (optional)	
ORP Sensor Type:	Platinum button
Range:	-999 to +999 mV
Accuracy:	±20 mV
Resolution:	0.1 mV

Barometer (optional)	
Range:	500 to 800 mm Hg
Accuracy:	±3 mm Hg within ±15°C temperature range from calibration point
Resolution:	0.1 mm Hg

14.2 Instrument Specifications

Memory Size:	1.5 MB Flash Memory 49,000 data sets (@ 6 parameters per set plus time stamp) 100 Sites
Size:	11.9 cm width x 22.9 cm length (4.7 in. x 9 in.)
Weight with batteries:	0.92 kg (2.1 lbs)
Power:	4 alkaline C-cells; optional rechargeable pack
Cables:	4, 10, and 20 m (13.1, 32.8, 65.6 ft.) lengths
Warranty:	3-Years for the instrument; 1-Year for the probe modules and cable

15.Appendix B Instrument Accessories

ITEM #	ACCESSORY
5563-4	4m Cable with DO/temp/conductivity
5563-10	10m Cable with DO/temp/conductivity
5563-20	20m Cable with DO/temp/conductivity
5564	pH Kit
5565	pH/ORP Kit
6118	Rechargeable Battery Pack Kit for use in US
5094	Rechargeable Battery Pack Kit with universal charger and three adapter s 
5095	Rechargeable Batt Pack Kit with universal charger and two adapter in plications 
5083	Flow Cell – probe module is secured in the flow cell and groundwater is pumped through it
616	Charger, Cigarette Lighter – used to power up the instrument from a car's cigarette lighter
4654	Tripod
614	Ultra Clamp, C Clamp –used to clamp the instrument to a table top or car dashboard
6081	Large Carrying Case, Hard-sided
5085	Hands-free Harness
5065	Carrying Case, Form-fitted, for use in the field – has a clear vinyl window, shoulder strap, belt loop strap and hand strap

16.Appendix C Required Federal Communications Notice

The Federal Communications Commission defines this product as a computing device and requires the following notice.

This equipment generates and uses radio frequency energy and if not installed and used properly, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class A or Class B computing device in accordance with the specification in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna
- Relocate the computer with respect to the receiver
- Move the computer away from the receiver
- Plug the computer into a different outlet so that the computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet, prepared by the Federal Communications Commission, helpful: "How to Identify and Resolve Radio-TV Interference Problems". This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402, Stock No.0004-000-00345-4.

YSI Conductivity solutions: 3161, 3163, 3165, 3167, 3168, 3169

INGREDIENTS:
- Iodine
- Potassium Chloride
- Water

WARNING: INHALATION MAY BE FATAL.

⚠ ***CAUTION*: AVOID INHALATION, SKIN CONTACT, EYE CONTACT OR INGESTION. MAY EVOLVE TOXIC FUMES IN FIRE.**

Harmful if ingested or inhaled. Skin or eye contact may cause irritation. Has a corrosive effect on the gastro-intestinal tract, causing abdominal pain, vomiting, and diarrhea. Hyper-sensitivity may cause conjunctivitis, bronchitis, skin rashes etc. Evidence of reproductive effects.

FIRST AID:
INHALATION: Remove victim from exposure area. Keep victim warm and at rest. In severe cases seek medical attention.
SKIN CONTACT: Remove contaminated clothing immediately. Wash affected area thoroughly with large amounts of water. In severe cases seek medical attention.
EYE CONTACT: Wash eyes immediately with large amounts of water, (approx. 10 minutes). Seek medical attention immediately.
INGESTION: Wash out mouth thoroughly with large amounts of water and give plenty of water to drink. Seek medical attention immediately.

YSI pH 4.00, 7.00, and 10.00 Buffer Solutions: 3821, 3822, 3823

pH 4 INGREDIENTS:

- Potassium Hydrogen Phthalate
- Formaldehyde
- Water

pH 7 INGREDIENTS:

- Sodium Phosphate, Dibasic
- Potassium Phosphate, Monobasic
- Water

pH 10 INGREDIENTS:

- Potassium Borate, Tetra
- Potassium Carbonate
- Potassium Hydroxide
- Sodium (di) Ethylenediamine Tetraacetate
- Water

⚠ ***CAUTION* - AVOID INHALATION, SKIN CONTACT, EYE CONTACT OR INGESTION. MAY AFFECT MUCOUS MEMBRANES.**

Inhalation may cause severe irritation and be harmful. Skin contact may cause irritation; prolonged or repeated exposure may cause Dermatitis. Eye contact may cause irritation or conjunctivitis. Ingestion may cause nausea, vomiting and diarrhea.

FIRST AID:

INHALATION - Remove victim from exposure area to fresh air immediately. If breathing has stopped, give artificial respiration. Keep victim warm and at rest. Seek medical attention immediately.

SKIN CONTACT - Remove contaminated clothing immediately. Wash affected area with soap or mild detergent and large amounts of water (approx. 15-20 minutes). Seek medical attention immediately.

EYE CONTACT - Wash eyes immediately with large amounts of water (approx. 15-20 minutes), occasionally lifting upper and lower lids. Seek medical attention immediately.

INGESTION - If victim is conscious, immediately give 2 to 4 glasses of water and induce vomiting by touching finger to back of throat. Seek medical attention immediately.

YSI Zobell Solution: 3682

INGREDIENTS:
- Potassium Chloride
- Potassium Ferrocyanide Trihydrate
- Potassium Ferricyanide

⚠ ***CAUTION* - AVOID INHALATION, SKIN CONTACT, EYE CONTACT OR INGESTION. MAY AFFECT MUCOUS MEMBRANES.**

May be harmful by inhalation, ingestion, or skin absorption. Causes eye and skin irritation. Material is irritating to mucous membranes and upper respiratory tract. The chemical, physical, and toxicological properties have not been thoroughly investigated.

Ingestion of large quantities can cause weakness, gastrointestinal irritation and circulatory disturbances.

FIRST AID:

INHALATION - Remove victim from exposure area to fresh air immediately. If breathing has stopped, give artificial respiration. Keep victim warm and at rest. Seek medical attention immediately.

SKIN CONTACT - Remove contaminated clothing immediately. Wash affected area with soap or mild detergent and large amounts of water (approx. 15-20 minutes). Seek medical attention immediately.

EYE CONTACT - Wash eyes immediately with large amounts of water (approx. 15-20 minutes), occasionally lifting upper and lower lids. Seek medical attention immediately.

INGESTION - If victim is conscious, immediately give 2 to 4 glasses of water and induce vomiting by touching finger to back of throat. Seek medical attention immediately.

18.Appendix E Customer Service

For information on Customer Service Centers, refer to *Authorized Service Centers* in this appendix.

Equipment exposed to biological, radioactive, or toxic materials must be cleaned and disinfected before being returned or presented for service. A cleaning certificate must accompany the equipment. Refer to *18.2 Cleaning Instructions* in this appendix.

18.1 YSI Environmental Authorized Service Centers

International Service Centers

YSI Incorporated · Repair Center · 1725 Brannum Lane
Yellow Springs, Ohio · 45387 · Phone: (937) 767-7241
E-Mail: support@ysi.com

Hydrodata Services (UK) Ltd. · Unit 8 · Business Centre West
Avenue One · Letchworth · Herts · SG6 2HB
Phone: (44-1462) 673581 · Fax: (44-1462) 673582
Email: hydrodatauk@cs.com

YSI Nanotech · Kaizuka 1-15-4, Kawasaki-Ku · Kawaskaki
City · Japan · 210-0014 · Phone: 011-814-4222-0009
Fax: 011-81-44-221102 · E-mail: Nanotech@ysi.com

Nortech GSI · 1131 Derry Road East · Mississauga, ONT
L5T 1P3 · Canada · Phone: 800-263-3427 · Fax: 905-564-4700

US Service Centers for Water Quality and 6-Series Instruments

Ohio
YSI Incorporated · Repair Center · 1725 Brannum Lane
Yellow Springs, Ohio · 45387 · Phone: (800) 765-4974
(937) 767-7241· E-Mail: info@ysi.com

California
EQUIPCO Sales and Service · 1110 Burnett Avenue, Suite D
Concord, CA · 94520 · Phone: (800)550-5875
Fax: (510)674-8655

Colorado
Ted D. Miller Associates, Inc. · 2525 S. Wadsworth Blvd., Suite 300 · Lakewood, CO · 80227 · Phone: (303) 989-7737 Fax: (303) 989-8875 · E:mail: tdma@earthlink.net

Mississippi
C.C. Lynch & Associates, Inc. · P.O. Box 456 · 300 Davis Street · Pass Christian, MS · 39571 Phone: (800) 333-2252 (228) 452-4612 · Fax (228) 452-2563

US Service Centers for Water Quality Instruments Only

Florida
Aquatic Eco Systems, Inc. · 1767 Benbow Court · Apopka, Florida · Phone: (407) 886-3939 · Fax: (407) 886-6787

Maine
Q.C. Services · P.O. Box 68 · Harrison, Maine · 04040 Phone: (207) 583-2980

Mississippi
Aquacenter · 166 Seven Oaks Road · Leland, Mississippi 38756 · Phone: (601) 378-2861 · Fax: (601) 378-2862

Oregon
Q.C. Services · P.O. Box 14831 · Portland, Oregon · 97293 Phone: (503) 236-2712

Wisconsin
North Central Labs · 400 Lyons Road · Birnamwood, Wisconsin · Phone: (800) 648-7836 · Fax: (715) 449-2454

18.2 Cleaning Instructions

Equipment exposed to biological, radioactive, or toxic materials must be cleaned and disinfected before being serviced. Biological contamination is presumed for any instrument, probe, or other device that has been used with body fluids or tissues, or with wastewater. Radioactive contamination is presumed for any instrument, probe or other device that has been used near any radioactive source.

If an instrument, probe, or other part is returned or presented for service without a Cleaning Certificate, and if in our opinion it represents a potential biological or radioactive hazard, our service personnel reserve the right to withhold service until appropriate cleaning, decontamination, and certification has been completed. We will contact the sender for instructions as to the disposition of the equipment. Disposition costs will be the responsibility of the sender.

When service is required, either at the user's facility or at a YSI Service Center, the following steps must be taken to ensure the safety of service personnel.

- In a manner appropriate to each device, decontaminate all exposed surfaces, including any containers. 70% isopropyl alcohol or a solution of 1/4-cup bleach to 1-gallon tap water is suitable for most disinfecting. Instruments used with wastewater may be disinfected with .5% Lysol if this is more convenient to the user.
- The user shall take normal precautions to prevent radioactive contamination and must use appropriate decontamination procedures should exposure occur.
- If exposure has occurred, the customer must certify that decontamination has been accomplished and that no radioactivity is detectable by survey equipment.
- Any product being returned to the YSI Repair Center should be packed securely to prevent damage.
- Cleaning must be completed and certified on any product before returning it to YSI.

18.3 Packing Procedure

- Clean and decontaminate items to ensure the safety of the handler.
- Complete and include the Cleaning Certificate.
- Place the product in a plastic bag to keep out dirt and packing material.
- Use a large carton, preferably the original, and surround the product completely with packing material.
- Insure for the replacement value of the product.

18.4 Cleaning Certificate

Organization _____

Department _____

Address _____

City _____ State __ Zip _____

Country _____ Phone _____

Model No. of Device __ Lot Number _____

Contaminant (if known) _____

Cleaning Agent(s) used _____

Radioactive Decontamination Certified?

(Answer only if there has been radioactive exposure)

_____ Yes _____ No

Cleaning Certified By _____

Name Date

18.5 Warranty

The instrument is warranted for three years against defects in workmanship and materials when used for its intended purposes and maintained according to instructions. The probe module and cables are warranted for one year. The dissolved oxygen, temperature/conductivity, pH, and pH/ORP combination sensors are warranted for one year. Damage due to accidents, misuse, tampering, or failure to perform prescribed maintenance is not covered. The warranty period for chemicals and reagents is determined by the expiration date printed on their labels. Within the warranty period, YSI will repair or replace, at its sole discretion, free of charge, any product that YSI determines to be covered by this warranty.

To exercise this warranty, write or call your local YSI representative, or contact YSI Customer Service in Yellow Springs, Ohio. Send the product and proof of purchase, transportation prepaid, to the Authorized Service Center selected by YSI. Repair or replacement will be made and the product returned transportation prepaid. Repaired or replaced products are warranted for the balance of the original warranty period, or at least 90 days from date of repair or replacement.

Limitation of Warranty

This Warranty does not apply to any YSI product damage or failure caused by (i) failure to install, operate or use the product in accordance with YSI's written instructions, (ii) abuse or misuse of the product, (iii) failure to maintain the product in accordance with YSI's written instructions or standard industry procedure, (iv) any improper repairs to the product, (v) use by you of defective or improper components or parts in servicing or repairing the product, or (vi) modification of the product in any way not expressly authorized by YSI.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. YSI'S LIABILITY UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF THE PRODUCT, AND THIS SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY. IN NO EVENT SHALL YSI BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY.

19.Appendix F Ferrite Bead Installation

⚠ **WARNING:** If you are using your YSI 556 in a European Community (CE) country or in Australia or New Zealand, you must attach a ferrite bead to the 655173 PC Interface Cable and the YSI 6117 Charger Adapter Cable in order to comply with the Residential, Commercial and Light Industrial Class B Limits for radio-frequency emissions specified in EN55011 (CISPR11) for Industrial, Scientific and Medical laboratory equipment. These ferrite assemblies are supplied as part of cable kits.

1. Make a small loop (approximately 5 cm in diameter) in the cable near the YSI 556 MS-19 connector.

2. Lay the open ferrite bead assembly under the loop with the cable cross-over position within the cylinder of the ferrite bead.

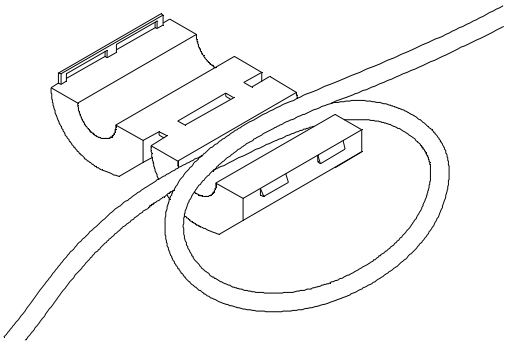


Figure 19.1 Ferrite Bead Installation

3. Snap the two pieces of the bead together making certain that the tabs lock securely.

4. When the installation is complete, the 655173 and YSI 6117 cables should resemble the following drawings.

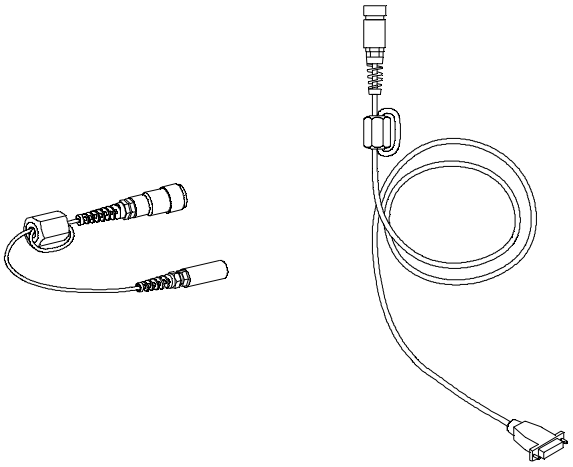


Figure 19.2 Cables with Ferrite Beads

20.Appendix G EcoWatch

EcoWatch™ for Windows™must be used as the PC software interface to the YSI 556 MPS. EcoWatch is a powerful tool that can also be used with YSI 6-series sondes. Many features of the software will only be utilized by advanced users or are not relevant to the 556 MPS at all. This section is designed in tutorial format to familiarize you with the commonly used features of EcoWatch so that it will be possible to:

- Upload data from a 556 MPS to a PC
- Assemble plots and reports of your data
- Zoom in on certain segments of the plots of your data to facilitate analysis
- Show statistical data for your studies
- Export data in spreadsheet-compatible formats
- Print plots and reports

The advanced features of EcoWatch can be explored by downloading a 6-series manual from the YSI Web Site (www.ysi.com), purchasing a hard copy of the manual through YSI Customer Service (Item # 069300), or utilizing the on-line help feature of the software.

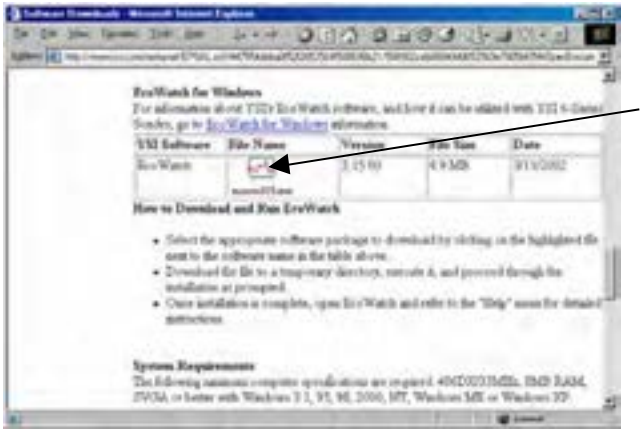
20.1 Installing EcoWatch for Windows

EcoWatch for Windows is available at no cost via a download from the YSI Web Site.

1. Access the YSI Environmental Web Site at www.ysi.com/edownloads.

2. Click on the **EcoWatch for Windows** link (or scroll down until you see the EcoWatch for Windows icon).

3. Click on the EcoWatch for Windows icon and save the file to a temporary directory on your computer.



4. After the download is complete, run the EcoWatch file (that you just downloaded) and follow the on screen instructions to install the software on your computer.

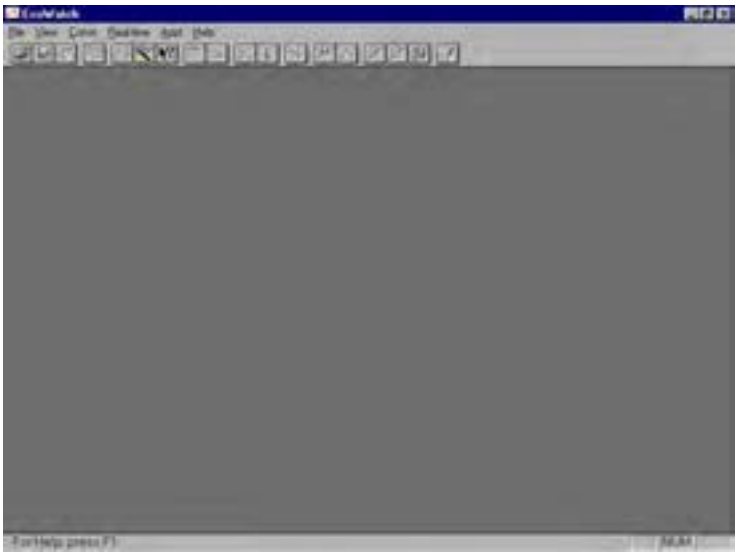
If you encounter difficulties in the download procedure, contact YSI Customer Service. Refer to ***Appendix E Customer Service***. Alternatively, you may purchase the software on CD ROM (Item #006075) by contacting YSI Customer Service.

20.2 EcoWatch Tutorial

This EcoWatch tutorial is designed to teach you the commonly used operations associated with the software when used with your 556 MPS.

After you have uploaded a file, Refer to Section 8.4 Upload to PC, you will see two files in the C:\ECOWWIN\DATA directory; the file you transferred and a file supplied by YSI designated SAMPLE.DAT. This SAMPLE.DAT file is referred to in the remainder of this tutorial section. After following the instructions below for the analysis of SAMPLE.DAT, you apply the same analysis to the data file which was uploaded from your 556 MPS to assure that you are familiar with the basic features and capabilities of EcoWatch for Windows.

To start the analysis of the SAMPLE.DAT file, note that a shortened menu bar is visible and many of the tools in the toolbar appear dimmed or “grayed out” before any file is opened (see below).



Full activation of EcoWatch features will be realized after a file is opened.

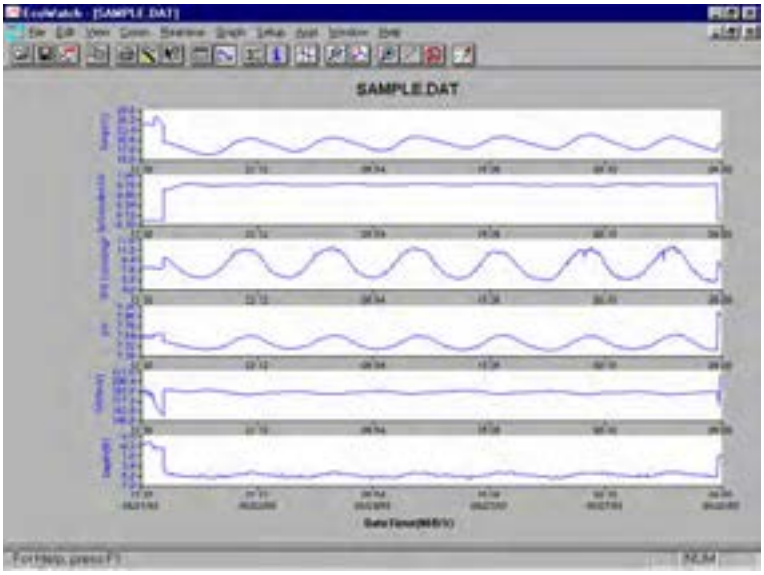
To open the sample data file:

5. 1. Click the **File** menu button in the toolbar.

6. 2. Select the **SAMPLE.DAT** file.

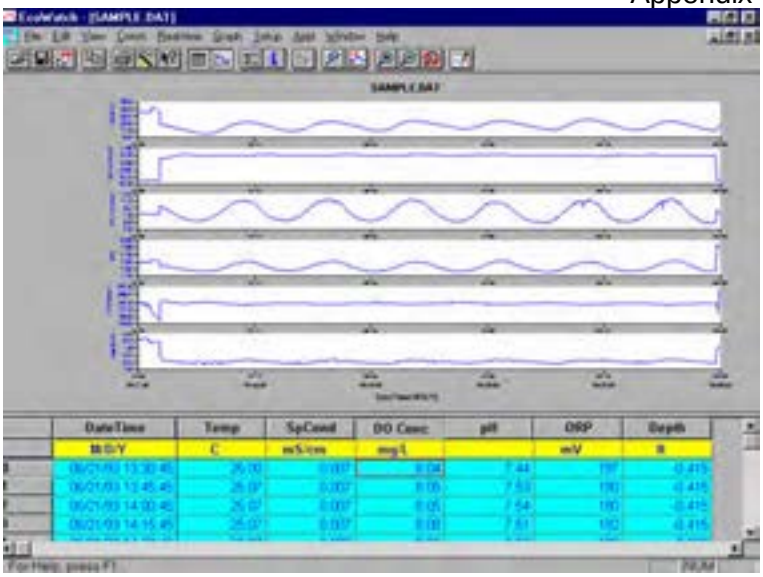
7. 3. Click **OK** to open the file.

The following display will appear:

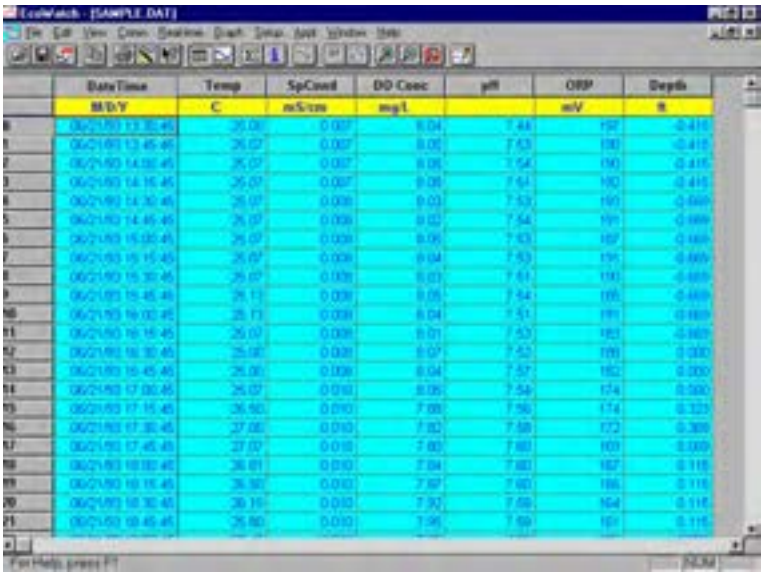


Note that the data in this file appears as a graph of temperature, specific conductance, dissolved oxygen, pH, ORP, and depth, all versus time. The graphs are scaled automatically so that all data fits comfortably on the computer screen. Note also that this data file was obtained with a 6-series sonde for which a depth sensor is available. Depth is NOT a current parameter for the 556 MPS.

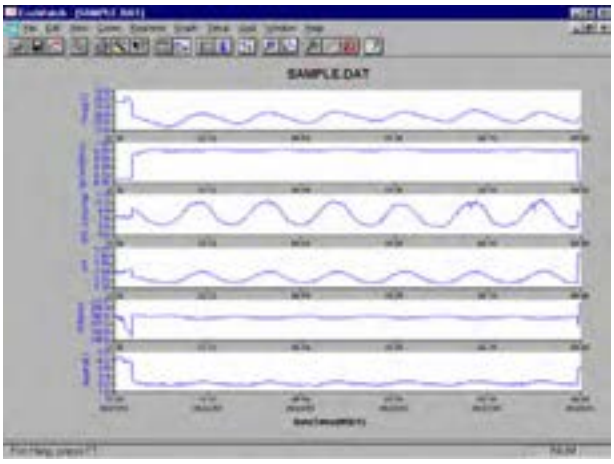
The **Table** and **Graph** buttons on the toolbar are on/off switches that are used to display or hide the graph and table pages respectively. When displaying a graph and a table at the same time, you can control the relative size of the two pages by placing the cursor over the small bar that separates them and then dragging it to the desired location. Click the **Table** button to generate the following dual display of data.



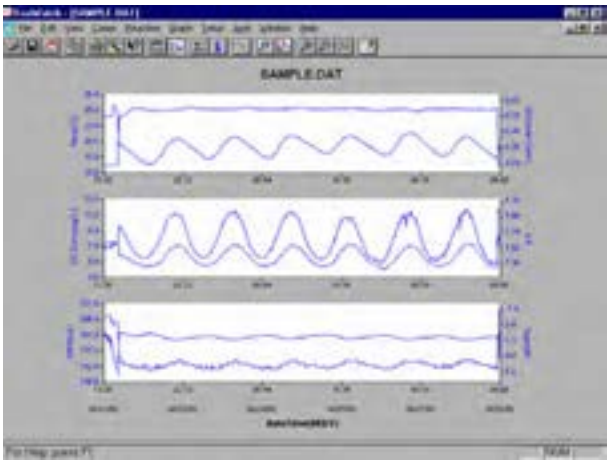
Now click the **Graph** button (turn it off) to display only a report of your data as shown below. Note that the size of the report can be varied by clicking on the and buttons in the Toolbar.



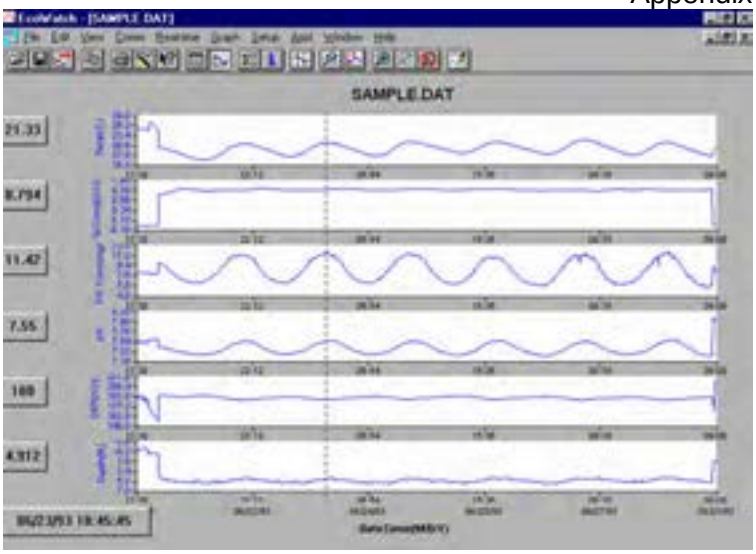
Now return to the original graphic display by toggling the **Table** button "off" and **Graph** button "on".



From the **Setup** menu, click **Graph**. Click **2 Traces per Graph** and notice that the parameters are now graphed in pairs for easy comparison of parameters.

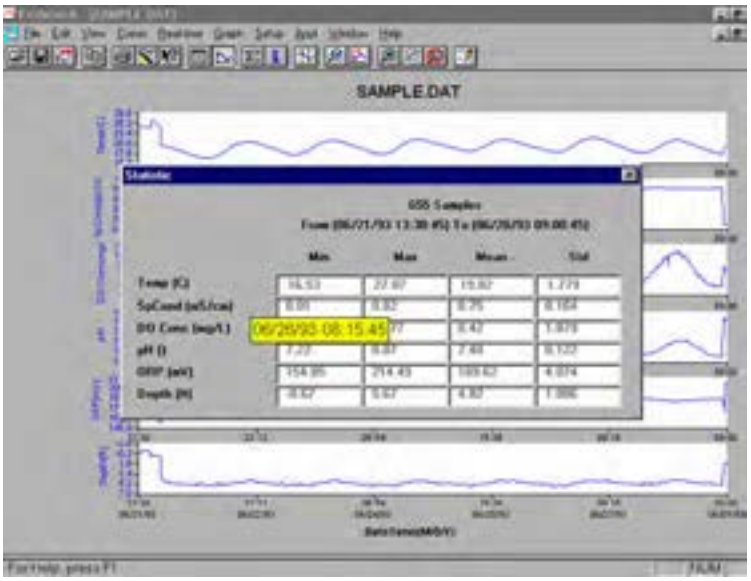


Click **1 Trace per Graph** to return the display to the original setting. Move the cursor to any position in the graph, then click and hold the right mouse button.



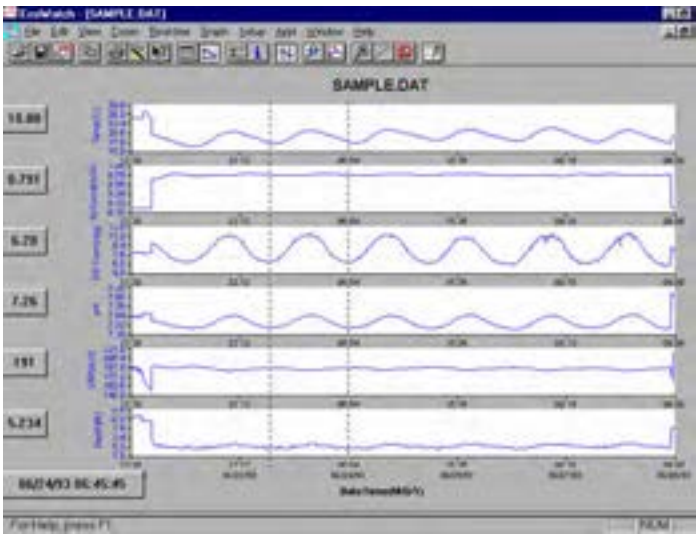
Note that the exact measurements for this point in time are displayed to the left of the graph. While holding down the right mouse button, move to another area on the graph. Notice how the measurements change as you move. When you release the mouse button, the display returns to normal.

To view statistical information for the study, click the **Statistics** button on the toolbar. On the statistics window, click on any min or max value to display the time when it occurred.

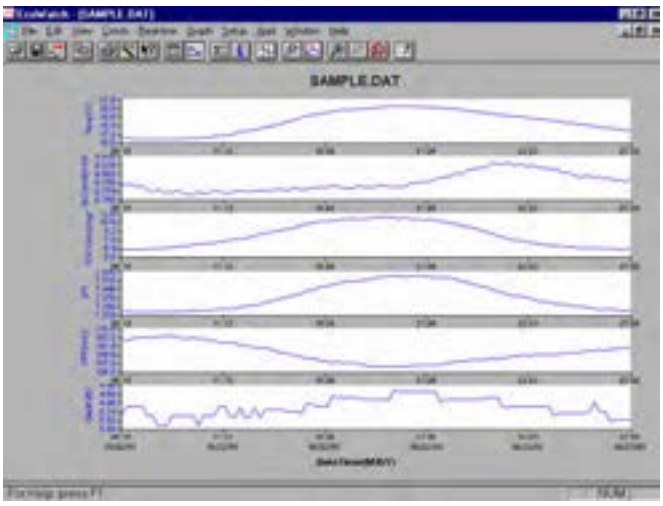


After viewing statistics, click the "x" at the upper right to close the window and return to the normal display.

Now click on the delimiter icon in the toolbar and then move the displayed icon to the graph. Click at the two points shown by dotted lines in the display below, being sure that the first click is to the left of the second.

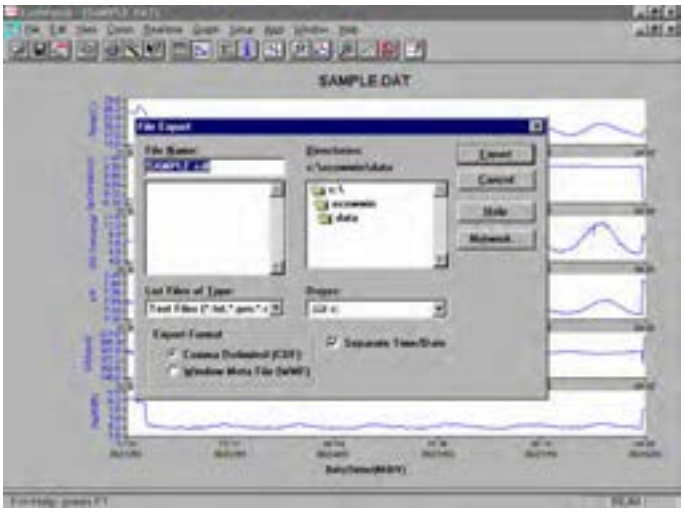


The data between the two selected points will then be graphed in higher resolution as shown below.

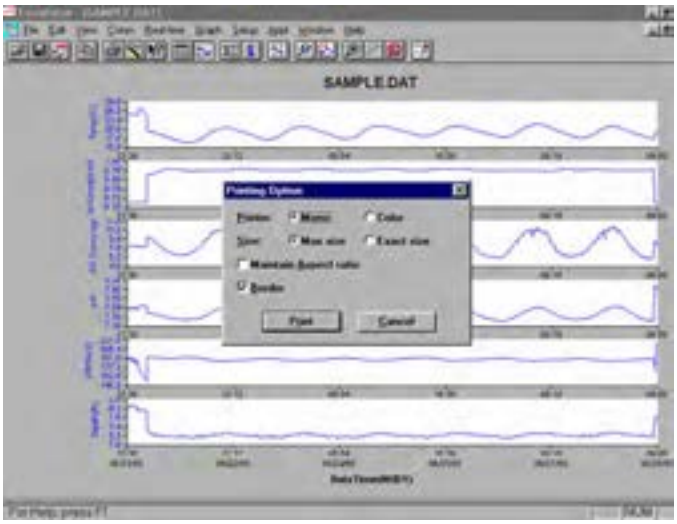


To return to the complete data set, select **Graph** from the toolbar and then click **Cancel Limits**.

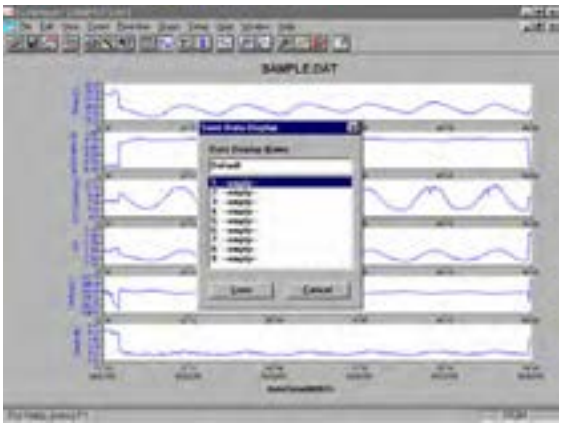
Now select the icon from the Toolbar to create a new data file which will allow your data to be imported into spreadsheets. Select the default export settings for a Comma Delimited File (.CDF) and click OK. A new spreadsheet-importable file (SAMPLE.CDF) is now present in the same folder as the SAMPLE.DAT file.



Now select the icon from the toolbar to print the plot. Accept the default settings and click OK to complete the printing operation.



Finally, end the tutorial by saving the **Data Display** in the format shown. From the **File** menu, click **Save Data Display**.



Then type “Default” for the file name and click **Save**. The parameters, colors, format, and x-axis time interval associated with the current display are now saved and can be accessed any time in the future. Nine different data displays may be saved for any data file. You can easily switch between various displays of the data. The data files can be accessed by clicking **Load Data Display** from the file menu and then selecting the desired presentation.

20.2.1 Summary of Toolbar Capability

The EcoWatch toolbar includes buttons for some of the most common commands in EcoWatch, such as **File Open**. To display or hide the toolbar, open the **View** menu and click on the **Toolbar** command. A check mark appears next to the menu item when the toolbar is displayed.

The toolbar is displayed across the top of the application window, below the menu bar.

Click To:

Open an existing data file (.DAT). EcoWatch displays the **Open** dialog box, in which you can locate and open the desired file.

Save the working Data Display of the active data file. EcoWatch displays the **Save Data Display** dialog box in which you can overwrite existing Data Display or save to a new one.

Export data as a graph in Window Meta File (.WMF) format or as data in Comma Delimited (.CDF) format.

Copy the whole graph page or data from the selection on the table to the clipboard.

Print the active graph page or table page depending on which one is currently active.

Open a new terminal window to communicate with the sonde.

Access context sensitive help (Shift+F1).

Toggle table window during file processing.

Toggle graph window during file processing.

Display study statistics.

Display study info.

Limit the data to be processed in a study.

Enlarge a selective portion of graph.

Center the graph under the cursor.

Enlarge graph or table 20%.

Reduce graph or table 20%.

Return graph or table to its normal state (unzoom)

Redraw the graph.

20.2.2 Other Capabilities

The above tutorial and function list for the toolbar provide basic information to allow you to view and analyze the field data which was stored in your 556 MPS. Some of the other commonly used capabilities of EcoWatch which the user may want to explore are listed below:

- Customize the units for each parameter, e.g., report uS/cm instead of mS/cm for conductivity.
- Customize the order of parameters in each plot or report.
- Customize the colors and fonts of each data display.
- Manually scale the y-axis sensitivity for each parameter.
- Merging of two or more data files with compatible parameter formats
- View information about the study such as number of points, instrument serial number, etc. which was stored in the 556 with the data.
- Print data reports in different statistical formats.
- Create plots of parameter vs. parameter rather than parameter vs. time.

These additional features of EcoWatch for Windows are explained in detail in the YSI 6-series manual (which can be downloaded at no cost from the YSI Web Site as described above) and the Help selection in the EcoWatch menubar. To purchase a hard copy of the 6-series manual, contact YSI Customer Service using the contact information in *Appendix E Customer Service*.

21.Appendix H Calibration Record Information

When your YSI 556 MPS sensors are initially calibrated, relevant information about the sensors will be stored in a separate file in the YSI 556 MPS memory.

NOTE: This file, by default, will have the name "556 Circuit Board Serial Number.glp." The circuit board serial number is assigned at the factory and has a hexadecimal format such as 000080A4. Thus the default calibration record file would be designated 00080A4.glp. Refer to Section *10.7 GLP Filename* to change the filename.

The information in the calibration record will track the sensor performance of your instrument and should be particularly useful for programs operating under Good Laboratory Practices (GLP) protocols.

21.1 Viewing the Calibration Record (.glp) File

NOTE: Make certain that you have performed a calibration on at least one of the sensors associated with your YSI 556 MPS.

1. Follow the procedures outlined in Section *8.3 View File*.

21.2 Uploading the Calibration Record (.glp) File

NOTE: Make certain that you have performed a calibration on at least one of the sensors associated with your YSI 556 MPS.

1. Follow the procedures outlined in Section *8.4 Upload to PC*.

21.3 Understanding the Calibration Record (.glp) File

1. Open a calibration record file. Refer to Section *8.3 View File*.

2. Use the arrow keys to scroll horizontally and/or vertically to view all the data.

00008003.glp

m/d/y	hh:mm:ss	S/N
01/24/2001	08:17:51	00008003
01/24/2001	08:17:51	00008003
01/24/2001	08:17:51	00008003
01/24/2001	08:17:51	00008003
01/24/2001	08:17:51	00008003
01/24/2001	08:17:51	00008003
01/24/2001	08:17:51	00008003
01/24/2001	08:17:51	00008003
01/24/2001	08:25:40	00008003
01/24/2001	08:25:40	00008003

735.9mmHg

01/24/2001 08:39:53

Figure 21.1 Calibration Record Screen 1

00008003.glp

Type	Value
Conductivity gain	1.000000
DO gain	1.000000
pH gain (pH-7)*K/mV	-5.05833
pH offest (pH-7)*K	0.000000
ORP offset mV	0.000000
TDS constant	0.650000
Barometer offset PSI	0.000000
DO gain	1.110250
pH gain (pH-7)*K/mV	-5.05833
pH offest (pH-7)*K	-12.2899

735.9mmHg

01/24/2001 08:39:19

Figure 21.2 Calibration Record Screen 2

NOTE: Each sensor (not parameter) is characterized by either 1 line (Conductivity, Dissolved Oxygen, ORP, TDS, or Barometer (Optional)) or 2 lines (pH) of calibration documentation.

The left hand portion of each calibration entry shows the date and time that a calibration of a particular sensor was performed. In addition, each calibration entry is characterized by the instrument serial number, as defined by YSI. See Figure 21.1 Calibration Record Screen 1. The right hand portion shows the YSI designation of the calibration constants and their values after their calibration has been performed. A more detailed description of the calibration constants is provided below:

- **Conductivity Gain** – A relative number which describes the sensitivity of the sensor. Basically, the value represents the calculated cell constant divided by the typical value of the cell constant (5 cm^{-1}).

- **DO Gain** – A relative number which describes the sensitivity of the sensor. Basically, the value represents the sensor current at the time of calibration divided by the typical value of the sensor current (15 uA).

- **pH Gain** – A number which basically represents the sensitivity of the pH sensor. To remove the effect of temperature on the slope of the relationship of probe output in mv versus pH, the value of pH/mv is multiplied by the temperature in degrees Kelvin (K).

- **pH Offset** – A number which basically represents the offset (or intercept) of the relationship of probe output in mv versus pH, the value of pH is multiplied by the temperature in degrees Kelvin (K).

Anytime you perform a calibration, information concerning the calibration constants will be logged to the Calibration Record file (.glp file). However, if the **Delete All Files** command is used, Refer to Section *8.6 Delete All Files*, the Calibration Record file will also be lost. It is critical that this file should be uploaded to your PC prior to issuing a **Delete All Files** command. Refer to Section *8.4 Upload to PC*.

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