Western Refining
GALLUP

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FEB 2010

CERTIFIED MAIL: 7008 2810 0000 4726 1284

February 23, 2010

Mr. James Bearzi, Bureau Chief
New Mexico Environmental Department
Hazardous Waste Bureau\
2905 Rodeo Park Drive East, Bldg 1
Santa Fe, NM 87505-6303

Re: RCRA Hazardous Waste Part A Permit Application and Part B Detailed Site-Specific information. EPA ID #NMD 000 333 211

Dear Mr. Valdez:

Pursuant to 40 CFR 270.13 and 40 CFR 270-14 through 270-27, Western Refining Company, Gallup Refinery is submitting Part A permit application for renewal of our existing Land Treatment Unit and Part B consisting of three volumes detailing site-specific information and post-closure activities to date.

Sincerely,

Cheryl Johnson
Environmental Specialist
cheryl.johnson@wnr.com
(505) 722-0231 Direct
(505) 722-0210 Fax

Enclosures
cc: Mark B. Turri, General Manager
Ed Riege, Environmental Manager

RCRA
PART A AND PART B
POST-CLOSURE
PERMIT APPLICATION

LAND TREATMENT UNIT
WESTERN REFINING COMPANY
GALLUP REFINERY

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ACRONYMS AND ABBREVIATIONS

%C	percent of completeness
%R	percent recovery
20 NMAC 4.1	Title 20 *New Mexico Administrative Code*, Chapter 4, Part 1
ASO	acid-soluble oil
BFB	4-bromofluorobenzene
BTEX	benzene, toluene, ethyl benzene, and xylene
BTZ	below the treatment zone
CAP	Corrective Action Plan
CEC	carbon exchange capacity
CFR	*Code of Federal Regulations*
Ciniza	Giant Refining CompanyXCiniza Refinery
CME	comprehensive monitoring evaluation
C:N:P	carbon:nitrogen:phosphorous
COC	chain of custody
CWWCS	Contact Wastewater Collection System
DMP	detection monitoring plan
DOT	U.S. Department of Transportation
DQO	Data Quality Objective
DRO	Range Organics
EDP	early detection plan
EDS	early detection system
EDW	early detection well
EM	Environmental Manager
EPA	U.S. Environmental Protection Agency
ERC	Emergency Response Coordinator
FR	*Federal Register*
FRP	facility response plan
Gallup	Gallup Refinery
Giant	Giant Refining Company
GRO	gasoline range organics
I-40	Interstate-40
LCS	laboratory control sample
LTD	land treatment demonstration
LTU	land treatment unit
MDL	method detection limit
MW	monitoring well
NMAC	*New Mexico Administrative Code*
NMED	New Mexico Environment Department
NMED/HRMB	New Mexico Environment Department/Hazardous and Radioactive Material Bureau
NMOCD	New Mexico Oil Conservation Division
PHC	principal hazardous constituents
PPE	personal protective equipment
PVC	polyvinyl chloride
QA	quality assurance
QA/QC	quality assurance/quality control
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFA	Resource Conservation Recovery Act Facility Assessment
RFI	Resource Conservation Recovery Act Facility Investigation

ACRONYMS AND ABBREVIATIONS (Continued)

RPD	relative percent difference
SAL	screening action level
SAP	sampling and analysis plan
SMW	shallow monitoring wells
SOP	standard operating procedure
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TPH	total petroleum hydrocarbons
TEGD	*RCRA Ground Water Monitoring Technical Enforcement Guidance Document* (EPA 1986)
U.S.C.	*United States Code*
UST	underground storage tank
VCAP	Voluntary Corrective Action Plan
VOA	volatile organic analyte
VOC	volatile organic compound
WAP	waste analysis plan
Western	Western Refining Company
ZOI	zone of incorporation

HAZARDOUS WASTE FACILITY PERMIT

Name of Permittee: Giant Refining Company

EPA Identification Number: NMD000333211
Permit Number: NMD000333211-1

Pursuant to the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (**RCRA**), as amended (42 U.S.C. 6901, et seq.), and the New Mexico Hazardous Waste Act, NMSA 1978, Sections 74-4-1 et seq. (Repl. Pamph. 1993), and regulations promulgated thereunder by the New Mexico Environmental Improvement Board (codified and to be codified in the Hazardous Waste Management Regulations [20 NMAC 4.1]), a Permit is issued to Giant Refining Company (**the Permittee**), for post-closure care of a Land Treatment Unit Facility (**the Facility**), comprising three cells. The Facility is located in Jamestown, McKinley County, New Mexico on Latitude 35.29.020 North, and Longitude 108.25.042 West.

The New Mexico Environment Department (**NMED**) is authorized by the Environmental Protection Agency (**EPA**) for all hazardous waste management regulations applicable to the Facility. The Permittee shall comply with all terms and conditions of this Permit. This Permit consists of the conditions herein including those in the Attachments.

This Permit is based on the assumption that all information contained in the Permit Application and the administrative record is accurate and that the facility will be constructed and operated as specified in the application. The permit application consists of information submitted in April 1998 and supplementary technical documents.

Any inaccuracies found in the submitted information may be grounds for the termination or modification of this Permit in accordance with 20 NMAC 4.1.900 incorporating 40 CFR §270.41, §270.42, and §270.43 and for potential enforcement action.

This Permit shall become effective thirty days (30) after notice of the decision has been served on the applicant, and shall remain in effect for ten (10) years in accordance with the New Mexico Hazardous Waste Act, Section 74-4-4 unless modified, suspended or revoked under Section 74-4-4.2 or 20 NMAC 4.1.900 incorporating 40 CFR §270.41, §270.42, §270.43, or continued in accordance with 20 NMAC 4.1.900 incorporating 40 CFR §270.51, or issued for a duration that is less than the full allowable term in accordance with 20 NMAC 4.1.900 incorporated at 40 CFR §270.50(c).

Signed this 17th day of August, 2000.

by Peter Maggiore

Peter Maggiore
Secretary
New Mexico Environment Department

Please print or type with ELITE type (12 characters per inch) in the unshaded areas only

Form Approved, OMB No. 2050-0034 Expires 9-30-96
GSA No. 0248-EPA-OT

For EPA Regional Use Only

Date Received
Month Day Year

EPA
United States Environmental Protection Agency
Washington, DC 20460

Hazardous Waste Permit Application Part A

(Read the Instructions before starting)

I. Installation's EPA ID Number *(Mark 'X' in the appropriate box)*

[ ] A. First Part A Submission

[XX] B. Part A Amendment #

C. Installation's EPA ID Number: NMD000331 1

D. Secondary ID Number *(If applicable)*:

II. Name of Facility

GIANT REFINING COMPANY

III. Facility Location *(Physical address not P.O. Box or Route Number)*

A. Street: INTERSTATE 40

Street *(Continued)*: EXIT 39

City or Town: AMESTOWN

State: NM

Zip Code: 87347

County Code *(If known)*:

County Name: MCKINLEY

B. Land Type *(Enter code)*: P

C. Geographic Location: LATITUDE *(Degrees, Minutes, & Seconds)* 35 29 020; LONGITUDE *(Degrees, Minutes & Seconds)* 108 25 042

D. Facility Existence Date: Month 10 Day 18 Year 1980

IV. Facility Mailing Address

Street or P.O. Box: ROUTE 3 BOX 7

City or Town: GALLUP

State: NM

Zip Code: 87301

V. Facility Contact *(Person to be contacted regarding waste activities at facility)*

Name *(Last)*: PAVLICH

(First): DAVID

Job Title: MANAGER H/S/E

Phone Number *(Area Code and Number)*: 505-722-3833

VI. Facility Contact Address *(See Instructions)*

A. Contact Address: Location [ ] Mailing [XX] Other [ ]

B. Street or P.O. Box:

City or Town:

State:

Zip Code:

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Form Approved, OMB No. 2050-0034 Expires 9-30-96
GSA No. 0248-EPA-OT

EPA I.D. Number (Enter from page 1)	Secondary ID Number (Enter from page 1)
NMD000333211	

VII. Operator Information (See Instructions)

Name of Operator: GIANT REFINING COMPANY CINIZA

Street or P.O. Box: ROUTE 3 BOX 7

City or Town: GALLUP | State: NM | ZIP Code: 87301-

Phone Number (Area Code and Number): 505-722-3833

B. Operator Type: P

C. Change of Operator Indicator: Yes [ ] No [X]

Date Changed: Month Day Year

VIII. Facility Owner (See Instructions)

A. Name of Facility's Legal Owner: GIANT INDUSTRIES ARIZONA INC

Street or P.O. Box: 23733 NORTH SCOTTSDALE ROAD

City or Town: SCOTTSDALE | State: AZ | ZIP Code: 85255-

Phone Number (Area Code and Number): 602-585-8888

B. Owner Type: P

C. Change of Owner Indicator: Yes [ ] No [X]

Date Changed: Month Day Year

IX. SIC Codes (4-digit, in order of significance)

Primary	Secondary
2911 (Description) Petroleum Refining	(Description)
Secondary	**Secondary**
(Description)	(Description)

X. Other Environmental Permits (See Instructions)

A. Permit Type (Enter code)	B. Permit Number	C. Description
R	NMD000333211	RCRA Part B Permit
E	AQP633-M-2	NM Air Quality Permit
N	NMR00A172	General NPDES Stormwater
E	GW-32	NMOCD Discharge Plan

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Form Approved, OMB No. 2050-0034 Expires 9-30-96
GSA No. 0248-EPA-OT

EPA I.D. Number (Enter from page 1): N M D 0 0 0 3 3 3 2 1 1

Secondary ID Number (Enter from page 1):

I. Nature of Business (Provide a brief description)

The Giant-Ciniza Plant refines crude oil and markets refined petroleum fuel products.

XII. Process Codes and Design Capacities

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 XIII.

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 from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

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

PROCESS CODE	PROCESS	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
	Disposal:	
D79	Underground Injection	Gallons; Liters; Gallons Per Day; or Liters Per Day
D80	Landfill	Acre-feet or Hectare-meter
D81	Land Treatment	Acres or Hectares
D82	Ocean Disposal	Gallons Per Day r Liters Per Day
D83	Surface Impoundment	Gallons or Liters
D99	Other Disposal	Any Unit of Measure Listed Below
	Storage:	
S01	Container (Barrel, Drum, Etc.)	Gallons or Liters
S02	Tank	Gallons or Liters
S03	Waste Pile	Cubic Yards or Cubic Meters
S04	Surface Impoundment	Gallons or Liters
S05	Drip Pad	Gallons or Liters
S06	Containment Building-Storage	Cubic Yards or Cubic Meters
S99	Other Storage	Any Unit of Measure Listed Below
	Treatment:	
T01	Tank	Gallons Per Day or Liters Per Day
T02	Surface Impoundment	Gallons Per Day or Liters Per Day
T03	Incinerator	Short Tons Per Hour; Metric Tons Per Hour; Gallons Per Hour; Liters Per Hour; or Btu's 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; or Btu's Per Hour
T80	Boiler	Gallons or Liters
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; or Btu's 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; or Btu's Per Hour
T88	Titanium Dioxide Chloride Process 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	
T92	Halogen Acid Furnaces	
T93	Other Industrial Furnaces Listed In 40 CFR §260.10	
T94	Containment Building-Treatment	Cubic Yards or Cubic Meters
	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; or Kilograms Per Hour
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; or Btu's Per Hour
X04	Geologic Repository	Cubic Yards or Cubic Meters
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

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

Please print or type with ELITE type (12 characters per inch) in the unshaded areas only

Form Approved, OMB No. 2050-0034 Expires 9-30-96
GSA No. 0248-EPA-OT

EPA I.D. Number (Enter from page 1): N M D 0 0 0 0 3 3 2 1 1

Secondary ID Number (Enter from page 1):

XII. Process Codes and Design Capabilities (Continued)

EXAMPLE FOR COMPLETING ITEM XII (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. 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 1	15 . 0	B	001	
2		.			
3		.			
4		.			
5		.			
6		.			
7		.			
8		.			
9		.			
10		.			
11		.			
12		.			
13		.			

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 XIII.

XIII. Other Processes (Follow instructions from Item XII for D99, S99, T04 and X99 process codes)

Line Number (Enter as in seq w/XII)	A. Process Code (From list above)	B. PROCESS DESIGN CAPACITY 1. Amount (Specify)	B. 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					

Please print or type with ELITE type (12 characters per inch) in the unshaded areas only

Form Approved, OMB No. 2050-0034 Expires 9-30-96
GSA No. 0248-EPA-OT

EPA I.D. Number (Enter from page 1)												Secondary ID Number (Enter from page 1)											
N	M	D	0	0	0	3	3	3	2	1	1												

XIV. Description of Hazardous Wastes

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 Item XII A. on page 3 to indicate how the waste will be stored, treated, and/or disposed of 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 Item XII A. 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 XIV-D(1).*
3. *Enter in the space provided on page 7, Item XIV-E, the line number and the additional code(s).*

2. PROCESS DESCRIPTION: *If a code is not listed for a process that will be used, describe the process in the space provided on the form (D.(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 XIV (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 operation. 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 HAZARD WASTE NO. (Enter code)				B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (Enter code)	D. PROCESS (1) PROCESS CODES (Enter code)									D. PROCESS (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

Please print or type with ELITE type (12 characters per inch) in the unshaded areas only

Form Approved, OMB No. 2050-0034 Expires 9-30-96
GSA No. 0248-EPA-OT

EPA I.D. Number (Enter from page 1): N M D 0 0 0 3 3 3 2 1 1

Secondary ID Number (Enter from page 1):

V. Description of Hazardous Wastes (Continued)

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	D001	45.0	T	D81	
2	K049	228.0	T	D81	
3	K050	6.0	T	D81	
4	K051	2325.0	T	D81	
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
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24					
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29					
30					
31					
32					
33					

Please print or type with ELITE type (12 characters per inch) in the unshaded areas only

Form Approved, OMB No. 2050-0034 Expires 9-30-96
GSA No. 0248-EPA-OT

EPA I.D. Number (Enter from page 1)	Secondary ID Number (Enter from page 1)
N M D 0 0 0 3 3 3 2 1 1	

XV. Map

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. Att. A

XVI. Facility Drawing

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

XVII. Photographs

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). Att. C

XVIII. Certification(s)

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.

Owner Signature	Date Signed
LEROY CROW SENIOR VICE PRESIDENT OPERATIONS	April 22, 1998
Name and Official Title (Type or print)	
Owner Signature	Date Signed
Name and Official Title (Type or print)	
Operator Signature	Date Signed
Name and Official Title (Type or print)	
Operator Signature	Date Signed
Name and Official Title (Type or print)	

XIX. Comments

This Part A permit application applies only to the post-closure of the land treatment unit at the Giant-Ciniza Refinery.

The volumes of waste entered in XIV B are the total volumes applied to the land treatment unit from 1987 to 1990.

Note: Mail completed form to the appropriate EPA Regional or State Office. (Refer to instructions for more information)

Part A

OMB# 2050-0024; Expires 11/30/2011

SEND COMPLETED FORM TO: The Appropriate State or Regional Office.	United States Environmental Protection Agency **RCRA SUBTITLE C SITE IDENTIFICATION FORM**

1. Reason for Submittal MARK ALL BOX(ES) THAT APPLY	**Reason for Submittal:** ☐ To provide an Initial Notification (first time submitting site identification information / to obtain an EPA ID number for this location) ☒ To provide a Subsequent Notification (to update site identification information for this location) ☐ 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 (If marked, see sub-bullet below) ☐ 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 (or State equivalent LQG regulations)
2. Site EPA ID Number	**EPA ID Number** N M D 0 0 0 3 3 3 2 1 1
3. Site Name	**Name:** Western Refining Southwest, Inc., Gallup Refinery
4. Site Location Information	**Street Address:** I-40 Exit 39, 17 Miles East of Gallup **City, Town, or Village:** Jamestown **County:** McKinley **State:** New Mexico **Country:** USA **Zip Code:** 87347
5. Site Land Type	☒ Private ☐ County ☐ District ☐ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other
NAICS Code(s) for the Site (at least 5-digit codes)	**A.** 3 2 4 4 1 0 **C.** **B.** **D.**
7. Site Mailing Address	**Street or P.O. Box:** Route 3 Box 7 **City, Town, or Village:** Gallup **State:** New Mexico **Country:** USA **Zip Code:** 87301
8. Site Contact Person	**First Name:** Ed **MI:** **Last:** Riege **Title:** Environmental Manager **Street or P.O. Box:** Route 3 Box 7 **City, Town or Village:** Gallup **State:** New Mexico **Country:** USA **Zip Code:** 87301 **Email:** ed.riege@wnr.com **Phone:** 505-722-0217 **Ext.:** **Fax:** 505-722-0210
9. Legal Owner and Operator of the Site	**A. Name of Site's Legal Owner:** Western Refining Company, LP **Date Became Owner:** 11/15/2007 **Owner Type:** ☒ Private ☐ County ☐ District ☐ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other **Street or P.O. Box:** 6500 Trowbridge Drive **City, Town, or Village:** El Paso **Phone:** 915-534-1400 **State:** Texas **Country:** USA **Zip Code:** 79905 **B. Name of Site's Operator:** Western Refining Southwest, Inc. **Date Became Operator:** 11/15/2007 **Operator Type:** ☒ Private ☐ County ☐ District ☐ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other

10. Type of Regulated Waste Activity (at your site)
Mark "Yes" or "No" for all current activities (as of the date submitting the form); complete any additional boxes as instructed.

A. Hazardous Waste Activities; Complete all parts 1-7.

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

☒ a. LQG: Generates, in any calendar month, 1,000 kg/mo (2,200 lbs./mo.) or more of hazardous waste; **or** Generates, in any calendar month, or accumulates at any time, more than 1 kg/mo (2.2 lbs./mo) of acute hazardous waste; **or** Generates, in any calendar month, **or** accumulates at any time, more than 100 kg/mo (220 lbs./mo) of acute hazardous spill cleanup material.

☐ b. SQG: 100 to 1,000 kg/mo (220 – 2,200 lbs./mo) of non-acute hazardous waste.

☐ c. CESQG: Less than 100 kg/mo (220 lbs./mo) of non-acute hazardous waste.

If "Yes" above, indicate other generator activities.

Y ☒ N ☐ d. Short-Term Generator (generate from a short-term or one-time event and not from on-going processes). If "Yes", provide an explanation in the 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** Note: A hazardous waste permit is required for these activities.

Y ☐ N ☒ **4. Recycler of Hazardous Waste**

Y ☐ N ☒ **5. Exempt Boiler and/or Industrial Furnace**
If "Yes", mark all that apply.

☐ 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 your State regulations to determine what is regulated]. Indicate types of universal waste managed at your site. If "Yes", mark all that apply.**

a. Batteries ☐
b. Pesticides ☐
c. Mercury containing equipment ☐
d. Lamps ☐
e. Other (specify) _____ ☐
f. Other (specify) _____ ☐
g. Other (specify) _____ ☐

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

C. Used Oil Activities; Complete all parts 1-4.

Y ☐ N ☒ **1. Used Oil Transporter**
If "Yes", mark all that apply.

☐ a. Transporter

☐ b. Transfer Facility (at your site)

Y ☐ N ☒ **2. Used Oil Processor and/or Re-refiner**
If "Yes", mark all that apply.

☐ a. Processor

☐ b. Re-refiner

Y ☐ N ☒ **3. Off-Specification Used Oil Burner**

Y ☐ N ☐ **4. Used Oil Fuel Marketer**
If "Yes", mark all that apply.

☐ 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

Eligible Academic Entities with Laboratories—Notification for opting into or withdrawing from managing laboratory hazardous wastes pursuant to 40 CFR Part 262 Subpart K

- You must check with your State to determine if you are eligible to manage laboratory hazardous wastes pursuant to 40 CFR Part 262 Subpart K

☐ 1. Opting into or currently operating under 40 CFR Part 262 Subpart K for the management of hazardous wastes in laboratories
See the item-by-item instructions for definitions of types of eligible academic entities. Mark all that apply:

☐ a. College or University

☐ b. Teaching Hospital that is owned by or has a formal written affiliation agreement with a college or university

☐ c. Non-profit Institute that is owned by or has a formal written affiliation agreement with a college or university

☐ 2. Withdrawing from 40 CFR Part 262 Subpart K for the management of hazardous wastes in laboratories

11. Description of Hazardous Waste

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	K049	K050	K051			

B. Waste Codes for State-Regulated (i.e., non-Federal) Hazardous Wastes. Please list the waste codes of the State-Regulated hazardous wastes handled at your site. List them in the order they are presented in the regulations. Use an additional page if more spaces are needed.

12. Notification of Hazardous Secondary Material (HSM) Activity

Y ☐ N ☒ Are you notifying under 40 CFR 260.42 that you will begin managing, are managing, or will stop managing hazardous secondary material under 40 CFR 261.2(a)(2)(ii), 40 CFR 261.4(a)(23), (24), or (25)?

If "Yes", you must fill out the Addendum to the Site Identification Form: Notification for Managing Hazardous Secondary Material.

13. Comments

~~Part A application applies only to the Post Closure of the Land Treatment Unit at the Western Refining, Gallup Refinery.~~

~~No Hazardous waste has been applied to the land treatment unit from 1990 to present February 2010.~~

14. 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 fines and imprisonment for knowing violations. For the RCRA Hazardous Waste Part A Permit Application, all owner(s) and operator(s) must sign (see 40 CFR 270.10(b) and 270.11).

Signature of legal owner, operator, or an authorized representative	Name and Official Title (type or print)	Date Signed (mm/dd/yyyy)
Mark B. Turri	Mark B. Turri	2/23/2010

EPA ID Number | N | M | D | 0 | 0 | 0 | 3 | 3 | 3 | 2 | 1 | 1 |

OMB#: 2050-0034; Expires 7/31/2012

United States Environmental Protection Agency

HARDOUS WASTE PERMIT INFORMATION FORM

1. Facility Permit Contact	**First Name:** Ed	**MI:**	**Last Name:** Riege
	Contact Title: Environmental Manager		
	Phone: 505-722-0217	**Ext.:**	**Email:** ed.riege@wnr.com
2. Facility Permit Contact Mailing Address	**Street or P.O. Box:** Route 3 Box 7		
	City, Town, or Village: Gallup		
	State: New Mexico		
	Country: USA	**Zip Code:** 87301	
3. Operator Mailing Address and Telephone Number	**Street or P.O. Box:** Route 3 Box 7		
	City, Town, or Village: Gallup		
	State: New Mexico	**Phone:**	
	Country: USA	**Zip Code:** 87301	
4. Facility Existence Date	**Facility Existence Date (mm/dd/yyyy):** 11/15/2007		

5. Other Environmental Permits

A. Facility Type (Enter code)	B. Permit Number													C. Description
R	N	M	D		0	0	0	3	3	3	2	1	1	Hazardous Waste Facility Permit
E	0	6	3	3		M	7							NSR Air Quality Permit - NMED
E	G	W		0	3	2								Discharge Permit - NMOCD
E	P	O		2	1		R	1						Air Quality Operating Permit - NMED
N	N	M	R		0	5		B		1	5	7		NPDES Stormwater Multi-Sector

6. Nature of Business:

Refines crude oil and markets refined petroleum fuel products.

7. Process Codes and Design Capacities – Enter information in the Section on Form Page 3

A. PROCESS CODE – Enter the code from the list of process codes below that best describes each process to be used at the facility. 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 8.

B. PROCESS DESIGN CAPACITY – For each code entered in Item 7.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 Item 7.B(1), enter the code in Item 7.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 Unit 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; Hectares-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	Gallons; Liters; Cubic Meters; or Cubic Yards
S05	Drip Pad	Gallons; Liters; 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
T02	Surface Impoundment	Gallons Per Day; Liters Per Day
T03	Incinerator	Short Tons Per Hour; Metric Tons Per Hour; Gallons Per Hour; Liters Per Hour; BTUs Per Hour; Pounds Per Hour; Short Tons Per Day; Kilograms Per Hour; Gallons 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; Short Tons Per Day; BTUs Per Hour; Gallons Per Day; Liters Per Hour; or Million BTU Per Hour
T80	Boiler	Gallons; Liters; Gallons Per Hour; Liters Per Hour; BTUs Per Hour; or Million BTU Per Hour

Process Code	Process	Appropriate Unit of Measure for Process Design Capacity (for T81 – T94)
	Treatment (Continued)	
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	
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	
T92	Halogen Acid Furnaces	
T93	Other Industrial Furnaces Listed in 40 CFR 260.10	
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	Unit of Measure	Unit of Measure Code	Unit of Measure	Unit of Measure Code
Gallons	G	Short Tons Per Hour	D	Cubic Yards	Y
Gallons Per Hour	E	Short Tons Per Day	N	Cubic Meters	C
Gallons Per Day	U	Metric Tons Per Hour	W	Acres	B
Liters	L	Metric Tons Per Day	S	Acre-feet	A
Liters Per Hour	H	Pounds Per Hour	J	Hectares	Q
Liters Per Day	V	Kilograms Per Hour	X	Hectare-meter	F
		Million BTU Per Hour	X	BTU Per Hour	I

7. Process Codes and Design Capacities (Continued)

EXAMPLE FOR COMPLETING Item 7 (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)	(2) Unit of Measure	C. Process Total Number of Units	For Official Use Only
X	1	S	0	2	533.788	G	001	
	1	D	8	1	15.0	B	001	
	2							
	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 line sequentially, taking into account any lines that will be used for "other" process (i.e., D99, S99, T04, and X99) in Item 8.

8. Other Processes (Follow instructions from Item 7 for D99, S99, T04, and X99 process codes)

Line Number (Enter #s in sequence with Item 7)		A. Process Code (From list above)			B. PROCESS DESIGN CAPACITY (1) Amount (Specify)	(2) Unit of Measure	C. Process Total Number of Units	For Official Use Only
X	2	T	0	4	100.00	U	001	

9. Description of Hazardous Wastes - Enter Information in the Sections on Form Page 5

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 Item 9.A, estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in Item 9.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 Item 9.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 Item 9.A, select the code(s) from the list of process codes contained in Items 7.A and 8.A on page 3 to indicate all the processes that will be used to store, treat, and/or dispose of all listed hazardous wastes.

For non-listed waste: For each characteristic or toxic contaminant entered in Item 9.A, select the code(s) from the list of process codes contained in Items 7.A and 8.A 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 9.D(1).**
3. **Use additional sheet, enter line number from previous sheet, and enter additional code(s) in Item 9.E.**

2. PROCESS DESCRIPTION: If code is not listed for a process that will be used, describe the process in Item 9.D(2) or in Item 9.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 Item 9.A. On the same line complete Items 9.B, 9.C, and 9.D by estimating the total annual quantity of the waste and describing all the processes to be used to store, treat, and/or dispose of the waste.**
2. **In Item 9.A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In Item 9.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 9 (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 Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
								(1) PROCESS CODES (Enter Code)									(2) PROCESS DESCRIPTION (If code is not entered in 9.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

EPA ID Number | N | M | D | 0 | 0 | 0 | 3 | 3 | 3 | 2 | 1 | 1 |

OMB#: 2050-0034; Expires 7/31/2012

Description of Hazardous Wastes ***(Continued. Use additional sheet(s) as necessary; number pages as 5a, etc.)***

Line Number		A. EPA Hazardous Waste No. (Enter code)				B. Estimated Annual Qty of Waste	C. Unit of Measure (Enter code)	D. PROCESSES									
								(1) PROCESS CODES (Enter Code)									(2) PROCESS DESCRIPTION (If code is not entered in 9.D(1))
	1	D	0	0	1	45.0	T	D	8	1							
	2	K	0	4	9	228.0	T	D	8	1							
	3	K	0	5	0	6.0	T	D	8	.1							
	4	K	0	5	1	2325.0	T	D	8	1							
	5																
	6																
	7																
	8																
	9																
1	0																
1	1																
1	2																
1	3																
1	4																
1	5																
1	6																
1	7																
1	8																
1	9																
2	0																
2	1																
2	2																
2	3																
2	4																
2	5																
2	6																
2	7																
2	8																
2	9																
3	0																
3	1																
3	2																
3	3																
3	4																
3	5																
3	6																

10. Map

Attach to this application a topographical 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 intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all spring, rivers, and other surface water bodies in this map area. See instructions for precise requirements.

11. Facility Drawing

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

12. Photographs

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).

13. Comments

Part A Permit Application applies only to the Post-Closure of the land treatment unit at the Western Refining - Gallup Refinery.

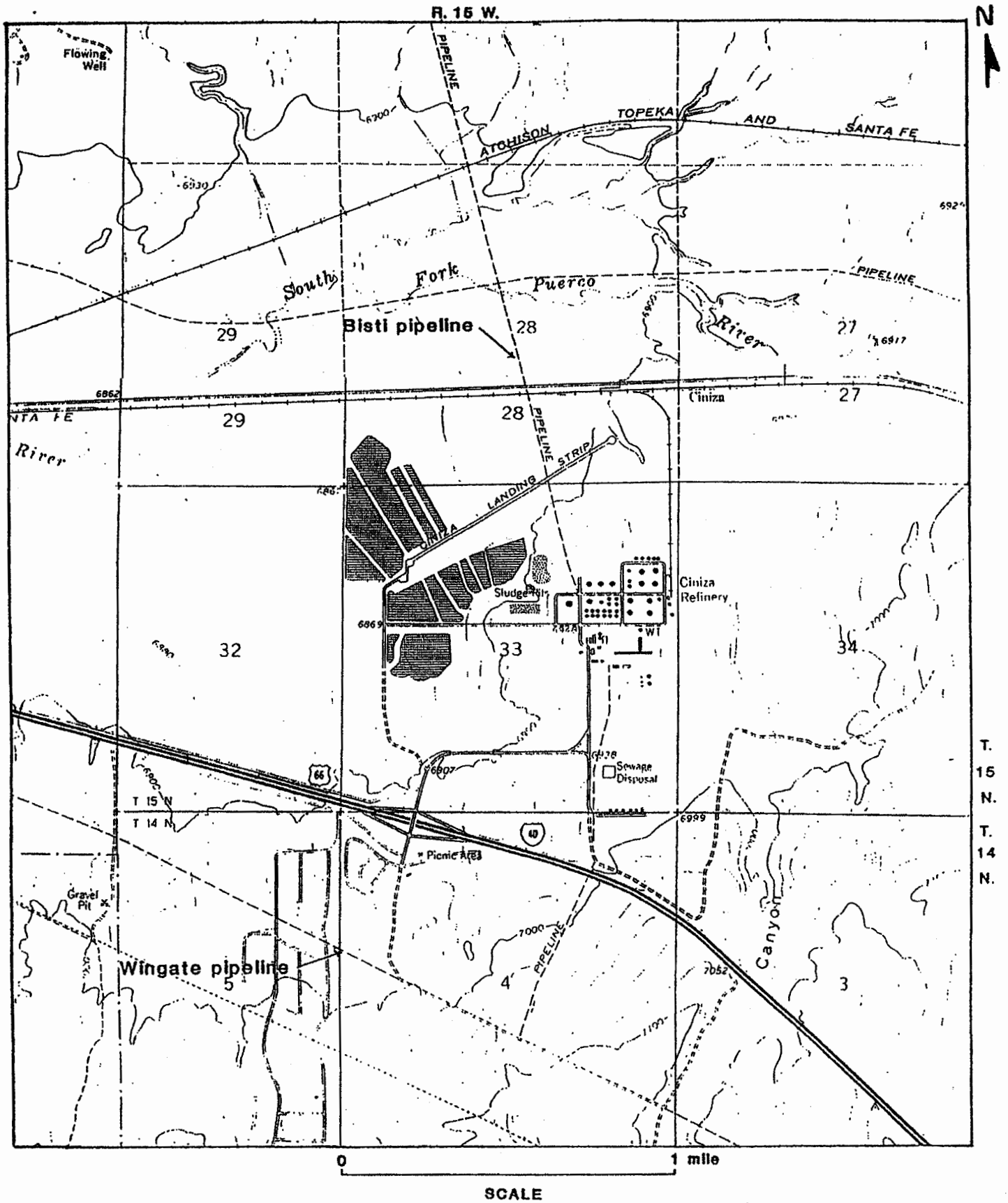
The volumes of waste entered in Section 9 are the total volumes applied to the land treatment unit from 1987 to 1990. No hazardous waste has been applied to the land treatment from 1990 to present, 2/2010.

A.O INTRODUCTION

This post closure permit application is submitted to the New Mexico Environment Department (NMED) and the U.S. Environmental Protection Agency (EPA) to meet the requirements of the RCRA; the New Mexico Hazardous Waste Act; and Title 20 New Mexico Administrative Code, Chapter 4, Part 1 (20 NMAC 4.1) subpart IX, §270. This post closure Part B permit application addresses the Land Treatment Unit (LTU) at Western Refining Company, Gallup Refinery (*Ciniza Permit No. NMD 000333211-2*). The information contained in this post closure application is designed to meet permit application requirements of 20 NMAC 4.1, subpart IX, 270 and the closure/post closure requirements of 20 NMAC 4.1, subpart V, §264.110 to §264.120. Closure and post closure obligations of 20 NMAC, Subpart V, §264.280 reflect the post-closure permit application focus.

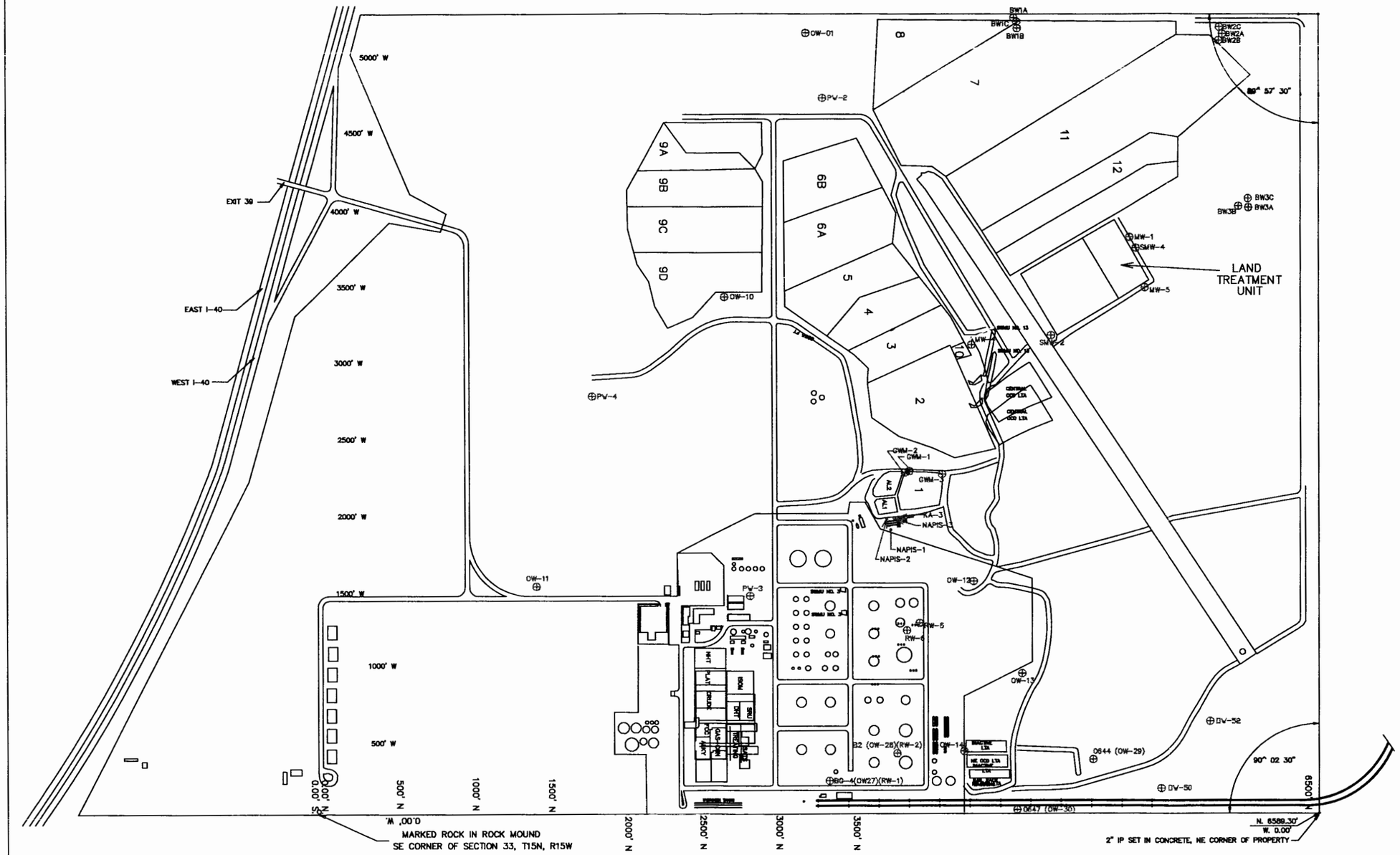
In addition to fulfilling RCRA Part B permit application requirements for the LTU, the Gallup Refinery is also including the RCRA Part A permit application which includes all hazardous waste codes and volumes applied to the LTU from 1988 to 1990. 20 NMAC 4.1, Subpart IX permitting regulations do not distinguish between information requirements for operating permits and post-closure permits. Therefore, this Part B permit application includes facility level information (20 NMAC 4.1 subpart IX, §270.14(b)) and unit specific information (20 NMAC 4.1 and subpart V, §264.980). All regulatory citations in this application reference 20 NMAC 4.1, which incorporates Title 40 of the Code of Federal Regulations (CFR), Parts 260 through 270.

Section A.0



Part A.
Attachment A. Topographic Map

TO VIEW THE MAP AND/OR MAPS WITH THIS DOCUMENT, PLEASE CALL THE HAZARDOUS WASTE BUREAU AT 505-476-6000 TO MAKE AN APPOINTMENT



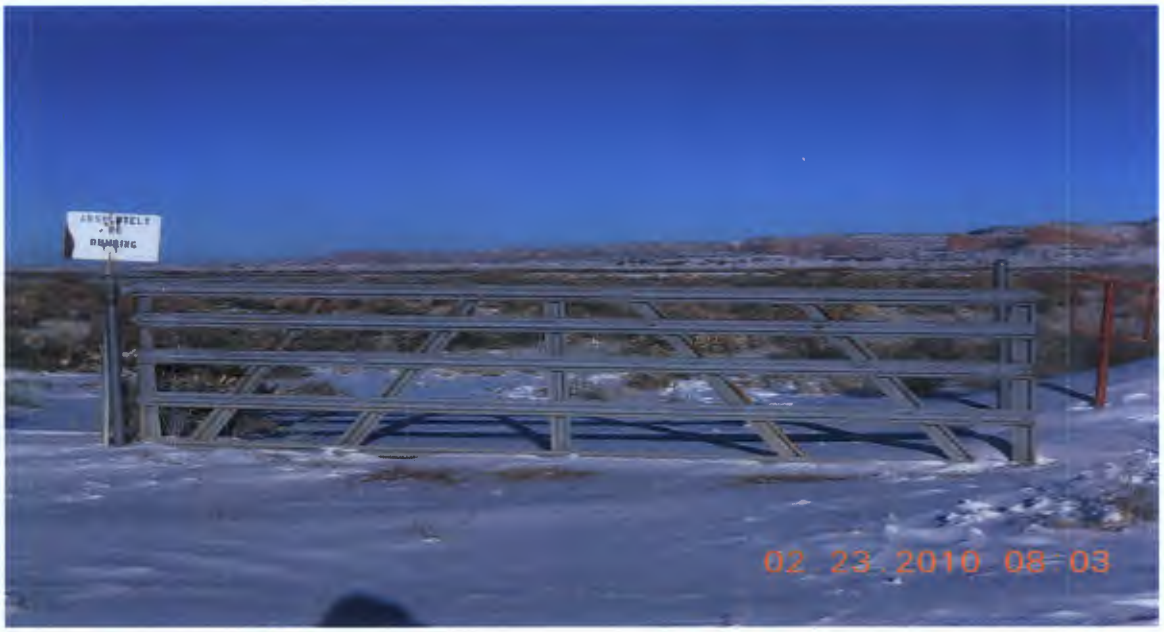
File 06-054

Attachment C
Wells/Evaporation Ponds

Western Refining
Gallup Refinery
Interstate 40, Exit 39
Jamestown, New Mexico 87347

Dwg:08-22-07 Rev. 02-03-10

PART A
Attachment C
Surface Wells, Waters



Entry Gate to the northeast LTU.

Vegetation growth inside northeast cell of the LTU.

Warning Signs alongside north berm of the LTU.

Warning sign on south side of LTU.

Part B

Section B.0

B.0 GENERAL DESCRIPTION

The information provided in this section is submitted in accordance with the applicable requirements of 20 NMAC 4.1, subpart IX §270.14(b) (1), §270.14(b) (11), and §270.14(b) (19). This section includes a general description of the Western Refining Southwest, Inc.'s Refinery near Gallup, New Mexico (Gallup Refinery), a description of the LTU, and facility location information for compliance with the topographic map, land use, seismic standard, floodplain and traffic pattern requirements.

B.1 General Description [20 NMAC 4.1, Subpart IX §270.14(b) (1)]

The Gallup Refinery is a small crude oil refining facility located in McKinley County, New Mexico at Township 15 North, Range 15 West, Sections 28 and 33, the northern one-third of Section 4 of the New Mexico coordinate system. The Gallup Refinery's mailing address is: Western Refining Southwest, Gallup Refinery, Route 3 Box 7, NM 87301 and the physical address is Western Refining Southwest, Gallup Refinery, Interstate 40 (I-40), Exit 39, Jamestown, New Mexico 87347. The Gallup Refinery is located just north of I-40 at Exit 39 (approximately 17 miles east of Gallup, New Mexico) as shown on Figure B-1.

The refinery was constructed in 1957 by El Paso Natural Gas Company near a former depot location along the adjacent railroad known locally as Ciniza. The refinery was purchased and operated by Shell Oil Company until 1982. The refinery was purchased in 1982 and operated by Giant Industries Arizona, Incorporated until May 2007. In May 2007, Western Refining, Inc. acquired all of Giant's stock from Giant (but not the assets) and currently operates the refinery as Western Refining Southwest, Inc. Western Refining Southwest, Inc. refers to the refinery as the *Gallup Refinery*.

The Gallup Refinery is a small crude oil refining facility. The refinery receives and processes crude oil and other feedstocks, and produces various finished products. These include propane, butane, naphtha, unleaded gasoline, diesel (low sulfur and ultra-low sulfur), and residual fuel.

B.2 Description of the Land Treatment Unit (20 NMAC 4.1, subpart IX §270.14(b)(1)]

The LTU is located within the Gallup Refinery property boundary. The primary purpose of the LTU is the degradation, transformation, or immobilization of hazardous wastes using microbial activity and soil characteristics. The LTU is approximately 1500 feet northwest of the refinery process area and is above the 100 year flood plain, as shown on Figures B-2 and B-3. The LTU consists of three 480 feet x 240 feet sections located immediately east of evaporation pond 12B. Each section is diked and contains 2.6 acres (1.0 hectare) of available treatment surface. The top 12 inches of soil, the Zone of Incorporation (ZOI) was periodically plowed and disked to encourage aerobic microbial activity and improved chemical reaction rates. During post closure maintenance activities, soil nutrients will be applied as necessary. Ciniza Hazardous Waste Facility Permit specified the design, capacity of, and conditional limits for the LTU during the operational phase of the LTU. During the post closure period, no hazardous waste, non-hazardous waste, refinery waste, or other material will be applied to the LTU.

B.3 Topographic Maps [20 NMAC 4.1, subpart IX, §270.14(b) (19)]

The maps identified in this section demonstrate compliance with 20 NMAC 4.1, subpart IX, §270.14(b) (19). All maps clearly show a map scale, date, and north arrow.

B.3.1 Legal Boundaries and Access Control [20 NMAC 4.1, subpart IX, §270.14(b), § (19) (vii), (viii)]

The topographic map of the Gallup Refinery (Figure B-4) shows the legal boundaries of Gallup Refinery, access control features (e.g. fences, gates) and location of the LTU. As shown on the topographic map, the nearest property line is approximately 1,000 feet from the LTU perimeter.

B.3.2 Surface Waters and Wells [20 NMAC 4.1, subpart IX, §270.14(b) (19) (iii), (ix)]

Surface waters and wells are shown on Figure B-3. Floodplain information is provided in Section B-5. In the event of a 100 year flood, water is diverted away from the LTU via surrounding berms, grading, and natural topography.

B.3.3 Surrounding land Uses [20 NMAC 4.1, subpart IX, §270.14(b) (19) (iv)]

The Gallup Refinery is located within a rural and sparsely populated section of McKinley County. The setting is a high desert plain on the western slope of the continental divide. The nearest population centers are the Pilot (formerly Giant) Travel Center refueling plaza, the Interstate 40 highway corridor, and a small cluster of residential homes located on the south side of Interstate 40 approximately 2 miles southwest of the Gallup Refinery. The surrounding land (as shown in Figure B-1) is comprised primarily of public lands and is used for cattle and sheep grazing at a density of less than six cattle or 30 sheep per section. McKinley County is predominantly rural, as are the adjoining portions of neighboring counties.

The Gallup Refinery maintains residences for several employees approximately 0.5 mile south of the refinery process area. A truck stop is located within one mile south-southwest of the process area at I-40 exit. A rural residential area, Whispering Cedars, with a density of eight to 10 residents per square mile is about 1.5 miles southwest of the refinery. A railroad is within two miles to the north; the small community of Iyanbito, is within three miles to the northwest; the Fort Wingate Military Reservation is within six miles to the west and the Cibola National Forest is within two miles to the southwest. The largest residential community near the refinery is the city of Gallup, New Mexico, which is 17 miles west of the refinery.

B.3.4 Wind Rose [20 NMAC 4.1, subpart IX §270.14(b) (19) (v)]

Wind rose data for the Gallup Refinery, New Mexico (17 miles west of the Gallup Refinery) is shown on Figure B-5. Surface winds at the Gallup Refinery vary throughout

the year. Wind speeds are strongest from March through May and are weakest in November. The strongest winds are generally west-southwest. Winds from March to October decrease linearly in average speed from 50 to 10 mph.

B.3.5 Structures [20 NMAC 4.1, subpart IX, §270.14(b), §(19) (x), (xi)

Runoff control systems, barriers for drainage or flood control, access and internal roads, storm systems, and fire control facilities are shown on Figures B-1, B-2 and B-3.

B.4 Seismic Standard [20 NMAC 4.1, subpart IX §270.14(b) (11) (i) (ii)]

McKinley County, New Mexico, is not listed in Appendix VI of Part 264. Compliance with the seismic standard need not be demonstrated.

B.5 Floodplain Standard [20 NMAC 4.1, subpart IX §270.14(b) (11) (iii) and §270.14(b) (19) (ii)]

In accordance with 20 NMAC 4.1, subpart IX, §270.14(b) (11) (iii), the 100 year floodplain is shown on Figure B-3. The LTU lies outside the 100 year floodplain boundary.

Figure B-3 shows the drainage areas and 100 year floodplain relative to Gallup Refinery and the LTU. The drainage area, which flows northwest of the LTU, includes 6965 acres south of I-40 draining through Four Mile Canyon. Existing drainage control structures at I-40 are three 10 feet x 12 feet concrete box culverts and one 6 feet x 7 feet concrete box culvert. The 100 year peak flow at these points (Tables B-1, B-2, B-3) totals 3,175 cfs, as shown on Figure B-3. After passing east of the Gallup Refinery, the drainage turns west (bounded on the north by the railroad bed) and flows past the refinery at 3,607 cfs. Existing drainage channels can contain the 100 year event within the areas delineated on Figure B-3. The 100 year floodplain is approximately 300 feet south of the railroad track and is adjacent to the northeast end of the Gallup Refinery landing strip. Tables B-1, B-2, and B-3 provide additional detailed floodplain information.

Approximately 2,572 acres drain 1,800 feet to the southwest of the Gallup Refinery. These flows originate south of I-40 and peak at 700 cfs for the 100 year event. Existing drainage control structures for Gallup Refinery roads and the evaporation ponds divert the 100 year flows away from the refinery, as shown on Figure B-3. Table B-4 provides additional floodplain information for this drainage area.

B.6 Traffic [20 NMAC 4.1, subpart IX §270.14(b) (10)]

Roads are asphalt paved, with the exception of the section starting from the sewage lagoon west to the LTU. During post closure, an estimated 52 trips per year by vehicle are expected for the LTU maintenance and monitoring. The LTU is an isolated area and restricted to personnel involved with the maintenance and monitoring activities. A Safe Work Permit is also required before entry into the LTU. Vehicle access to the LTU requires entry through the refinery process area. The location of the roads leading from the process area to the LTU traffic is shown on Figure B-6. Figure B-6 also shows the landing strip for the pipeline area, which serves as an emergency landing strip.

Table B-1. Peak Discharge and Runoff Calculation Sheet No. 1

Reference	Chapter 2 – Engineering Field Manual for Conservation Practices; USDA, Soil Conservation Service	
Location	Area NW, Four Mile Canyon, Gallup Refinery, New Mexico.	
Soil and Cover:	Subarea I, B/C soil, 75 percent cover, good condition, ponderosa pine	
Date:	December 15, 1983	
Purpose:	100 year floodplain at Gallup Refinery	
Drainage Area:	A	5071 ac
Length	L	20,000 feet
Elevation Differences	H	900 feet
Runoff Curve Number	CN	58
Time of Concentration	Tc	8.82 hours
Rainfall, 24-hour at 100 year	P_{24}	2.8 inches
Direct Runoff	Q	0.3 inches
Distribution Curve No.	DC	70
Runoff Rate	R	0.84 cfs/ac-in.
Peak Discharge	q = A x Q x R	1280 cfs
Runoff Volume	v = A x Q/12	127 ac-ft

Delta H Engineering, LTD., 1983

Table B-2. Peak Discharge and Runoff Calculation Sheet No. 2

Reference	Chapter 2 – Engineering Field Manual for Conservation Practices; USDA, Soil Conservation Service	
Location	Area NW, Four Mile Canyon, Gallup Refinery, New Mexico.	
Soil and Cover:	Subarea II, B/C soil, 50 percent cover, mountain brush and juniper grass	
Date:	December 15, 1983	
Purpose:	100 year floodplain at Gallup Refinery	
Drainage Area:	A	1894 ac
Length	L	17,000 feet
Elevation Differences	H	200 feet
Runoff Curve Number	CN	65
Time of Concentration	T_c	1.3 hours
Rainfall, 24-hour at 100 year	P_{24}	2.8 inches
Direct Runoff	Q	0.4 inches
Distribution Curve No.	DC	70
Runoff Rate	R	0.55 cfs/ac-in.
Peak Discharge	q = A x Q x R	1895 cfs
Runoff Volume	v = A x Q/12	3175 ac-ft*

Delta H Engineering, LTD., 1983

*Calculations indicate approximate number as 63 ac-ft., Benchmark 1998.

Table B-2. Peak Discharge and Runoff Calculation Sheet No. 3

Reference	Chapter 2 – Engineering Field Manual for Conservation Practices; USDA, Soil Conservation Service	
Location	Area NW, Four Mile Canyon, Gallup Refinery, New Mexico.	
Soil and Cover:	Subarea III, B/C soil, 50 percent cover, herbaceous and mountain brush	
Date:	December 15, 1983	
Purpose:	100 year floodplain at Gallup Refinery	
Drainage Area:	A	1028 ac
Length	L	14,000 feet
Elevation Differences	H	2500 feet
Runoff Curve Number	CN	70
Time of Concentration	T_c	0.95 hours
Rainfall, 24-hour at 100 year	P_{24}	2.8 inches
Direct Runoff	Q	0.60 inches
Distribution Curve No.	DC	70
Runoff Rate	R	0.70 cfs/ac-in.
Peak Discharge	q = A x Q x R	432 cfs
Runoff Volume	v = A x Q/12	51.4 ac-ft

Delta H Engineering, LTD., 1983

Table B-2. Peak Discharge and Runoff Calculation Sheet No. 4

Reference	Chapter 2 – Engineering Field Manual for Conservation Practices; USDA, Soil Conservation Service	
Location	Area SW, immediately west of Four Mile Canyon, Gallup Refinery, New Mexico.	
Soil and Cover:	B/C soil, 60 percent Ponderosa Pine, 40-Percent mountain brush.	
Date:	December 15, 1983	
Purpose:	100 year floodplain at Gallup Refinery	
Drainage Area:	A	2572 ac
Length	L	22,000 feet
Elevation Differences	H	690 feet
Runoff Curve Number	CN	64
Time of Concentration	T_c	1.0 hours
Rainfall, 24-hour at 100 year	P_{24}	2.8 inches
Direct Runoff	Q	0.4 inches
Distribution Curve No.	DC	70
Runoff Rate	R	0.68 cfs/ac-in.
Peak Discharge	q = A x Q x R	700 cfs
Runoff Volume	v = A x Q/12	86 ac-ft

Delta H Engineering, LTD., 1983

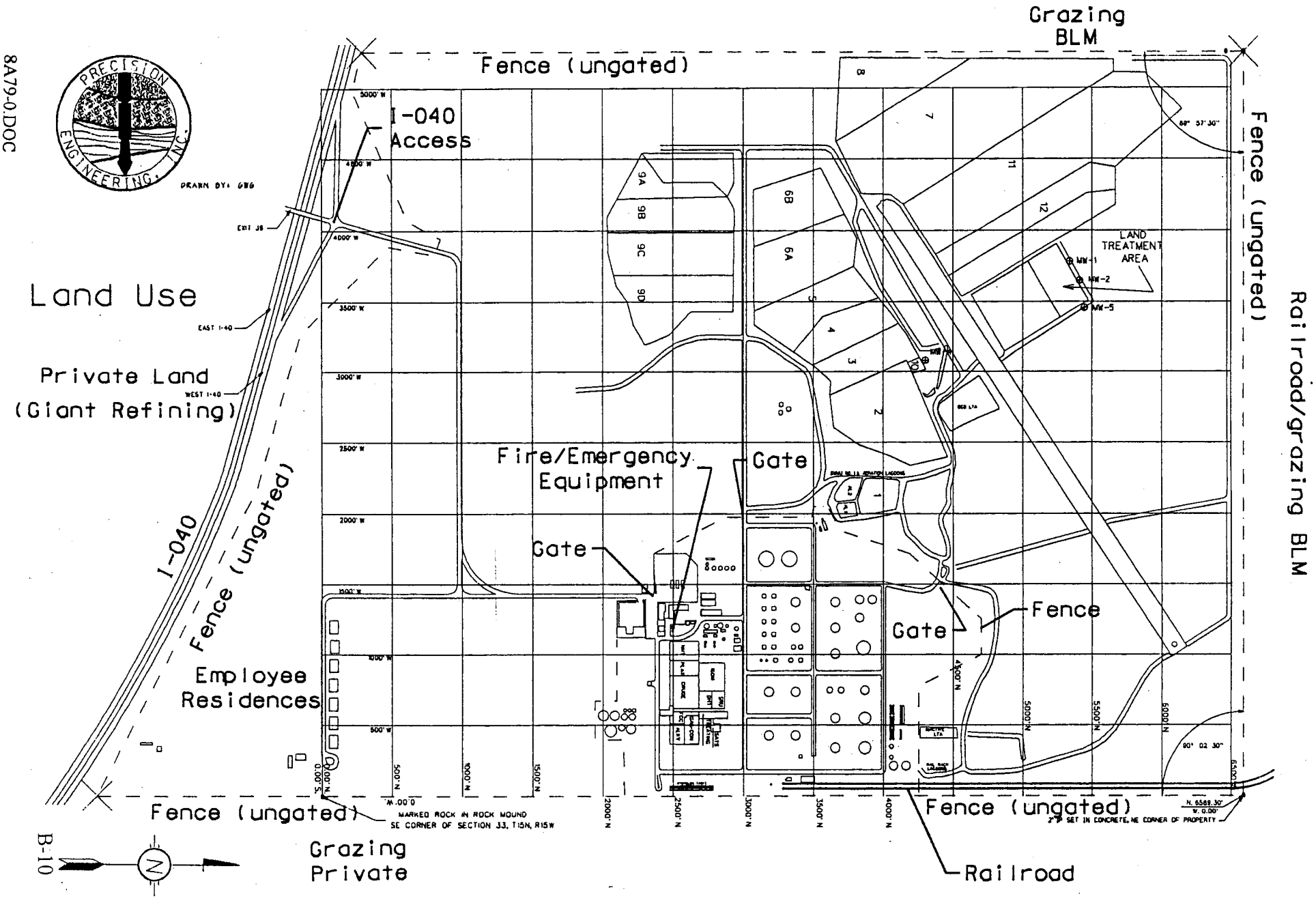


Figure B-1. Refinery Site and Surrounding Land Uses

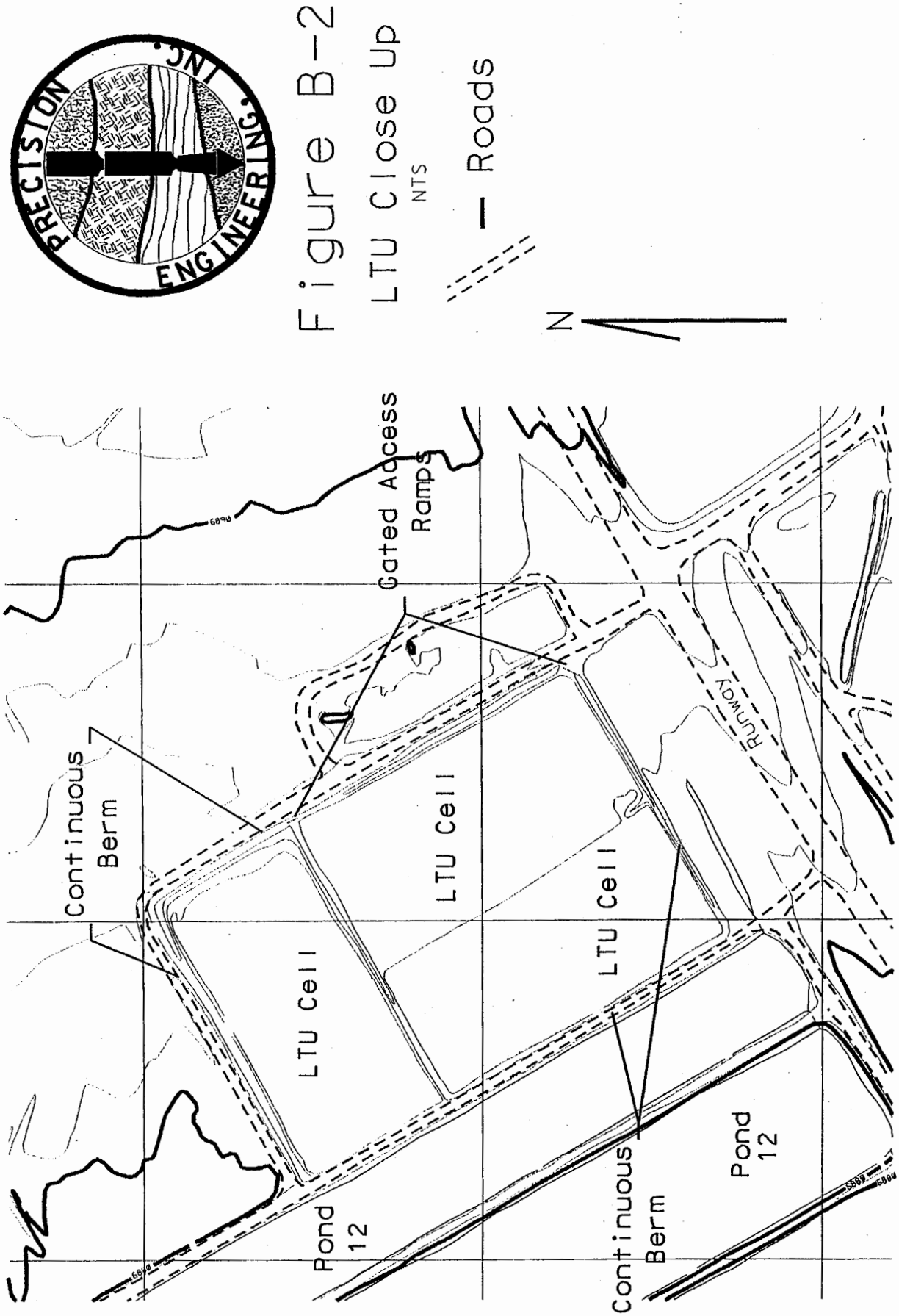


Figure B-2. Gallup Refinery Land Treatment Unit

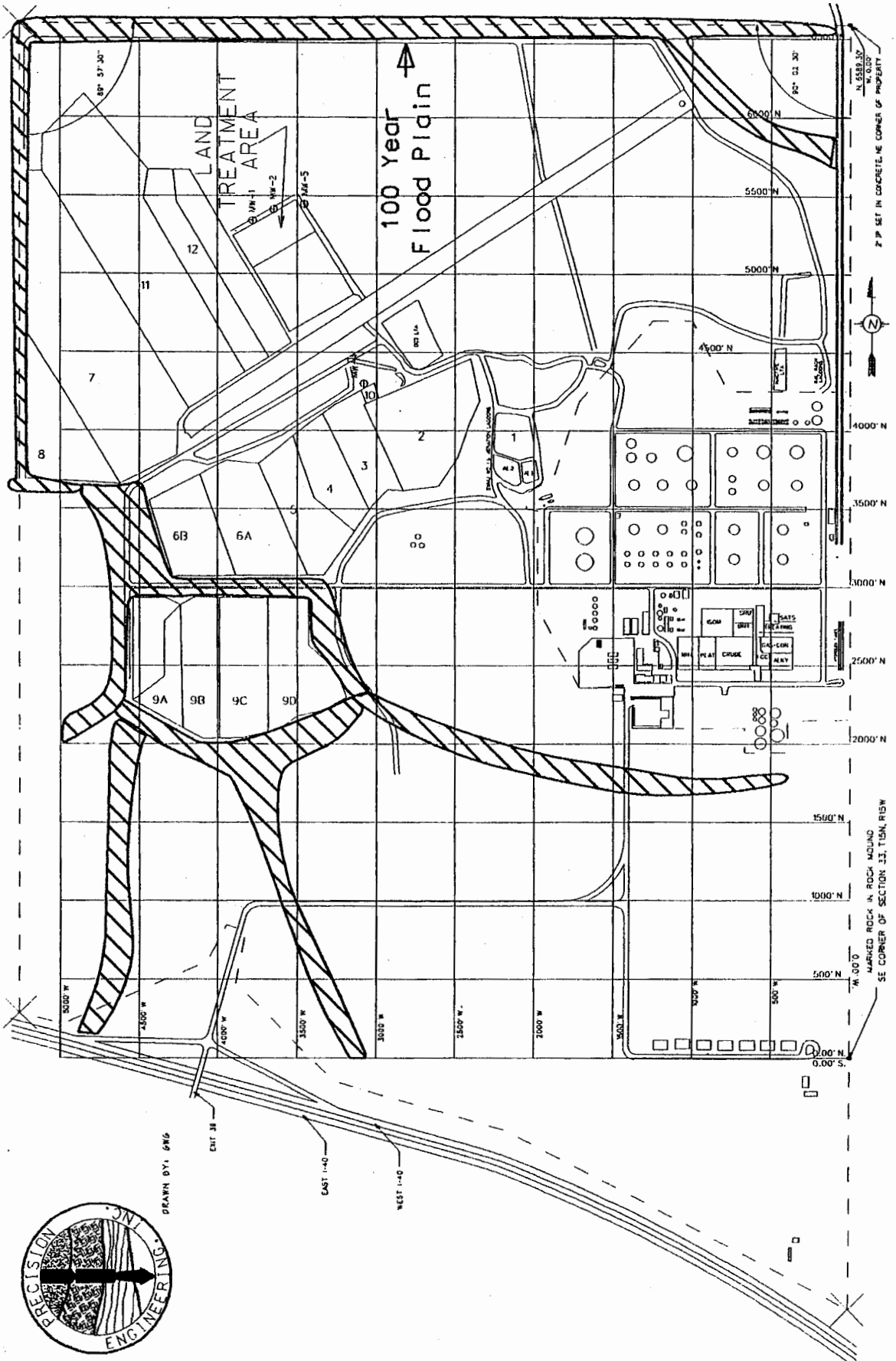
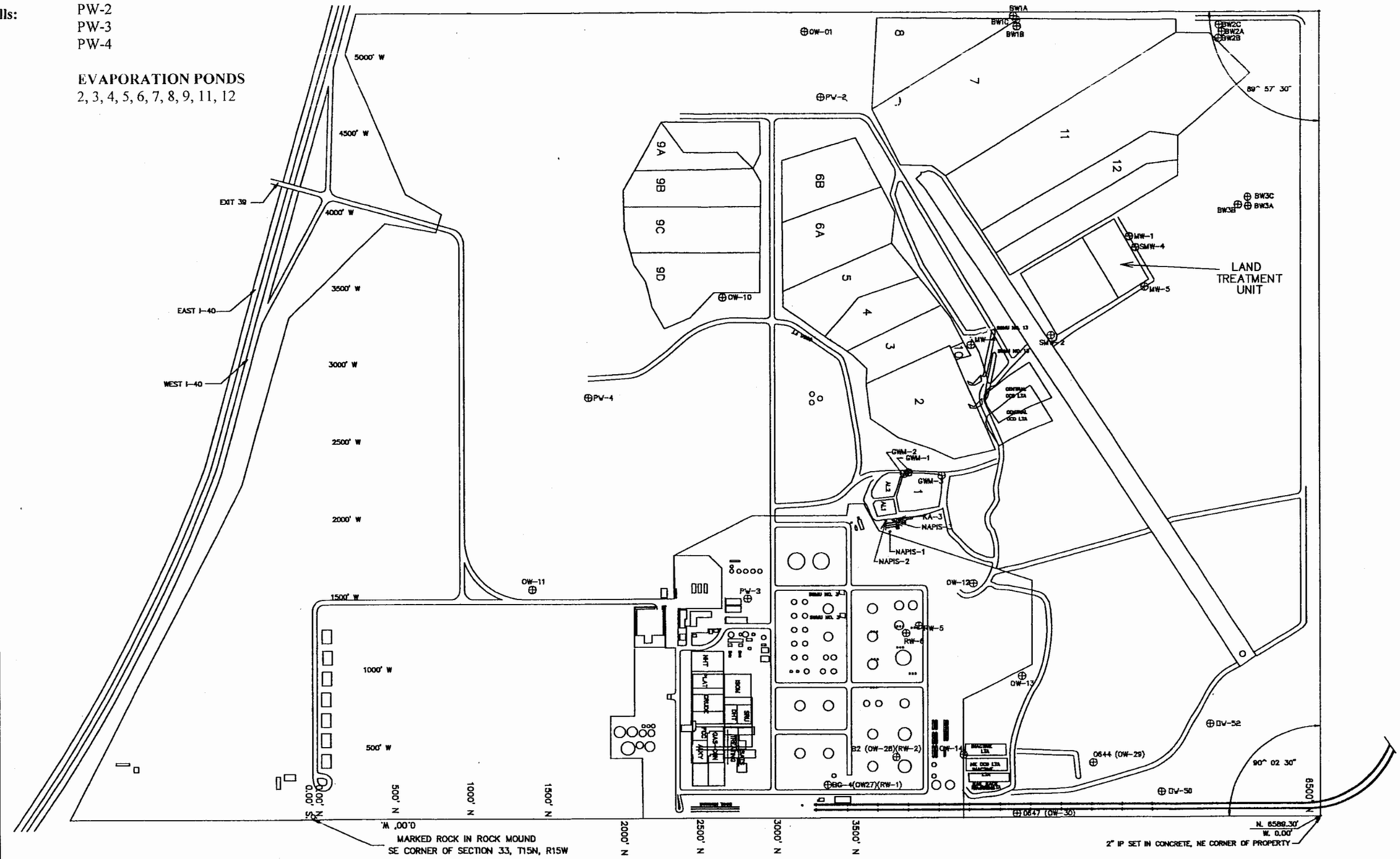


Figure B-3. 100 year Flood Plain

Monitoring Wells:
BW-1A
BW-1B
BW-1C
BW-2A
BW-2B
BW-2C
BW-3A
BW-3B
BW-3C
GWM-1
GWM-2
GWM-3
NAPIS-1
NAPIS-2
NAPIS-3
KA-3
MW-1
MW-2
MW-4
MW-5
OW-01
OW-10
OW-11
OW-12
OW-13
OW-14
OW-29
OW-30
OW-50
OW-52
RW-1
RW-2
RW-5
RW-6
SMW-2
SMW-4

POTABLE WELLS
PW-2
PW-3
PW-4

EVAPORATION PONDS
2, 3, 4, 5, 6, 7, 8, 9, 11, 12

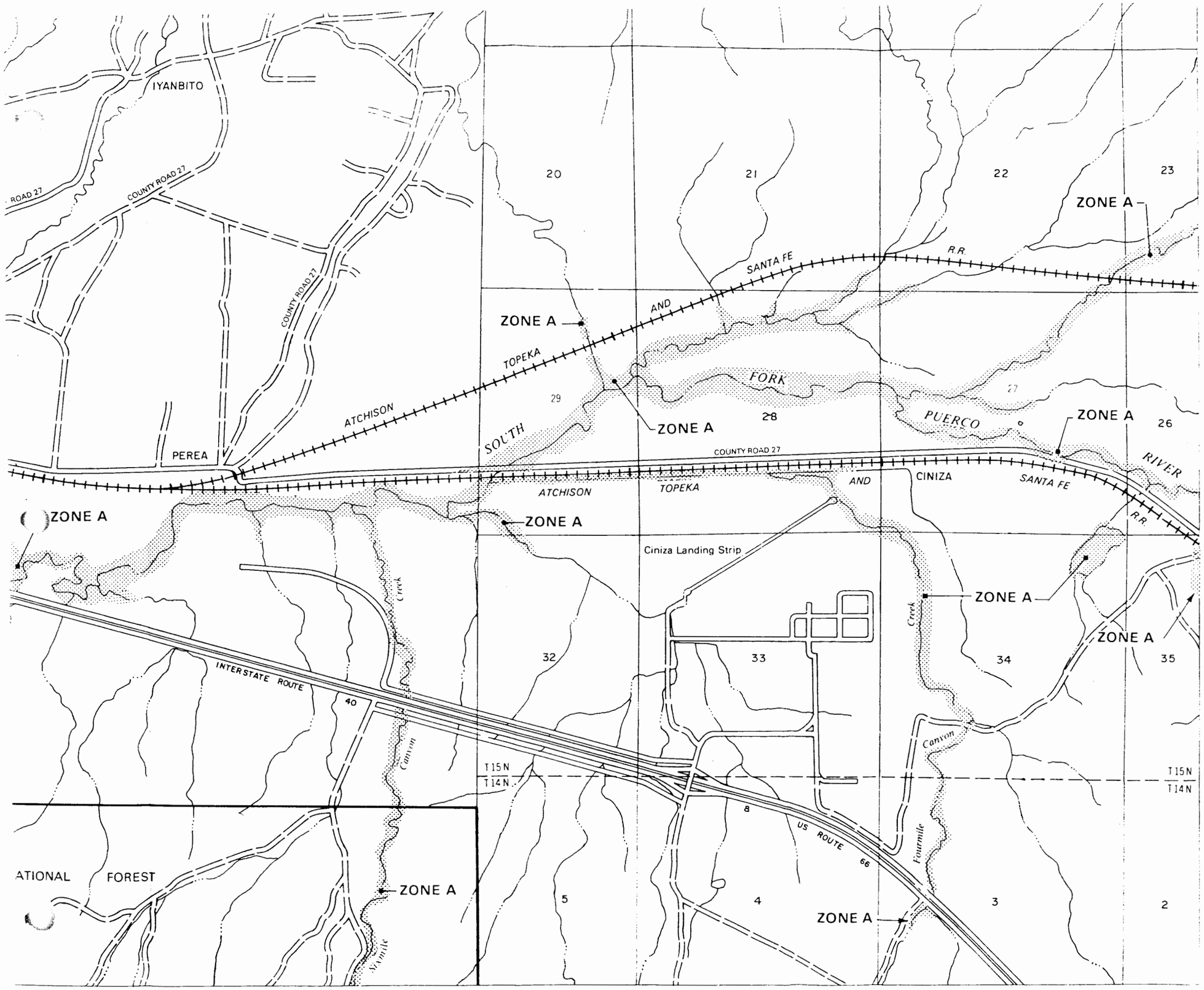


File 06-054

FIGURE 3A

Wells/Evaporation Ponds

Western Refining
Gallup Refinery
Interstate 40, Exit 39
Jamestown, New Mexico 87347
Dwg:08-22-07 Rev. 02-03-10



LEGEND

SPECIAL FLOOD HAZARD AREA — ZONE A

Note: These maps may not include all Special Flood Hazard Areas in the community. After a more detailed study, the Special Flood Hazard Areas shown on these maps may be modified, and other areas added

TO DETERMINE IF FLOOD INSURANCE IS AVAILABLE IN THIS COMMUNITY, CONTACT YOUR INSURANCE AGENT, OR CALL THE NATIONAL FLOOD INSURANCE PROGRAM, AT (800) 638-6620, OR (800) 424-8872.

APPROXIMATE SCALE IN FEET

2000 0 2000

FLOOD HAZARD BOUNDARY MAP

McKINLEY COUNTY, NEW MEXICO

UNINCORPORATED AREA

PAGE 21 OF 46

(SEE MAP INDEX FOR PAGES NOT PRINTED)

EFFECTIVE DATE:
JULY 4, 1978

COMMUNITY - PANEL NO.
350039 0021 A

Figure 3B

Flood Hazard Boundary Map

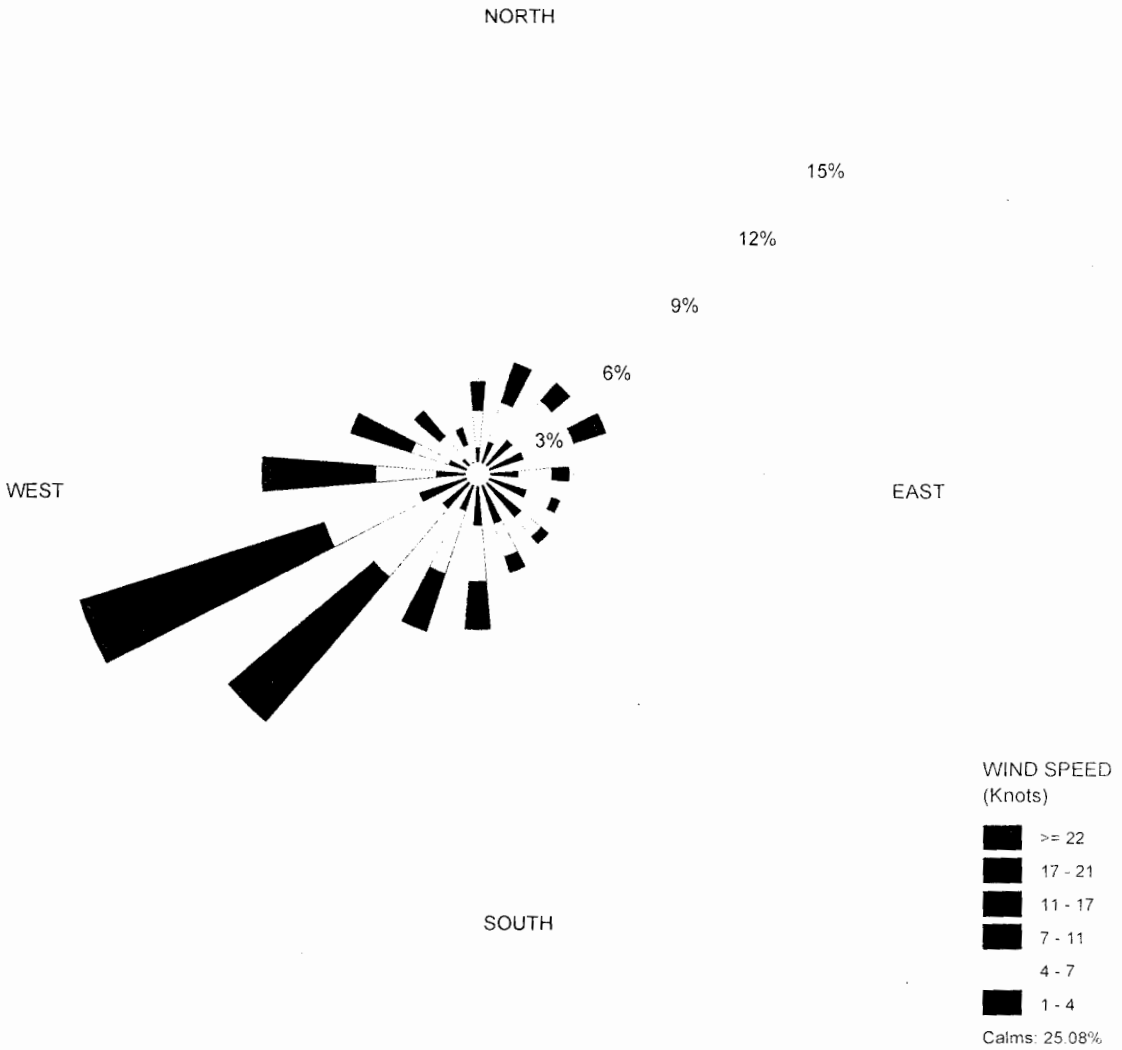
U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
FEDERAL INSURANCE ADMINISTRATION

WIND ROSE PLOT:

Station #23081 - GALLUP/FAA AIRPORT, NM

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:

Gallup surface data.
SCRAM_GALLUP_91

DATA PERIOD:

1991
Jan 1 - Dec 31
00:00 - 23:00

COMPANY NAME:

MODELER:

CALM WINDS:

25.08%

TOTAL COUNT:

8760 hrs.

AVG. WIND SPEED:

5.51 Knots

DATE:

7/11/2007

PROJECT NO:

SCRAM_GALLUP_91

WRPLOT View - Lakes Environmental Software

Figure B-5. Wind Rose

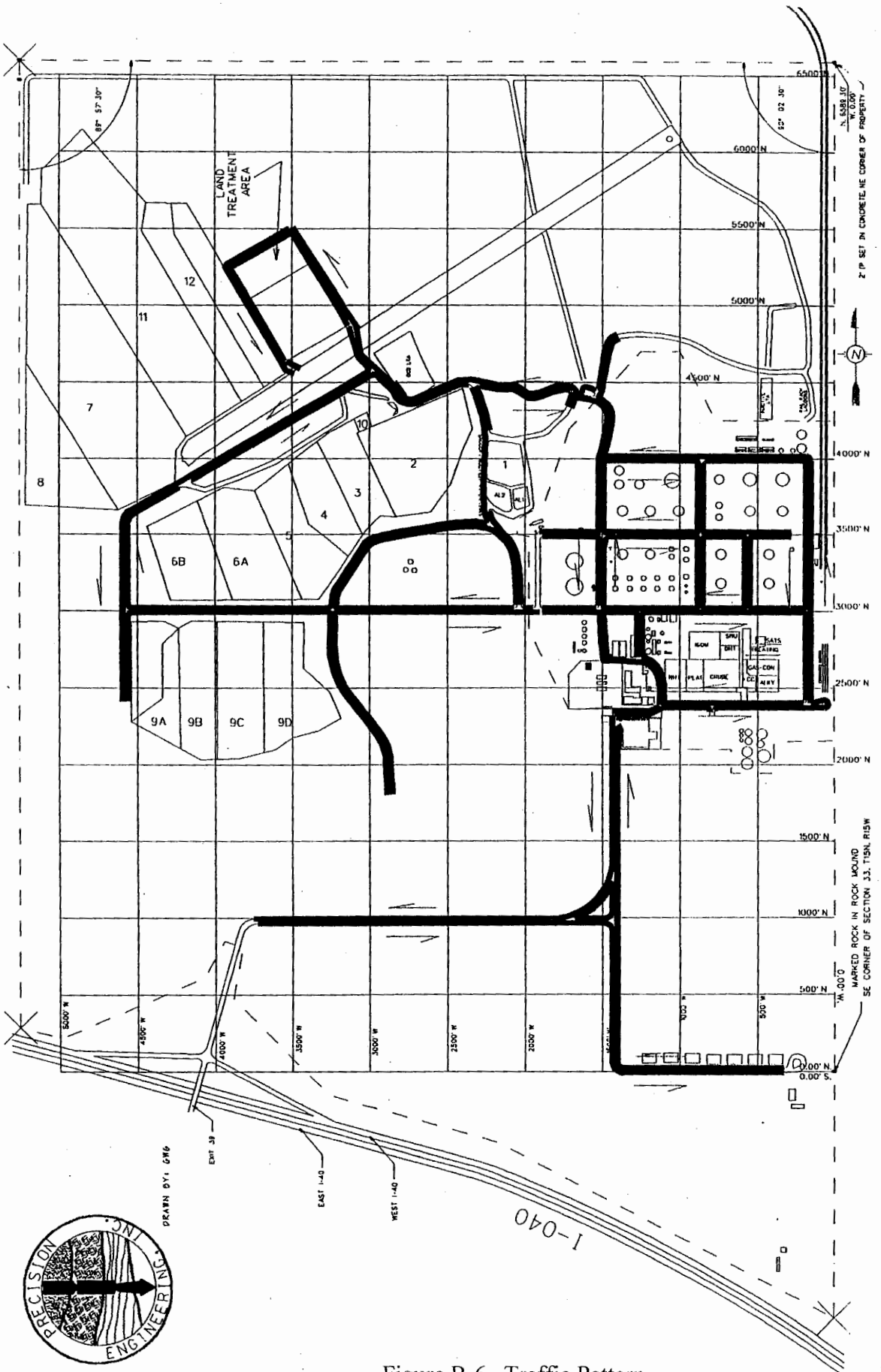


Figure B-6. Traffic Pattern

Section C.0

C.0. CHEMICAL AND PHYSICAL PROPERTIES

The information provided in this section is submitted in accordance with the applicable requirements of 20 NMAC 4.1, subpart V, §264.13, and subpart IX, §270.14(b) (2).

C.1 CHEMICAL AND PHYSICAL PROPERTIES [20 NMAC 4.1, subpart V, §264.13(a), subpart IX, §270.14(b) (2)]

The Gallup Refinery applied refinery sludge carrying the EPA hazardous waste numbers D001, D007, K049, K050, K051, and K052 to the LTU in accordance with the Ciniza Hazardous Waste Facility Permit until November 8, 1990. During this time of hazardous waste applications, Gallup Refinery treated approximately 2,600 tons of hazardous waste at the LTU. The refinery sludge treated at the LTU was viscous oil-water-solid mixtures. Appendix A describes the chemical and physical properties of the hazardous waste steams treated at the LTU. Gallup Refinery maintains laboratory reports detailing the chemical and physical analysis of representative samples of the waste.

Section D.0

D.0 LAND TREATMENT UNIT PROGRAM HISTORY

Western Refining Southwest, Inc. (a unit of Western Refining, Inc.) operates the Gallup Refinery (formerly known as *Ciniza*) in McKinley County, New Mexico. Ciniza was constructed in 1957 by the El Paso Natural Gas Company. El Paso owned and operated Ciniza from 1957 to 1964 and sold the facility to Shell Oil. Shell owned and operated the facility from 1964 to 1982. Giant Industries, Incorporated bought the facility in 1982 and operated until May 2007. All of Giant's stock (but none of the assets) was acquired by Western Refining, Inc. in May 2007. Shortly thereafter, Western Refining began referring to the refinery as the *Gallup Refinery*. Gallup Refinery is a crude oil refining facility. The refinery receives and processes crude oil and other feedstocks, and then produces various finished products. These include propane, butane, naphtha, unleaded gasoline, diesel (low sulfur and ultra-low sulfur), kerosene, and residual fuel. Crude oil, natural gasoline, intermediate feedstocks, finished products, chemicals and water are stored on-site in tanks and distributed throughout the refinery via an extensive piping system. Various wastes are generated from the Gallup Refinery operations. The Gallup Refinery established the LTU for the degradation, transformation, or immobilization of hazardous wastes generated at the facility. Over time, microbial activity occurring in the soil (enhanced with application of fertilizer) degrades the hazardous constituents in the waste. The LTU is approximately 1,500 feet northwest of the refinery process area and consists of three 480 feet x 240 feet sections, as shown on Figure B-1. The LTU received hazardous wastes from October 10, 1980 to November 8, 1990. The LTU received non-hazardous waste between 1990 and 1993. No waste has been added to the LTU since 1993.

The Gallup Refinery established the LTU for the degradation, transformation, or immobilization of hazardous wastes generated at the Gallup Refinery. The history of the LTU is summarized in Table D-1. Table D-2 lists the ZOI sample event results from 1993 to 1999. Background sample results are detailed on Table D-3. Figures D-1 and D-2 identify sample locations in the vicinity of the LTU and the sampling grid-random number system.

The 9 year soil sampling event was conducted in December 2009. ZOI (Zone of Incorporation and TZ (Treatment Zone) sample results are detailed on Table D-4. Random sampling grid numbers were generated utilizing a random integer provided by Random.Org (Figure D-4). A map of the sample locations is also provided in Figure D-3. In early July 2009 sampling of the Chinle Slope Wash and the Sonsela well sampling was conducted with the annual groundwater sampling event. Wells MW 1, 2, 4, and 5 and SMW 2 and 4 sampling results are detailed on Table D-4a.

Historical LTU information and data extracted from existing permit applications, operating permits, operating records, and other source documents are divided as Appendix C. The inclusion of this appendix does not imply that historical information and data have been verified.

Table D-2a. Ciniza ZOI Analytical Results, 1993 – 1999

Fall of 1999

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-055-101999	7.5	1.40	190	210	710	mg/kg
ZOI-1-193-101999	8.1	0.38	140	300	580	mg/kg
ZOI-2-055-101999	7.7	2.20	260	600	4400	mg/kg
ZOI-3-160-101999	8.1	0.37	210	260	180	mg/kg

Bi-Monthly Fall 1999

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-160-100799					5700	mg/kg
ZOI-1-198-100799					390	mg/kg
ZOI-2-084-100799					2600	mg/kg
ZOI-3-158-100799					360	mg/kg

Spring 1999

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-040-051899	7.6	2.8	0.1	730	6600	mg/kg
ZOI-1-098-051899	7.2	2.6	0.3	500	4900	mg/kg
ZOI-1-143-051899	7.9	5.5	0.2	230	10000	mg/kg
ZOI-2-040-051899	7.1	5.8	0.2	700	18000	mg/kg
ZOI-2-041-051899	8.1	3.2	0.2	540	4500	mg/kg
ZOI-2-107-051899	7.5	3.4	0.2	510	7000	mg/kg
ZOI-038-051899	6.6	1.7	0.1	500	3500	mg/kg
ZOI-097-051899	8.0	0.5	0.5	190	900	mg/kg
ZOI-135-051899	8.8	0.3	0.2	320	ND	mg/kg
ZOI-152-051899	8.4	0.4	0.2	300	ND	mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

[c] Total P = Total Phosphorus

[d] TKN = Total Kjeldahl Nitrogen

[e] O&G = Oil and Grease

Table D-2a. Ciniza Z01 Analytical Results, 1993 – 1999 (Continued)

Fall of 1998

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-127-011499	8.6	0.3	120	190	ND	mg/kg
ZOI-142-011499	8.0	0.4	130	190	ND	mg/kg
ZOI-113-011499	8.7	0.5	140	220	ND	mg/kg
ZOI-3-056-011499	8.8	0.4	150	220	ND	mg/kg

Bi-Monthly Summer 1998

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-176-060598					210	mg/kg
ZOI-2-014-060598					9200	mg/kg
ZOI-2-070-060598					470	mg/kg
ZOI-3-058-060598					400	mg/kg

Spring 1998

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-174-042398	8.5	0.5	230	220	120	mg/kg
ZOI-2-186-042398	8.5	0.3	190	160	ND	mg/kg
ZOI-3-036-042398	7.9	0.7	230	350	220	mg/kg
ZOI-3-119-042398	8.4	0.5	250	280	80	mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

[c] Total P = Total Phosphorus

[d] TKN = Total Kjeldahl Nitrogen

[e] O&G = Oil and Grease

Table D-2a. Ciniza Z01 Analytical Results, 1993 – 1999 (Continued)

Fall of 1997

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-039-111197	7.8	0.5	270	150	120	mg/kg
ZOI-1-163-111197	8.1	0.6	220	280	55	mg/kg
ZOI-2-114-111197	8.2	0.2	190	130	74	mg/kg
ZOI-3-153-111197	8.5	0.4	280	190	74	mg/kg

Bi-Monthly Fall 1997

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-075-091097	8.7	0.7				mg/kg
ZOI-2-198-091097	8.6	0.4				mg/kg
ZOI-3-064-091097	8.6	0.8				mg/kg
ZOI-3-142-091097	8.5	0.7				mg/kg

Bi-Monthly Summer 1997

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-068-052797	7.8	0.5			50	mg/kg
ZOI-2-037-052797	7.8	0.4			110	mg/kg
ZOI-3-079-052797	7.5	1.0			ND	mg/kg
ZOI-3-093-052797	7.6	1.0			80	mg/kg

Spring 1997

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-140-050297	7.7	<1	267	313		mg/kg
ZOI-2-068-050297	7.7	<1	139	470		mg/kg
ZOI-2-073-050297	7.7	<1	81	359		mg/kg
ZOI-3-066-050297	7.7	<1	99	455		mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

[c] Total P = Total Phosphorus

[d] TKN = Total Kjeldahl Nitrogen

[e] O&G = Oil and Grease

Table D-2a. Ciniza Z01 Analytical Results, 1993 – 1999 (Continued)

Fall of 1996

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-089-021897	7.5	0.01	0.1	400	ND	mg/kg
ZOI-2-168-021897	7.7	0.01	0.2	300	ND	mg/kg
ZOI-3-027-021897	7.8	0.01	0.2	400	ND	mg/kg
ZOI-3-186-021897	7.7	0.01	0.3	400	ND	mg/kg

Bi-Monthly Fall 1996

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-082-090396					138	mg/kg
ZOI-2-033-090396					29	mg/kg
ZOI-2-165-090396					ND	mg/kg
ZOI-3-088-090396					ND	mg/kg

Summer 1996

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-073-061196					ND	mg/kg
ZOI-2-075-061196					ND	mg/kg
ZOI-2-120-061196					ND	mg/kg
ZOI-3-148-061196					ND	mg/kg

Spring 1996 – Special Sampling

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-014-040296					3930	mg/kg
ZOI-1-091-040196					2940	mg/kg
ZOI-1-104-040196		Container broken in transit to the Lab				mg/kg
ZOI-1-178-040296					6900	mg/kg
ZOI-2-050-040196					4850	
ZOI-2-078-040196					13400	
ZOI-2-081-040196					3640	
ZOI-2-132-040296					4760	
ZOI-3-090-040296					164	
ZOI-3-092-040296					ND	
ZOI-3-163-040296					ND	
ZOI-3-198-040296					ND	

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

[c] Total P = Total Phosphorus, [d] TKN = Total Kjeldahl Nitrogen, [e] O&G = Oil and Grease

Table D-2a. Ciniza Z01 Analytical Results, 1993 – 1999 (Continued)

Fall of 1995

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-088-111595	7.7		360	470	88000	mg/kg
ZOI-2-114-111595	7.7		350	710	75000	mg/kg
ZOI-3-043-111595	8.3		220	510	14000	mg/kg
ZOI-3-134-111595	8.6		230	290	100	mg/kg

Bi-Monthly Fall 1995

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-118-083195					6590	mg/kg
ZOI-2-008-083195					10800	mg/kg
ZOI-2-178-083195					3950	mg/kg
ZOI-3-145-083195					17	mg/kg

Bi-Monthly Summer 1995

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-038-062995					5830	mg/kg
ZOI-1-085-062995					9720	mg/kg
ZOI-2-117-062995					7390	mg/kg
ZOI-3-065-062995					2870	mg/kg

Spring 1995

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-015-042895	6.0		301	1330	18000	mg/kg
ZOI-1-186-042895	7.5		297	666	14000	mg/kg
ZOI-2-064-042895	7.5		334	775	9400	mg/kg
ZOI-3-099-042895	10.1		410	49	6340	mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

[c] Total P = Total Phosphorus

[d] TKN = Total Kjeldahl Nitrogen

[e] O&G = Oil and Grease

Table D-2a. Ciniza Z01 Analytical Results, 1993 – 1999 (Continued)

Fall of 1994

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-089-080494					32000	mg/kg
ZOI-1-069-080494					16000	mg/kg
ZOI-2-132-080494					16000	mg/kg
ZOI-3-122-080494					60000	mg/kg

Bi-Monthly Summer 1994

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-056-061694					21000	mg/kg
ZOI-1-149-061694					22000	mg/kg
ZOI-2-097-061694					19000	mg/kg
ZOI-3-126-061694					2100	mg/kg

Spring 1994

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-174-052394	7.8	1.3	270	8	70	mg/kg
ZOI-2-061-052394	7.7	5.8	310	7	65	mg/kg
ZOI-2-147-052394	7.3	4.5	330	13	ND	mg/kg
ZOI-3-153-052394	7.9	2.1	270	25	160	mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

[c] Total P = Total Phosphorus

[d] TKN = Total Kjeldahl Nitrogen

[e] O&G = Oil and Grease

Table D-2a. Ciniza Z01 Analytical Results, 1993 – 1999 (Continued)

Bi-Monthly Fall 1993

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-147-092193					9300	mg/kg
ZOI-2-025-092193					9400	mg/kg
ZOI-2-124-092193					20000	mg/kg
ZOI-3-022-092193					2600	mg/kg

Fall 1993

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-179-080293					11000	mg/kg
ZOI-2-032-080293					29000	mg/kg
ZOI-2-136-080293					28000	mg/kg
ZOI-3-1089-080293					1500	mg/kg

Spring 1993

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-039-060293	7.3		200	1700	15000	mg/kg
ZOI-2-027-060293	7.2		210	1700	17000	mg/kg
ZOI-2-062-060293	8.1		245	1000	15000	mg/kg
ZOI-3-015-060293	7.8		160	820	180	mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

[c] Total P = Total Phosphorus

[d] TKN = Total Kjeldahl Nitrogen

[e] O&G = Oil and Grease

Table D-2b. Ciniza BTZ Analytical Results, 1993 - 1999

Fall 1999

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-055-101999	8.0	0.3	Lab error -	ND	ND	ug/kg
BTZ-1-193-101999	8.1	0.3	did not run	ND	ND	ug/kg
BTZ-2-055-101999	8.8	0.1	requested	ND	ND	ug/kg
BTZ-3-160-101999	8.2	0.3	analyses	ND	ND	ug/kg

Spring 1999

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-040-051899	8.4	0.2	12	ND	ND	ug/kg
BTZ-1-098-051899	8.4	0.3	13	ND	ND	ug/kg
BTZ-1-143-051899	8.5	0.4	12	ND	ND	ug/kg
BTZ-2-040-051899	8.1	0.3	15	ND	ND	ug/kg
BTZ-2-041-051899	8.1	0.3	13	ND	ND	ug/kg
BTZ-2-107-051899	8.4	0.2	13	ND	ND	ug/kg
BTZ-3-038-051899	8.4	0.3	16	ND	ND	ug/kg
BTZ-3-097-051899	8.6	0.2	13	ND	ND	ug/kg
BTZ-3-135-051899	8.4	0.4	14	ND	ND	ug/kg
BTZ-3-152-051899	8.9	0.1	10	ND	ND	ug/kg

[a] Sample Number Identification
(1) Below Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

Table D-2b. Ciniza BTZ Analytical Results, 1993 – 1999 (Continued)

Fall 1998

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-127-011499	8.9	0.3	13	ND	ND	ug/kg
BTZ-1-142-011499	8.8	0.2	10	ND	ND	ug/kg
BTZ-2-113-011499	8.9	0.6	6	ND	ND	ug/kg
BTZ-3-056-011499	8.3	0.3	5	ND	ND	ug/kg

Summer 1998

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-058-061798				ND	ND	ug/kg
BTZ-1-189-061798				ND	ND	ug/kg
BTZ-2-089-061798				ND	ND	ug/kg
BTZ-3-047-061798				ND	ND	ug/kg

Spring 1998

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-174-042398	8.4	0.4	12	ND	ND	ug/kg
BTZ-2-186-042398	8.6	0.4	13	ND	ND	ug/kg
BTZ-3-036-042398	8.5	0.4	19	ND	ND	ug/kg
BTZ-3-119-042398	8.7	0.4	14	ND	ND	ug/kg

[a] Sample Number Identification
(1) Below Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

Table D-2b. Ciniza BTZ Analytical Results, 1993 – 1999 (Continued)

Fall 1997

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-039-111197	8.1	0.4	12	ND		ug/kg
BTZ-1-163-111197	8.6	0.1	8	ND		ug/kg
BTZ-2-114-111197	8.5	0.5	15	ND		ug/kg
BTZ-3-153-111197	8.5	0.4	11	ND		ug/kg

Summer 1997

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-140-050297	7.8	<1	10.7	ND	ND	ug/kg
BTZ-2-068-050297	7.8	<1	14.3	ND	ND	ug/kg
BTZ-2-073-050297	7.8	<1	12.9	ND	ND	ug/kg
BTZ-3-066-050297	7.8	<1	11.8	ND	ND	ug/kg

Fall 1997

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-039-111197	8.1	0.4	12	ND		ug/kg
BTZ-1163-111197	8.6	0.1	8	ND		ug/kg
BTZ-2-114-111197	8.5	0.5	15	ND		ug/kg
BTZ-3-153-111197	8.5	0.4	11	ND		ug/kg

Spring 1997

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-140-050297	7.8	<1	10.7	ND	ND	ug/kg
BTZ-2-068-050297	7.8	<1	14.3	ND	ND	ug/kg
BTZ-2-073-050297	7.8	<1	12.9	ND	ND	ug/kg
BTZ-3-066-050297	7.8	<1	11.8	ND	ND	ug/kg

[a] Sample Number Identification
(1) Below Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

Table D-2b. Ciniza BTZ Analytical Results, 1993 – 1999 (Continued)

Fall 1996

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-089-021897	7.6	0.01	13.0	ND	ND	ug/kg
BTZ-2-168-021897	7.6	0.01	13.8	ND	ND	ug/kg
BTZ-3-027-021897	7.8	0.01	18.9	ND	ND	ug/kg
BTZ-3-186-021897	7.9	0.01	11.5	ND	ND	ug/kg

Summer 1996

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-073-061196	8.1	0.3	11.5	ND	ND	ug/kg
BTZ-2-075-061196	8.0	0.2	13.9	ND	ND	ug/kg
BTZ-2-120-061196	7.8	0.2	15.4	ND	ND	ug/kg
BTZ-3-148-061196	8.1	0.2	13.8	ND	ND	ug/kg

Spring 1996 Special Sampling

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-014-040296		0.4		ND	ND	ug/kg
BTZ-1-091-040196		0.4		ND	ND	ug/kg
BTZ-1-104-040196		0.5		ND	ND	ug/kg
BTZ-1-178-040296		0.3		ND	ND	ug/kg
BTZ-2-050-040196		0.3		ND	ND	ug/kg
BTZ-2-078-040196		0.4		ND	ND	ug/kg
BTZ-2-081-040196		0.2		ND	ND	ug/kg
BTZ-2-132-040296		0.4		ND	ND	ug/kg
BTZ-3-090-040296		0.3		ND	ND	ug/kg
BTZ-3-092-040296		0.3		ND	ND	ug/kg
BTZ-3-163-040296		0.3		ND	ND	ug/kg
BTZ-3-198-040296		0.3		ND	ND	ug/kg

[a] Sample Number Identification
(1) Below Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

Table D-2b. Ciniza BTZ Analytical Results, 1993 – 1999 (Continued)

Fall 1995

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-088-111595	9.5		13	ND	ND	ug/kg
BTZ-2-114-111595	9.1		15	ND	ND	ug/kg
BTZ-3-043-111595	9.6		10	ND	ND	ug/kg
BTZ-3-134-111595	9.2		13	ND	ND	ug/kg

Spring 199

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-015-042895	8.2		14.8	ND	ND	ug/kg
BTZ-1-186-042895	8.3		14.0	ND	ND	ug/kg
BTZ-2-064-042895	8.0		16.4	ND	ND	ug/kg
BTZ-3-099-042895	7.0		17.5	ND	ND	ug/kg

[a] Sample Number Identification
(1) Below Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

Table D-2b. Ciniza BTZ Analytical Results, 1993 – 1999 (Continued)

Fall 1994

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-174-052394	8.8	0.4	14	ND	ND	ug/kg
BTZ-2-081-052394	9.0	0.3	12	ND	ND	ug/kg
BTZ-2-147-052394	9.2	0.3	13	ND	ND	ug/kg
BTZ-3-143-052394	9.5	0.3	9	ND	ND	ug/kg

[a] Sample Number Identification
(1) Below Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

Table D-2b. Ciniza BTZ Analytical Results, 1993 – 1999 (Continued)

Fall 1993

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-180-080393	8.3		14.8	ND	ND	ug/kg
BTZ-2-115-080393	8.4		15.1	ND	ND	ug/kg
BTZ-2-023-080393	7.9		17.8	ND	ND	ug/kg
BTZ-3-088-080393	9.2		3.2	ND	ND	ug/kg

[a] Sample Number Identification
(1) Below Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

Table D-2c. Ciniza LTU Characterization Studies, 1996 – 1999

SPRING 1999 RCRA METALS

Sample ID [a]	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Nickel	Selenium	Vanadium	Mercury	Units
ZOI-1-040-051899	ND	ND	290	ND	ND	190	7.1	40	28	ND	30	1	mg/kg
ZOI-1-098-051899	ND	ND	210	1.1	ND	15	5.7	11	13	ND	19	ND	mg/kg
ZOI-1-143-051899	ND	ND	240	1	ND	9.2	ND	9.1	10	ND	13	ND	mg/kg
ZOI-2-040-051899	ND	20.0	710	ND	ND	200	9.7	87	54	ND	40	13	mg/kg
ZOI-2-041-051899	1.2	10.0	550	ND	ND	310	8.2	54	32	3.3	35	8.4	mg/kg
ZOI-2-107-051899	ND	7.5	350	ND	0.8	220	6.2	40	24	ND	21	1.6	mg/kg
ZOI-3-038-051899	ND	3.9	340	ND	ND	190	5.1	21	11	ND	16	0.9	mg/kg
ZOI-3-097-051899	ND	1.6	360	1.4	ND	24	7	12	14	ND	30	ND	mg/kg
ZOI-3-135-051899	ND	1.3	330	1.6	ND	23	8.2	14	17	ND	36	ND	mg/kg
ZOI-3-152-051899	ND	1.5	350	1.5	ND	8.5	5.3	10	11	ND	17	ND	mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

Table D-2c. Ciniza LTU Characterization Studies, 1996 – 1999

SPRING 1999 RCRA METALS

Sample ID [a]	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Nickel	Selenium	Vanadium	Mercury	Units
3'-1-040-051899	16	ND	180	1.1	ND	9.5	4.1	11	9.4	ND	16	ND	mg/kg
3'-1-098-051899	ND	ND	140	ND	ND	7	ND	7.9	7	ND	12	ND	mg/kg
3'-1-143-051899	ND	ND	240	ND	ND	14	5.7	10	13	ND	20	ND	mg/kg
3'-2-040-051899	ND	1.2	310	1.3	ND	7.4	4.9	9.6	9.4	ND	14	ND	mg/kg
3'-2-041-051899	ND	1.3	290	1.7	ND	18	7	13	15	ND	28	ND	mg/kg
3'-2-107-051899	ND	ND	290	ND	ND	9.4	4.3	11	9.4	ND	15	ND	mg/kg
3'-3-038-051899	ND	1.5	200	1.4	ND	8.9	5	11	9.8	ND	18	ND	mg/kg
3'-3-097-051899	ND	1.6	360	1.8	ND	27	8.8	13	19	ND	40	ND	mg/kg
3'-3-135-051899	ND	1.7	330	1.5	ND	24	8.4	12	18	ND	36	ND	mg/kg
3'-3-152-051899	ND	1.4	370	1.4	ND	17	7	11	15	ND	27	ND	mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

Table D-2c. Ciniza LTU Characterization Studies, 1996 – 1999

SPRING 1999 RCRA METALS

Sample ID [a]	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Nickel	Selenium	Vanadium	Mercury	Units
BTZ-1-040-051899	ND	ND	210	ND	ND	12	5.2	8.9	13	ND	20	ND	mg/kg
BTZ-1-098-051899	ND	ND	210	1.1	ND	15	5.7	11	13	ND	19	ND	mg/kg
BTZ-1-143-051899	ND	ND	240	1	ND	9.2	ND	9.1	10	ND	13	ND	mg/kg
BTZ-2-040-051899	ND	1.4	260	1.5	ND	17	6.9	12	15	ND	27	0.2	mg/kg
BTZ-2-041-051899	ND	1.8	270	1.4	ND	18	7.1	12	15	ND	30	ND	mg/kg
BTZ-2-107-051899	ND	ND	230	1.1	ND	12	5.1	10	12	ND	19	ND	mg/kg
BTZ-3-038-051899	ND	2.4	300	1.4	ND	25	8.6	12	20	ND	43	ND	mg/kg
BTZ-3-097-051899	ND	1.6	330	1.2	ND	10	5.3	9.1	11	ND	22	ND	mg/kg
BTZ-3-135-051899	ND	1.4	330	1.6	ND	6.2	4.1	10	7.8	ND	16	ND	mg/kg
BTZ-3-152-051899	ND	1.1	430	ND	ND	7.8	4.7	8.5	8.8	ND	18	ND	mg/kg

[a] Sample Number Identification
(1) Below Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

Table D-2c. Ciniza LTU Characterization Studies, 1996 – 1999

SPRING 1998 RCRA METALS, VOLATILES, AND SEMI-VOLATILES

Sample ID	Silver	Arsenic	Barium	Mercury	Cadmium	Chromium	Lead	Selenium	Vols 8021	Semi-Vols 8270	Units
[a] ZOI-1-058-061798	ND	ND	210	ND	ND	9	6	ND	ND	ND	mg/kg
ZOI-1-189-061798	ND	ND	180	ND	ND	9	ND	ND	ND	ND	mg/kg
ZOI-2-089-061798	ND	ND	230	ND	ND	10	ND	ND	ND	ND	mg/kg
ZOI-3-047-061798	ND	ND	280	ND	ND	10	8	ND	ND	ND	mg/kg
[b] 2'-1-058-061798	ND	ND	160	ND	ND	10	6	ND	ND	ND	mg/kg
2'-1-189-061798	ND	ND	310	ND	ND	9	5	ND	ND	ND	mg/kg
2'-2-089-061798	ND	ND	240	ND	ND	9	6	ND	ND	ND	mg/kg
2'-3-047-061798	ND	ND	360	ND	ND	11	7	ND	ND	ND	mg/kg
4'-1-058-061798	ND	ND	170	ND	ND	8	8	ND	ND	ND	mg/kg
4'-1-189-061798	ND	ND	280	ND	ND	8	6	ND	ND	ND	mg/kg
4'-2-089-061798	ND	ND	200	ND	ND	11	8	ND	ND	ND	mg/kg
4'-3-047-061798	ND	ND	270	ND	ND	12	6	ND	ND	ND	mg/kg
[c] BTZ-1-058-061798	ND	ND	210	ND	ND	12	7	ND	ND	ND	mg/kg
BTZ-1-189-061798	ND	ND	180	ND	ND	12	ND	ND	ND	ND	mg/kg
BTZ-2-089-061798	ND	ND	160	ND	ND	11	6	ND	ND	ND	mg/kg
BTZ-3-047-061798	ND	ND	240	ND	ND	12	7	ND	ND	ND	mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] Sample Number Identification
(1) Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[c] Sample Number Identification
(1) Below Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

Table D-2c. Ciniza LTU Characterization Studies, 1996 – 1999

SPRING 1998 RCRA METALS, VOLATILES, AND SEMI-VOLATILES

Sample ID	Silver	Arsenic	Barium	Mercury	Cadmium	Chromium	Lead	Selenium	Vols 8021	Semi-Vols 8270	Units
[a] ZOI-1-174-042398	ND	ND	190	ND	ND	10	6	ND	ND	ND	mg/kg
ZOI-2-186-042398	ND	ND	350	ND	ND	16	7	ND	ND	ND	mg/kg
ZOI-3-036-042398	ND	ND	340	0.1	ND	30	9	ND	ND	ND	mg/kg
ZOI-3-119-042398	ND	ND	280	ND	ND	12	8	ND	ND	ND	mg/kg
[b] 2'-1-174-042398	ND	ND	450	ND	ND	10	ND	ND	ND	ND	mg/kg
2'-2-186-042398	ND	ND	240	ND	ND	10	ND	ND	ND	ND	mg/kg
2'-3-036-042398	ND	ND	310	ND	ND	10	6	ND	ND	ND	mg/kg
2'-3-119-042398	ND	ND	240	ND	ND	13	5	ND	ND	ND	mg/kg
4'-1-174-042398	ND	ND	350	ND	ND	9	7	ND	ND	ND	mg/kg
4'-2-186-042398	ND	ND	220	ND	ND	11	5	10	ND	ND	mg/kg
4'-3-036-042398	ND	ND	240	ND	ND	10	ND	ND	ND	ND	mg/kg
4'-3-119-042398	ND	ND	310	ND	ND	11	6	ND	ND	ND	mg/kg
[c] BTZ-1-174-042398	ND	ND	340	ND	ND	9	8	ND	ND	ND	mg/kg
BTZ-2-186-042398	ND	ND	270	0.1	6	12	6	ND	ND	ND	mg/kg
BTZ-3-036-042398	ND	ND	240	ND	ND	12	6	ND	ND	ND	mg/kg
BTZ-3-119-042398	ND	ND	270	ND	ND	13	7	ND	ND	ND	mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] Sample Number Identification
(1) Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[c] Sample Number Identification
(1) Below Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

Table D-2c. Ciniza LTU Characterization Studies, 1996 – 1999

Fall 1997 RCRA METALS

Sample ID [a]	Silver	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Mercury	Units
ZOI-1-075-091097	ND	ND	270	ND	13	7	ND	ND	mg/kg
ZOI-2-198-091097	ND	ND	250	ND	7	8	ND	0.3	mg/kg
ZOI-3-064-091097	ND	ND	320	ND	8	9	ND	ND	mg/kg
ZOI-3-142-091097	ND	ND	20	ND	8	9	ND	ND	mg/kg

Summer 1997 RCRA METALS

Sample ID [a]	Silver	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Mercury	Units
ZOI-1-068-052797	ND	0.8	360	ND	9	12	ND	ND	mg/kg
ZOI-2-037-052797	ND	0.8	310	0.1	8	9	ND	0.1	mg/kg
ZOI-3-079-052797	ND	ND	280	0.1	28	15	ND	0.2	mg/kg
ZOI-3-093-052797	ND	ND	290	0.1	31	13	ND	0.5	mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

Table D-2c. Ciniza LTU Characterization Studies, 1996 – 1999

Summer 1996 RCRA METALS

Sample ID [a]	Silver	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Mercury	Units
ZOI-1-073-061196	ND	0.4	191	ND	11	6.3	ND	ND	mg/kg
ZOI-2-075-061196	0.8	0.6	227	ND	10	8.4	ND	0.3	mg/kg
ZOI-2-120-061196	ND	0.5	305	ND	10	6.9	ND	ND	mg/kg
ZOI-3-148-061196	1.7	0.5	140	ND	14	6.9	ND	ND	mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

Table D-2c. Ciniza LTU Characterization Studies, 1996 – 1999

Spring 1996 Special Sampling

Sample ID [b]	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Nickel	Selenium	Vanadium	Mercury	Units
BTZ-1-014-040296	ND	0.4	271	1.2	ND	14.8	5.8	10	11.5	ND	18.5	ND	mg/kg
BTZ-1-091-040196	ND	0.4	301	0.9	ND	10.6	4.6	6.5	8.3	ND	17	ND	mg/kg
BTZ-1-104-040196	ND	0.5	265	1.3	ND	16.4	6.5	9.6	12.5	ND	20.7	ND	mg/kg
BTZ-1-178-040296	ND	0.5	266	0.9	ND	13.7	6.2	9.4	11.9	ND	19.8	ND	mg/kg
BTZ-2-050-040196	ND	0.6	240	1.3	ND	15.7	6	9.2	12.3	ND	19.0	ND	mg/kg
BTZ-2-078-040196	ND	0.6	260	1.3	ND	20.5	7.5	10.4	15.1	ND	26.8	ND	mg/kg
BTZ-2-081-040196	ND	0.4	253	1.3	ND	17.1	6.8	9.7	12.8	ND	20.5	ND	mg/kg
BTZ-2-132-040296	ND	0.5	268	1.3	ND	18.7	5.9	8.8	12.3	ND	22.1	ND	mg/kg
BTZ-3-090-040296	ND	1.1	337	0.9	ND	21.8	7.7	8	17.1	ND	29.5	ND	mg/kg
BTZ-3-092-040296	ND	0.7	392	1.3	ND	16.8	6.6	9	13.3	ND	23	ND	mg/kg
BTZ-3-163-040296	ND	0.7	247	1.3	ND	19.5	7.8	9	15.1	ND	27.3	ND	mg/kg
BTZ-3-198-040296	ND	0.5	243	1.3	ND	16.2	5.6	9.2	12	ND	19.2	ND	mg/kg

[b] Sample Number Identification
(1) Below Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

TABLE D-3. Background Sample Event May 18, 1997 – Results

Sample Number	Parameter	Silver	Arsenic	Barium	Cadmium	Chromium	Mercury	Lead	Selenium
	Reporting Limit	**1**	**5**	**1**	**0.5**	**1**	**0.02**	**5**	**10**
	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
705350-01		ND	ND	240	ND	8	ND	7	ND
705350-02		ND	ND	240	ND	13	ND	8	ND
705350-03		ND	ND	310	ND	13	ND	10	ND
705350-04		ND	ND	240	ND	13	ND	7	ND

Note: SW-846-6010 and 7471 RCRA Metals and Mercury

Table D-4 Gallup ZOI and TZ Analytical Results 2009

Fall of 2009 – 9 year Sampling Event

Sample ID [a]	DRO 8015B	GRO 8015B	Units
ZOI-1-371-120809	ND	ND	mg/kg
ZOI-1-2521-120909	ND	ND	mg/kg
ZOI-2-8334-120909	7000	ND	mg/kg
ZOI-2-4139-120909	9400	ND	mg/kg
ZOI-3-3414-120909	1800	ND	mg/kg
ZOI-3-7544-121109	270	ND	mg/kg
TZ-1-371-121109	ND	ND	mg/kg
TZ-1-2521-121109	ND	ND	mg/kg
TZ-2-4139-121109	ND	ND	mg/kg
TZ-2-8334-121109	ND	ND	mg/kg
TZ-3-3414-121109	ND	ND	mg/kg
TZ-3-7544-121109	ND	ND	mg/kg
NMWQS	0.2		
EPA MCL			

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number
*See Table D-4a for complete list of constituents

Table D-4 Gallup ZOI and TZ Analytical Results 2009

Fall of 2009 – 9 year Sampling Event

EPA METHOD 8270C – Semi Volatiles (Units are in mg/kg)

Sample ID [a]	Z0I-1-2521-120909	Z0I-2-8334-120909	Z0I-2-4139-120909	Z0I-3-3414-120909	Z0I-3-7544-121109	TZ-1-371-121109	TZ-1-2521-121109	TZ-2-4139-121109	TZ-2-8334-121109	TZ-3-3414-121109	NMWQS	EPA MCLs
1-methylnaphthalene		0.246										
2-methylnaphthalene		0.408										
3+4-Methylphenol			0.454	0.104								
5+6 Methylchrysene		38.5	40.8	0.740	4.73				0.817			
Anthracene				0.088							8.3	
Benzenethiole		0.292	3.04	0.292	0.401							
Benzo(a)anthracene		1.22	0.889		0.361						.000038	
Benzo(a)pyrene		8.18	12.1	0.701	2.60				0.237		.000038	.0002
Benzo(b)fluoranthene		1.27									.000038	
Butylbenzylphthalate			0.436									
bis(2-Ethylhexyl)phthalate						0.082	0.101	0.093	0.195	0.101	.012	.006
Chrysene		9.12	13.0	0.401	1.54				0.328		.000038	
Cresol(total)			0.454	0.104								
Dibenz(a,h)anthracene		0.943			0.531						.000038	
Diethylphthalate	0.408	0.204		0.378		0.158	0.185	0.143	0.133	0.063	17	
Di-n-octylphthalate									0.135			
Ideno(1,2.3-cd)pyrene		0.450			0.294						.000038	
Naphthalene		0.161										
Phenanthrene					0.121							
Phenol			0.200	0.151							21	
Pyrene		2.88	3.63		0.125				0.105		.83	

[a] Sample Number Identification
(1) Zone of Incorporation (Z0I)
Treatment Zone (TZ)
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

Table D-4 Gallup ZOI and TZ Analytical Results 2009

Sample ID – That showed Non-Detect (ND) levels on EPA Method 8270C-Semi-Volatile Analysis

Sample ID [a]	8270C Semi-Volatiles
ZOI-1-371-120809	ND
TZ-3-7544-121109	ND

[a] Sample Number Identification
(1) Zone of Incorporation (ZOI)
Treatment Zone (TZ)
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

Table D-4 Gallup ZOI and TZ Analytical Results 2009

Fall of 2009 – 9 year Sampling Event

EPA METHOD 8260B –Volatile Organics.
(Units are in mg/kg)

Sample ID [a]	Z0I-1-371-120809	Z0I-2-8334-120909	Z0I-2-4139-120909	Z0I-3-3414-120909	NMWQS	EPA MCLS
Benzene		0.00629			0.01	.005
Carbon Disulfide		0.00845	0.00536			
Ethylbenzene		0.00740			0.75	0.7
M+p-Xylene	0.00566	0.0179	0.00773	0.00882		
o-Xylene		0.00709				
Toluene		0.0153		0.00832	0.75	1

Sample ID – That showed Non-Detect (ND) on 8260B-Volatile Organics

Sample ID [a]	8260B Volatile Organics
Z0I-1-2521-120909	ND
Z0I-3-7544-121109	ND
TZ-1-371-121109	ND
TZ-1-2521-121109	ND
TZ-2-4139-121109	ND
TZ-2-8334-121109	ND
TZ-3-3414-121109	ND
TZ-3-7544-121109	ND

[a] Sample Number Identification
(1) Zone of Incorporation (Z0I)
Treatment Zone (TZ)
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

Table D-4. Gallup ZOI and TZ Analytical Results 2009

FALL 2009 – 9 YEAR SAMPLING

EPA 6020A, RCRA METALS; EPA 9012B, TOTAL AND AMENABLE CYANIDE; EPA 7471A, MERCURY
(Units in mg/kg)

Sample ID [a]	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Cyanide	Lead	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc	% Moisture
ZOI-1-371-120809	ND	1.71	314	1.51	ND	26.1	8.54	ND	13.6	ND	18.9	ND	ND	29.0	32.4	12.4
ZOI-1-2521-120909	ND	1.56	389	1.73	ND	26.4	8.99	ND	15.5	ND	19.5	ND	ND	30.8	30.1	30.1
ZOI-2-8334-120909	ND	14.5	481	1.03	ND	123	12.6	10.8	89.7	6.14	46.7	ND	ND	43.7	718	18.6
ZOI-2-4139-120909	ND	10.5	619	1.47	1.11	638	11.4	28.9	79.4	4.23	33.8	1.75	ND	43.9	924	19.4
ZOI-3-3414-120909	ND	6.96	302	1.10	ND	122	12.4	5.22	61.1	1.31	26.9	ND	ND	34.1	235	10.4
ZOI-3-7544-121109	ND	2.69	441	1.61	ND	135	9.59	6.74	23.6	0.399	24.2	ND	ND	40.9	152	14.5
TZ-1-371-121109	ND	1.49	275	1.50	ND	22.1	8.01	ND	13.3	ND	16.1	ND	ND	29.6	25.4	12.6
TZ-1-2521-121109	ND	1.72	281	1.70	ND	29.6	9.54	ND	14.6	ND	22.8	ND	ND	35.7	36.8	20
TZ-2-4139-121109	ND	1.60	326	1.91	ND	32.3	10.3	ND	15.6	ND	21.9	ND	ND	40.3	35.3	15.7
TZ-2-8334-121109	ND	1.68	328	1.53	ND	27.6	8.61	ND	16.6	0.135	17.9	ND	ND	33.2	44.7	16.9
TZ-3-3414-121109	ND	1.71	462	1.85	ND	29.5	9.93	ND	15.5	ND	20.8	ND	ND	36.2	33.2	14.7
TZ-3-7544-121109	ND	1.40	393	1.70	ND	28.3	9.20	ND	14.8	ND	18.7	ND	ND	35.7	30.5	12.9
NMWQS	.0056	.0023	2	.004	.005	0.1		0.2	0.05		0.1	.05			7.4	
EPA MCLS	.006	0.01	2	.004	.005	0.1		0.2	.015	.002		.05				

[a] Sample Number Identification
(1) Zone of Incorporation (Z0I)
Treatment Zone (TZ)
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

Table D-4a. Sample Results from Chinle Slope Wash and Sonsela 2009

2009 Sampling Event – July 2009

SM4500-H+B: PH; EPA 120:1, EPA Method 300.0: Anions, EPA Method 8015B DRO/GRO

Sample ID	Collection Date	pH	Specific Conductance (mhos/cm)	Fl (mg/L)	Cl (mg/L)	Nitrate (mg/L)	Phosphorous, Orthophosphate (as P) (mg/L)	Sulfate (mg/L)	DRO (mg/L)	GRO (mg/L)
MW-4	7/8/09	8.74	1200	0.37	16	-	-	160	-	-
MW-5	7/15/09	8.96	1100	0.76	66	-	-	180	-	-
MW-1	7/16/09	9.02	1100	0.76	53	-	-	160		
MW-2	7/16/09	9.00	1100	0.82	60	-	-	170	-	-
SMW-2	7/27/09	7.61	7700	0.32	2300	-	-	1700	-	0.73
SMW-4	7/27/09	8.53	1300	1.2	58	-	-	170	-	-

RCRA metals found in Chinle Slope Wash and Sonsela Wells

Sample ID	Collection Date	Method	Barium (mg/L)	Beryllium (mg/L)	Cadmium (mg/L)	Calcium (mg/L)	Chromium (mg/L)	Cobalt (mg/L)	Lead (mg/L)	Magnesium (mg/L)	Nickel (mg/L)	Potassium (mg/L)	Silver (mg/L)	Sodium (mg/L)	Vanadium (mg/L)	Zinc (mg/L)
Standards	NMWQS		2	.004	.005		0.1		.05		0.1					7.4
	EPA MCLS		2	.004	.005		0.1		.015							
	RRSL															
MW-4	7/8/09	6010B	.022	-	-	1.7	-	-	-	-	-	-	-	280	-	-
MW-5	7/15/09	6010B	.017	-	-	1.5	-	-	-	-	-	-	-	260	-	-
MW-1	7/16/09	6010B	.015	-	-	2.1	-	-	-	-	-	-	-	250	-	-
MW-2	7/16/09	6010B	.019	-	-	1.6	-	-	-	-	-	-	-	250	-	-
SMW-2	7/27/09	6010B	.016	-	-	220	-	-	.0063	68	-	1.1	-	2000	-	-
SMW-4	7/27/09	6010B	.028	-	-	4.4	.0075	.010	-	1.4	-	-	-	310	-	-

Sample ID	Collection Date	Method	Antimony (mg/L)	Arsenic (mg/L)	Selenium (mg/L)	Cyanide (mg/L)	Mercury (mg/L)
Standards	NMWQS		.0056	.0023	.05	0.2	
	EPA MCLS		.006	0.01	.05	.002	.002
	RRSL						
MW-4	7/8/09	6020A/335.4/7470	.022	-		-	-
MW-5	7/15/09	6020A/335.4/7470	-	-	-	-	-
MW-1	7/16/09	6020A/335.4/7470	-	.00124	-	-	-
MW-2	7/16/09	6020A/335.4/7470	-	.00104	-	-	-
SMW-2	7/27/09	6020A/335.4/7470	-	.00384	.00474	0.0662	-
SMW-4	7/27/09	6020A/335.4/7470	-	.00297	-	-	-

Notes:
- = No Detect

Table D-4a: Sample Results from Chinle Slope Wash and Sonsela Wells

2009 Special Sampling Event

VOCs results in sample wells.

Sample ID	Collection Date	Method	Acetone (mg/L)	0-Xylene (mg/L)	Toluene (mg/L)
Standards	NMWQS		.01		0.75
	EPA MCLS				1.0
	RRSL		22.0		0.0015
MW-4	7/8/09	8260B		.00059	.0008
MW-5	7/15/09	8260B	.00492		
MW-1	7/16/09	8260B	-	-	-
MW-2	7/16/09	8260B	-	-	-
SMW-2	7/27/09	8260B	.00625		
SMW-4	7/27/09	8260B	-	-	-

Semi-VOC results in sample wells

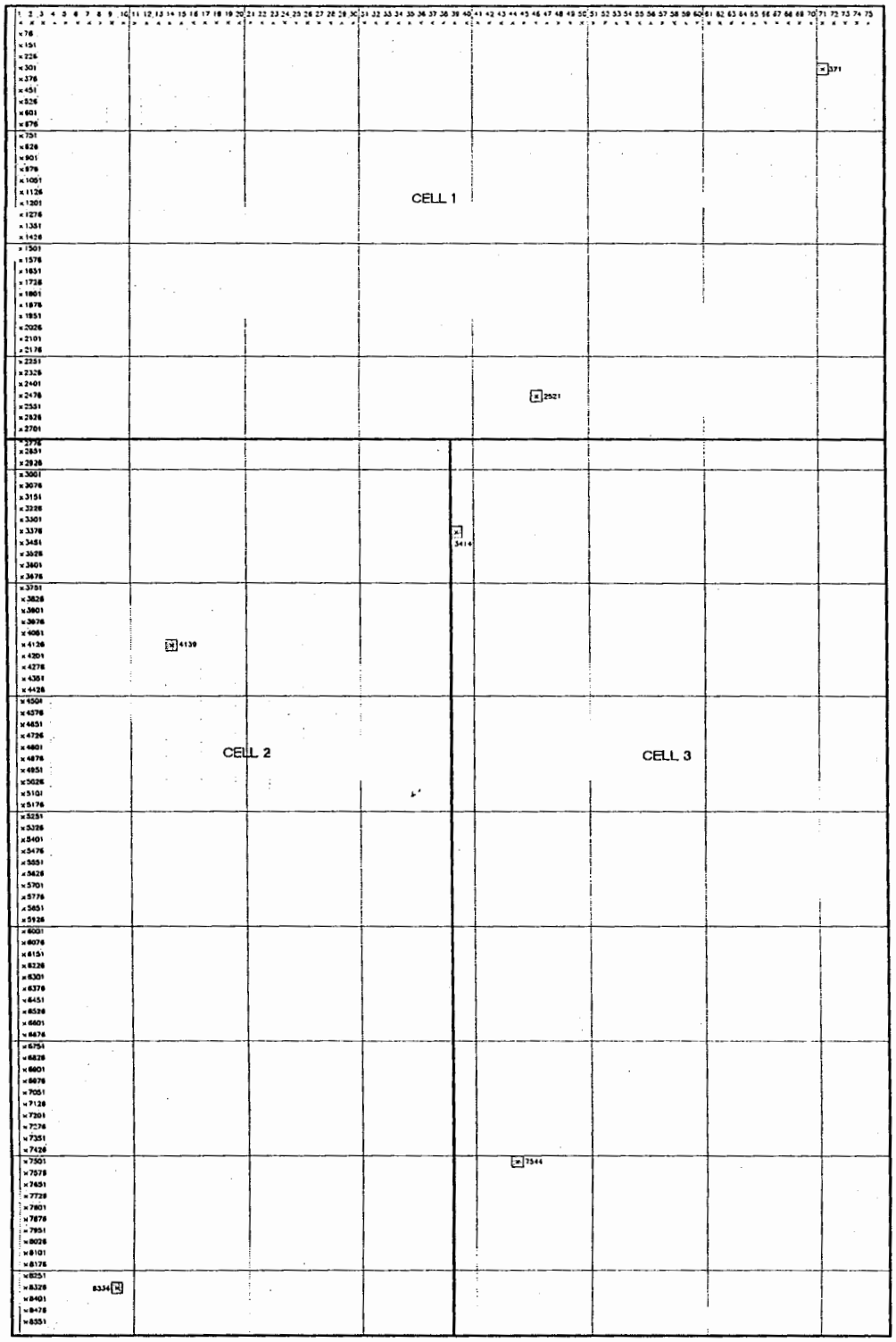
Sample ID	Collection Date	Method	bis(2-Ethylhexyl)phthalate (mg/L)	Diethylphthalate (mg/L)
Standards	NMWQS		.012	17
	EPA MCLS		.006	
	RRSL			
MW-4	7/8/09	8270C	No detect for all parameters	
MW-5	7/15/09	8270C	No detect for all parameters	
MW-1	7/16/09	8270C	No detect for all parameters	
MW-2	7/16/09	8270C	No detect for all parameters	
SMW-2	7/27/09	8270C	No detect for all parameters	
SMW-4	7/27/09	8270C	.00105	.00148

Notes:
- = No Detect

Figure D-2. Sampling Grid – Random Number system

Used for Sampling Points – Cell #1, Cell #2 and Cell #3

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130
131	132	133	134	135	136	137	138	139	140
141	142	143	144	145	146	147	148	149	150
151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170
171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189	190
191	192	193	194	195	196	197	198	199	200



EXPLANATION

- APPROXIMATE LAND TREATMENT UNIT BOUNDARY
- MAJOR GRID
- MINOR GRID
- 6551 6'X6' GRID
- 6639 6'X6' GRID TO BE SAMPLED

NOTES:

1. GRIDS TO BE SAMPLED WERE DETERMINED USING RANDOM.ORG RANDOM INTEGER GENERATOR.
2. PARTIAL 6'X6' GRIDS WERE NOT INCLUDED IN THE SAMPLE LOCATION SELECTION.

N

0 ~40' ~80'

Trihydro CORPORATION
1252 Commerce Drive
Laramie, Wyoming 82070
www.trihydro.com
(P) 307/745.7474 (F) 307/745.7729

FIGURE 1

LTU RCRA SOIL SAMPLING LOCATIONS (DECEMBER 2009)

WESTERN REFINING COMPANY L.L.C.
GALLUP REFINERY
GALLUP, NEW MEXICO

Drawn By: REP	Checked By: GP	Scale: 1" = ~40'	Date: 11/30/09	File: 697038-LTU-SOIL-20091130

Figure D-3: LTU Soil Sampling Locations for 2009

Figure D-4: Random Integer Generator for 2009 Sampling Event

Section E.0

E.0 POST CLOSURE MONITORING

The Gallup Refinery has established a post closure monitoring program in accordance with requirements of 20 NMAC 4.1, subpart IX, §270.14(c) and §270.20(b) (3). The Gallup Refinery is committed to protecting human health and the environment and therefore proposes a post closure monitoring program that consists of two monitoring sequences; early detection monitoring in the unsaturated zone, and detection monitoring in the groundwater at the point of compliance. The two monitoring sequences ensure that data obtained during all post closure monitoring activities are scientifically defensible and support regulatory compliance.

Early detection monitoring will detect whether migration of hazardous constituents from the treatment zone has occurred and to ensure that hazardous constituents within the treatment zone have been successfully treated. The number and depth of samples have been (1), selected to adequately detect potential migration of hazardous constituents, and (2), determined as successful treatment, degradation, transformation, and immobilization in the treatment zone. The details for early detection monitoring are provided in Appendix E. Post Closure Monitoring Plan, and are summarized in Section E.1.

Detection monitoring comprises the monitoring program required at 20 NMAC 4.1, subpart V, §264, and subpart F for the uppermost Sonsela aquifer. The purpose of the detection monitoring is to determine existing conditions of groundwater quality and quantity around the LTU. The number and depth of samples and analytical methods have been selected to effectively monitor the saturated zones beneath the LTU. The detection monitoring, designed to monitor conditions in the Sonsela aquifer, is provided in Appendix E, Post Closure Monitoring Plan and is summarized in Section E.2.

E.1 Early Detection Monitoring [20 NMAC 4.1, subpart V, §264,278, subpart IX, §270.20(b)]

The Gallup Refinery will sample and analyze soil and groundwater during the post closure care period to meet the requirements of 20 NMAC 4.1 subpart V, §264.278 and subpart IX §270.20(b). The early detection monitoring includes sampling soil in the zone of infiltration (ZOI), the treatment zone, and the groundwater in the Chinle slope wash. The early detection monitoring will yield samples that provide a reliable measurement of the quality of the soil and groundwater beneath the treatment zone.

Selection of analytical parameters, i.e., the *modified Skinner List* including total petroleum hydrocarbons (TPH) as gasoline range organics (GRO) and diesel range organics (DRO), and principal hazardous constituents (PHCs), is based on the hazardous constituents expected to be present in the waste and their associated degradation products. The modified Skinner List is a subset of 40 CFR 261 Appendix VIII constituents and identifies the specific hazardous constituents of concern that typically may be found in refinery waste. NMED established PHCs for the LTU in the *Ciniza Hazardous Waste Facility Permit NMD000333211-1*. PHCs are hazardous constituents contained in waste applied to the LTU. NMED determined these PHCs most difficult to treat, considering the combined effects of degradation, transformations, and immobilization. The Gallup Refinery will analyze samples for hazardous constituents from the modified Skinner List including TPH as GRO and DRO and PHCs, collectively referred to as the modified Skinner List.

The sampling schedule (Figure E-1) for the zone of incorporation (ZOI), treatment zone, and Chinle slope wash provides a sampling frequency based on maximum protection of human health and the environment, while minimizing disruption of the LTU and underlying sediments. The Gallup Refinery will analyze samples for organics and metals identified on the modified Skinner List. The sampling schedule is described for each zone in the following sub sections.

E.1.1 Zone of Incorporation Sampling.

The Gallup Refinery will sample the ZOI (upper 12 inches of the treatment zone) to confirm treatment and to ensure that hazardous constituents within the treatment zone have been successfully treated. The Gallup Refinery will obtain soil samples following the protocols in the Post Closure Monitoring Plan, which identifies procedures for obtaining soil samples, determining sampling locations, decontaminating equipment and chain of custody (COC); analytical parameters; analytical procedures; and quality assurance/quality control (QA/QC) requirements.

E.1.1.1 Sampling Frequency and Analytical Parameters.

Characterization of the ZOI was completed in 1999 during a special sampling event. The ZOI was characterized for both the organics and metals as identified on the modified Skinner List (Tables E-1A through E-1D). Tables E-2A through E-2D list the results for this sampling event. Event 1 (9th year) post closure sampling was conducted in December 2009. Tables E-3A through E-3E list the results from this sampling event. During the post closure care period, the ZOI will be sampled three times, with minimum disruption of the vegetative cover.

- Events 1, 2, and 3: The three post closure sampling events will take place in the ninth year, 19th year, and 30th year, respectively, of post-closure care. Analytical parameters selected for Events 1, 2, and 3 are both organics and metals identified on the modified Skinner List.

- Organics	Modified Skinner List (Includes TPH, GRO, DRO)	Tables E-1A thru E-1B
- Metals	Modified Skinner List	Tables E-1C thru E-1D

The sampling frequency for organics and metals during post closure care period is detailed on Figure E-1. The schedule assumes the early sampling events demonstrate that there is no statistically significant increase for any analytes in the Z0I.

If sample results from any sampling event indicate a statistically significant increase in hazardous constituents as defined in 40 CFR 264.278 and §264.97(h), then sampling frequency may be modified after consultation with NMED. If a statistically significant increase is indicated and confirmed following protocol established in Appendix E, Post Closure Monitoring Plan, appropriate notification to NMED will be provided and a permit modification may be required for further characterization of the ZOI. The characterization, if required, will include organics and metals in the modified Skinner List including TPH as GRO and DRO. Confirmation may also trigger a special sampling and analysis event of the Chinle slope wash. This special sampling event, if necessary, will provide additional information on hazardous constituents' present and potential migration out of the ZOI.

E.1.2 Treatment Zone Sampling

Gallup Refinery will sample the treatment zone following the protocols in Appendix E, Post Closure Monitoring Plan. The plan identifies procedures for obtaining soil samples, determining sampling locations, decontaminating equipment and COC; analytical parameters, analytical procedures and QA/QC requirements.

Initial characterization of the treatment zone was conducted in a 1999 special sampling event (Tables E-2A thru E-2D). The zones were characterized for both organics and metals identified in the modified Skinner List (Tables E-1A thru Tables E-1D).

The treatment zone sampling frequency is parallel to the frequency of the ZOI sampling. The treatment zone will be sampled within the 9th, 19th year, and 30th year of post closure care. The samples will be analyzed for both organics and metals in the modified Skinner List plus TPH as GRO and DRO. The sampling schedule is detailed on Figure E-1.

If a statistically significant increase is indicated and confirmed following protocol established in the Post Closure Monitoring Plan, appropriate notification to NMED will be provided and a permit modification may be required for further characterization of the treatment zone. The characterization, if required, will include all organics and metals in

the modified Skinner List plug TPH as GRO and DRO. Confirmation may also trigger a special sampling and analysis event of the Chinle slope wash. This special sampling event will provide additional information on hazardous constituents' present and potential migration out of the treatment zone.

E.1.3 Chinle Slope Wash Sampling

Beneath the LTU, a water bearing unit known as the Chinle slope wash lies on top of, but is not part of, the Chinle formation. This water bearing unit is located above the Chinle formation, and consequently, is located above the Sonsela aquifer (Figure I-1 demonstrates this stratigraphic sequence). The Sonsela is the geologic unit that meets the regulatory definition of the uppermost aquifer that must be monitored in accordance with 20 NMAC 4.1, subpart V, 264. Although the Chinle slope wash does not meet the regulatory definition of an aquifer that must be monitored, as part of early detection monitoring, the Gallup Refinery will voluntarily sample groundwater from the Chinle slope wash to be protective of human health and the environment.

The Chinle slope wash will be sampled using one down gradient stainless steel, shallow monitoring well (SMW-4). The Post Closure Monitoring Plan identifies procedures for obtaining groundwater samples from SMW-4, decontaminating equipment, and COC; analytical parameters; analytical procedures; and QA/QC requirements. If SMW-4 is dry, this observance will be reported for that sampling event and no further sampling will be conducted until the next scheduled sampling event.

E.1.3.1 Background Determination.

Background values for Chinle slope wash samples are not established. Detection of any constituents from Tables E-1A thru E-1D, above regulatory limits, may generate additional sampling after consultation with NMED.

E.1.3.2 Sampling Frequency:

The Chinle slope wash will be sampled annually for three years. After year three, the Chinle slope wash will be sampled bi-annually up to and including year nine of the post

closure care period. Then Chinle slope wash will be sampled in year 19 and 30 of post closure care period. The samples will be analyzed for the organics noted in the modified Skinner List (Tables E-1A and E-1B).

If a statistically significant increase is indicated and verified following protocol established in the Post Closure Monitoring Plan, Gallup Refinery will submit the required notification to the NMED, and a permit modification of the sampling schedule may be required to further characterize the release. Prior to submitting a modification request, Gallup Refinery may demonstrate that the release is from a source other that the LTU or is from errors in sampling, analysis, or data evaluation. Any modification request will address compliance monitoring requirements and will consist of an approach that is tailed to the specific qualities of the release (e.g. location, depth, concentration, media, constituent identified, migration characteristics expected).

E.2 Detection Monitoring [20 NMAC 4.1, subpart V, §264.97 and §264.98, subpart IX §270.14©]

The Gallup Refinery will conduct detection monitoring during the post closure care period in accordance with the requirements of 20 NMAC 4.1, subpart V, §264.97 and §264.98, subpart IX §270.14(c). The detection monitoring will yield (1), samples that represent the quality of hydraulically up gradient groundwater in the Sonsela that could not be affected by the LTU operations, and (2), samples that represent the quality of down gradient groundwater passing the point of compliance (defined in Section E.2.2).

E.2.1 Containment Plume Description [20 NMAC 4.1, subpart IX, §270.14(c) (4)]

The Gallup Refinery has routinely monitored the Sonsela aquifer as well as the Vadose zone above the Chinle formation in accordance with the *Ciniza Hazardous Waste Facility Permit* throughout the life of the LTU. This monitoring has at no time indicated that a plume of contamination has migrated from the treatment zone; therefore, the requirements of 20 NMAC 4.1, subpart IX, §270.14(c) (4) do not apply.

E.2.2 Description of Wells [20 NMAC 4.1, subpart V, §264.97(a), (b), and (c); §264.98(b); subpart IX, §270.14(c) (5)]

20 NMAC 4.1, subpart V, §264.97 requires that the quality of the groundwater passing the point of compliance in the uppermost aquifer be monitored. 20 NMAC 4.1, subpart V, §264.95 defines the point of compliance as a vertical surface located at the hydraulically down gradient limit of the waste management unit that extends down into the uppermost aquifer underlying the unit. The uppermost aquifer beneath the LTU is the Sonsela, which is a confined aquifer that generally flows to the north/northeast under the LTU. The Gallup Refinery maintains four active groundwater monitoring wells (MWs) at/near the LTU (MW-1, MW-2, MW-4, and MW-5).

Pursuant to 20 NMAC subpart V, §264.97, the Gallup Refinery measured background conditions in the Sonsela by sampling groundwater from MW-4, which is completed in the same region of the Sonsela as MW-1, MW-2, and MW-5. MW-4 is located up gradient from the LTU. Water that passes beneath the LTU in the Sonsela is sampled from MW-1, MW-2, and MW-5, which are located on the down gradient edge of the LTU. MW-1, MW-2 and MW-5 are completed in the uppermost aquifer (i.e., Sonsela) at the point of compliance.

E.2.3 Sampling and Analysis Procedures [20 NMAC 4.1, subpart V, §264.97(d), (e), (f) and §264.98(d), (e), (f); subpart IX, §270.14(c) (5), and §270.14(c) (6) (iv)]

The Gallup Refinery obtains groundwater samples following the protocols in the Post Closure Monitoring Plan. The Post Closure Monitoring Plan identifies procedures for obtaining groundwater samples, decontaminating equipment, and COC; analytical parameters; analytical procedures; and QA/QC requirements. These procedures have been designed to ensure that monitoring results provide a reliable indication of groundwater quality below the LTU. The Gallup Refinery will determine groundwater elevations in MWs prior to well evacuation each time the groundwater is sampled. The Gallup Refinery will determine the groundwater surface elevation using the electric tape method or other acceptable method prior to obtaining samples. Using the groundwater surface elevation data, The Gallup Refinery will determine the groundwater flow rate and

the direction of flow in the Sonsela aquifer at least annually to ensure that the monitoring system location is adequate.

The Sonsela aquifer will be sampled annually for three years. After year three, the Sonsela aquifer will be sampled biennially up to and including year nine of the post closure care period; then the aquifer will be sampled in years 19 and 30 of post closure care period. The samples will be analyzed for both organics and metals in the modified Skinner List provided in Tables E-1A thru E-1D.

If Sonsela sampling results indicate that there is statistically significant increase of hazardous constituents in the Sonsela aquifer, notification of the increase will be provided to the NMED in writing within seven business days indicating which concentration limits have been exceeded. At that time, the Gallup Refinery will sample MW-1, MW-2, MW-4 and MW-5, to determine whether constituents in Appendix VIII of 20 NMAC 4.1, subpart V, 264 are present and in what concentrations. Within one month after determination and notification to NMED, the Gallup Refinery will re-sample these MWs and repeat the analysis for any compounds previously detected. Prior to submitting a modification request, the Gallup Refinery may demonstrate that the release is from a source other than the LTU or is from errors in sampling, analysis, or data evaluation. If confirmation sampling verifies Appendix VIII constituents, the Gallup Refinery will, within 90 days, submit an application to the NMED to establish a compliance monitoring program for the LTU using the detected compounds as a basis for the compliance monitoring program.

E.2.4 Indicator Parameters, Waste Constituents, Reaction Products to be Monitored [20 NMAC 4.1, subpart V, §264.98(a), subpart IX, §270.14(c) (6) (i)]

Selection of analytical parameters is based on the hazardous constituents expected to be present in the waste and their associated degradation products. Expected hazardous constituents were identified from the modified Skinner List and PHCs (collectively referred to as the modified Skinner List). PHCs are those identified on the *Ciniza Hazardous Waste Facility Permit* and the Modified Skinner List is a subset of 40 CFR

261 Appendix VIII constituents and identifies the specific hazardous constituents of concern that typically may be found in refinery waste. The analytical parameters for detection monitoring are listed in Tables E-1A thru E-1D.

E.2.5 Background Groundwater Quality and Concentration Values [20 NMAC 4.1, subpart V, §264.97(a) (1) and (g), §264.98(g), subpart IX, §270.14(c) (6) (iii)]

Background groundwater quality values were established for the LTU during the Land Treatment Demonstration; however, MW-4 will continue to be sampled at the same interval as the other MWs to continuously monitor any changes in background water quality. To ensure that sampling and analytical quality control (QC) is verified, analytical results for the up gradient well (MW-4) will be compared to down gradient wells (MW-1, MW-2, and MW-5). Statistical methods will be employed to determine whether fluctuations in results represent impacts from the LTU or reflect variances in sampling and analytical procedures, natural groundwater fluctuation, or other non-LTU influences. A summary of the statistical methods used is provided in Section E.2.6.

E.2.6 Statistical Procedures [20 NMAC 4.1, subpart V, §264.97(h), §264.97(i) (1), (5) and (6).

20 NMAC 4.1, subpart V, §264.97(h) requires that groundwater monitoring data be evaluated using statistical analysis. The Gallup Refinery has evaluated groundwater monitoring data using Cochran's approximation to the Behrens-Fisher Student's T-test for its existing groundwater monitoring program. The Gallup Refinery plans to continue using this methodology to evaluate groundwater monitoring data during the post closure care period. Details about the methodology used for the detection monitoring is included as Appendix E, Post Closure Monitoring Plan.

E.2.7 Notification and Reporting [20 NMAC 4.1, subpart V, §264.97(j) and §264.98(g)]

Pursuant to the requirements of 20 NMAC 4.1, subpart V, §264.97(j), the Gallup Refinery will submit a groundwater monitoring report annually to the NMED for review.

Table E-1A. Modified Skinner List 8260 Volatile Organics and PHCs[a]

Parameter	EPA Method SW-846	Description	Containers	Preservative	Holding Time/Days	Liquid Reporting[c] Limit (µg/L)	Soil Reporting[c] Limit (mg/kg)
Benzene	8260	GC/MS	G	4EC	14	5	0.67
2-Butanone (MEK)	8260	GC/MS	G	4EC	14	1900	7000
Carbon Disulfide	8260	GC/MS	G	4EC	14	1000	350
Chlorobenzene	8260	GC/MS	G	4EC	14	39	54
Chloroform	8260	GC/MS	G	4EC	14	0.16	0.24
Chloromethane	8260	GC/MS	G	4EC	14	1.5	1.2
1,1 Dichloroethane	8260	GC/MS	G	4EC	14	25	580
1,2 Dichloroethane	8260	GC/MS	G	4EC	14	5	0.34
1,1 Dichloroethene	8260	GC/MS	G	4EC	14	5.0	0.053
trans-1,2-Dichloroethene	8260	GC/MS	G	4EC	14	100	63
1,4-Dioxane	8260	GC/MS	G	4EC	14	6.1	44
Ethylbenzene[a]	8260	GC/MS	G	4EC	14	700	230
Methylene Chloride	8260	GC/MS	G	4EC	14	4.3	8.6
Styrene	8260	GC/MS	G	4EC	14	100	1700
1,1,2,2-Tetrachloroethane[b]	8260	GC/MS	G	4EC	14	0.055	0.37
Tetrachloroethene[b]	8260	GC/MS	G	4EC	14	5	4.9
Toluene	8260	GC/MS	G	4EC	14	1000	1000
1,1,1-Trichloroethane	8260	GC/MS	G	4EC	14	60	200
Trichloroethene	8260	GC/MS	G	4EC	14	5	2.7
Total Xylene[a, d]	8260	GC/MS	G	4EC	14	10,000	860
Ethylene Dibromide[b]	8260	GC/MS	G	4EC	14	0.1	0.005
Acetone	8260	GC/MS	G	4EC	14	610	1500

[a]Principal hazardous constituent identified in Ciniza Hazardous Waste Facility Permit.
[b]Additional constituents.
[c]Based on EPA Region 6, Human Health Medium-Specific Screening Levels (1999) and NM WQCC Regulations (1996). Analytical detection limits are required to be lower than reporting limits.
[d]Regulatory limits for individual isomers combined into a 'total' limit for these compounds.

mg/kg = milligrams per kilogram
Φg/L = microgram per liter
G = glass with Teflon-lined lid
GC/MS = gas chromatography/mass spectrometry

Table E-1B. Modified Skinner List 8270 Semivolatile Organics Including TPH and PHCs[a]

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Liquid Reporting Limit (µg/L)[c]	Soil Reporting Limit (mg/kg)[c]
Anthracene	8270	GC/MS	G	4EC	14	1800	16000
Acenaphthene	8270	GC/MS	G	4EC	14	370	2800
Benzo(a)Anthracene	8270	GC/MS	G	4EC	14	0.09	0.62
Benzo(b)Fluoranthene	8270	GC/MS	G	4EC	14	0.09	0.62
Benzo(k)Fluoranthene	8270	GC/MS	G	4EC	14	0.9	6.2
Benzo(a)Pyrene[a]	8270	GC/MS	G	4EC	14	0.0007	0.062
Butyl Benzyl Phthalate	8270	GC/MS	G	4EC	14	7300	240
Chrysene[a]	8270	GC/MS	G	4EC	14	9.2	62
Diethyl Phthalate	8270	GC/MS	G	4EC	14	29000	49000
7,12-Dimethylbenz(a)-Anthracene	8270	GC/MS	G	4EC	14	[e]	[e]
Dimethyl Phthalate	8270	GC/MS	G	4EC	14	370000	100000
Di-n-Octyl Phthalate	8270	GC/MS	G	4EC	14	730	1200
Fluoranthene	8270	GC/MS	G	4EC	14	1500	2300
Fluorene	8270	GC/MS	G	4EC	14	240	2000
Indeno(1,2,3-cd)Pyrene	8270	GC/MS	G	4EC	14	0.09	0.62
2-Methylnaphthalene[a]	8270	GC/MS	G	4EC	14	30	660
2-Methylphenol (Cresol)	8270	GC/MS	G	4EC	14	1800	3000
3/4-Methylphenol (Cresol)	8270	GC/MS	G	4EC	14	1980	3300
Naphthalene[g]	8270	GC/MS	G	4EC	14	30	55
Nitrobenzene	8270	GC/MS	G	4EC	14	3.4	17
4-Nitrophenol	8270	GC/MS	G	4EC	14	2300	3800
Phenanthrene[a]	8270	GC/MS	G	4EC	14	[e]	[e]
Pyrene[a]	8270	GC/MS	G	4EC	14	180	1700
Pyridine	8270	GC/MS	G	4EC	14	37	61
Quinoline	8270	GC/MS	G	4EC	14	0.0056	0.04
Benzenethiole	8270	GC/MS	G	4EC	14	[e]	[e]
Phenol	8270	GC/MS	G	4EC	14	5	36000
Bis(2-Ethylhexyl)phthalate[b]	8270	GC/MS	G	4EC	14	6.0	35
Dibenz(a,j)acridine[b]	8270	GC/MS	G	4EC	14	[e]	[e]
Dibenz(a,h)-anthracene	8270	GC/MS	G	4EC	14	0.0092	0.062
Dichlorobenzene[b, f]	8270	GC/MS	G	4EC	14	675	410
Methyl Naphthalene	8270	GC/MS	G	4EC	14	30	[e]
2,4-Dimethylphenol	8270	GC/MS	G	4EC	14	730	1200
2,4-Dinitrotoluene	8270	GC/MS	G	4EC	14	73	120

Table E-1B. Modified Skinner List 8270 Semivolatile Organics Including TPH and PHCs[a] (Continued)

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Liquid Reporting Limit (µg/L)[c]	Soil Reporting Limit (mg/kg)[c]
2,4-Dinitrophenol[b]	8270	GC/MS	G	4EC	14	73	120
Benzo(j)Fluoranthene	8270	GC/MS	G	4EC	14	[e]	[e]
2-Chlorophenol	8270	GC/MS	G	4EC	14	30	61
2,4,6-Trichlorophenol	8270	GC/MS	G	4EC	14	6.1	44
Di-n-Butyl Phthalate	8270	GC/MS	G	4EC	14	3700	6100
Benzyl Alcohol[b]	8270	GC/MS	G	4EC	14	11000	18000
Methyl Chrysene	8270	GC/MS	G	4EC	14	[e]	[e]
Total Cresol[a, f]	8270	GC/MS	G	4EC	14	3780	6300
TPH[h]	8015m	GS	G	4EC	7	—	1000

[a]Principal hazardous constituent identified in Ciniza Hazardous Waste Facility Permit.
[b]Additional constituents.
[c]Based on EPA Region 6, Human Health Medium-Specific Screening Levels (1999) and NM WQCC Regulations (1996). Analytical detection limits are required to be lower than reporting limits.
[e]No regulatory limit provided. Laboratory detection limit will be used.
[f]Regulatory limits for individual isomers combined into a 'total' limit for these compounds.
[g]Total naphthalene plus monomethylnaphthalenes regulatory limit is < 30µg/L for aqueous samples.
[h]Total Petroleum Hydrocarbon as Gasoline Range Organics and Diesel Range Organics

Φg/L = microgram per liter
mg/kg = milligram per kilogram
G = glass with Teflon-lined lid
GC/MS = gas chromatography/mass spectrometry
GC = gas chromatography

Table E-1C. Modified Skinner List Metals and PHCs[a]

Parameter	EPA Method SW-846	Description	Container	Preservative [b]	Holding Time/Days	Aqueous Reporting Limit (µg/L)[c]	Soil Reporting Limit (mg/kg)[c]
Antimony	7060(aq), 6010	GFAA/ICP	P or G	4EC	180	6.0	31
Arsenic	6010	ICP-AES	P or G	4EC	180	50	22
Barium	6010	ICP-AES	P or G	4EC	180	2000	5400
Beryllium	6010	ICP-AES	P or G	4EC	180	4.0	150
Cadmium	6010	ICP-AES	P or G	4EC	180	5.0	39
Chromium[a]	6010	ICP-AES	P or G	4EC	180	50	210
Cobalt	6010	ICP-AES	P or G	4EC	180	50	3400
Lead[a]	6010	ICP-AES	P or G	4EC	180	15	400
Nickel	6010	ICP-AES	P or G	4EC	180	100	1600
Selenium	6010	ICP-AES	P or G	4EC	180	50	390
Silver	6010	ICP-AES	P or G	4EC	180	50	390
Vanadium	6010	ICP-AES	P or G	4EC	180	260	550
Zinc	6010	ICP-AES	P or G	4EC	180	10000	23000

[a]Principal hazardous constituent identified in Ciniza Hazardous Waste Facility Permit.
[b]Aqueous samples are field acidified to pH < 2 with HNO_3 and must not be refrigerated. Non-aqueous samples are cooled to 4°C.
[c]Based on EPA Region 6, Human Health Medium-Specific Screening Levels (1999) and NM WQCC Regulations (1996). Analytical detection limits are required to be lower than reporting limits.

µg/l = microgram per liter
mg/kg = milligram per kilogram
ICP-AES = Inductively Coupled Plasma - Atomic Emission Spectroscopy
G = glass
P = linear polyethylene, polypropylene, or Teflon

Table E-1D. Mercury[a] and Cyanide

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Aqueous Reporting Limit (µg/L)[c]	Soil Reporting Limit (mg/kg)[c]
Mercury[a]	7470/7471	CVAA	P or G	4EC[b]	28	2.0	23.
Cyanide	335.3/ 9010, 9014	Colorimetry	P or G	4EC[d]	14	200	1200

[a]Principal hazardous constituent identified in Ciniza Hazardous Waste Facility Permit.

[b]Aqueous samples are field acidified to pH < 2 with HNO_3 and must not be refrigerated. Non-aqueous samples are cooled to 4°C.

[c]Based on EPA Region 6, Human Health Medium-Specific Screening Levels and NM WQCC Regulations (1996). Analytical detection limits are required to be lower than reporting limits.

[d]Aqueous samples are field adjusted to pH >12 with NaOH and refrigerated. Non-aqueous samples are cooled to 4EC.

µg/l = microgram per liter
mg/kg = milligram per kilogram
CVAA = cold vapor atomic absorption
G = glass
P = linear polyethylene, polypropylene, or Teflon

Table E-2A. Inorganic Parameters – ZOI, Treatment Zone, BTZ – 1999

Sample Number	Analyte	pH	Total Phosphorus	Oil & Grease	Total Organic Carbon	Total Kjeldahl Nitrogen
	Reporting Limit	NA	0.025	50	0.05	50
	Units	pH units	mg/Kg	mg/Kg	%	mg/Kg
ZOI-3-38-051899		6.60	0.06	3500	1.7	500
3FT-3-38-051899		*	*	*	*	*
BTZ-3-38-051899		8.35	*	*	0.27	*
ZOI-3-97-051899		8.01	0.54	900	0.50	190
3FT-3-97-051899		*	*	*	*	*
BTZ-3-97-051899		8.57	*	*	0.18	*
ZOI-3-135-051899		8.48	0.24	<50	0.26	320
3FT-3-135-051899		*	*	*	*	*
BTZ-3-135-051899		8.41	*	*	0.32	*
ZOI-3-152-051899		8.40	0.19	<50	0.36	300
3FT-3-152-051899		*	*	*	*	*
BTZ-3-152-051899		8.93	*	*	0.14	*
ZOI-2-40-051899		7.09	0.24	18000	5.8	700
3FT-2-40-051899		*	*	*	*	*
BTZ-2-40-051899		8.05	*	*	0.31	*
ZOI-2-41-051899		8.09	0.2	4500	3.2	540
3FT-2-41-051899		*	*	*	*	*
BTZ-2-41-051899		8.10	*	*	0.31	*
ZOI-2-107-051899		7.47	0.17	7000	3.4	510
3FT-2-107-051899		*	*	*	*	*
BTZ-2-107-051899		8.40	*	*	0.22	*
ZOI-1-40-051899		7.61	0.13	6600	2.8	730
3FT-1-40-051899		*	*	*	*	*
BTZ-1-40-051899		8.39	*	*	0.22	*

Table E-2A. Inorganic Parameters – ZOI, Treatment Zone, BTZ – 1999 (Continued)

Sample Number	Analyte	pH	Total Phosphorus	Oil & Grease	Total Organic Carbon	Total Kjeldahl Nitrogen
	Reporting Limit	NA	0.025	50	0.05	50
	Units	pH units	mg/Kg	mg/Kg	%	mg/Kg
ZOI-1-98-051899		7.20	0.27	4900	2.6	500
3FT-1-98-051899		*	*	*	*	*
BTZ-1-98-051899		8.42	*	*	0.29	*
ZOI-1-143-051899		7.90	0.18	10000	5.5	230
3FT-1-143-051899		*	*	*	*	*
BTZ-1-143-051899		8.54	*	*	0.37	*

NOTE:
* Analysis not required

Table E-2B. ICP 6010 Metals and Mercury – ZOI, Treatment Zone, BTZ – 1999

Sample Number	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Nickel	Selenium	Vanadium	Mercury
ZOI-3-38-051899	<1.2	3.9	340	<1.2	<1.2	190	5.1	21	11	<1.2	16	<0.1
3FT-3-38-051899	<1.2	1.5	200	1.4	<1.2	8.9	5	11	9.8	<1.2	18	<0.1
BTZ-3-38-051899	<1.2	2.4	300	1.4	<1.2	25	8.6	12	20	<1.2	43	<0.1
ZOI-3-97-051899	<1.2	1.6	360	1.4	<1.2	24	7	12	14	<1.2	30	<0.1
3FT-3-97-051899	<1.2	1.6	310	1.8	<1.2	27	8.8	13	19	<1.2	40	<0.1
BTZ-3-97-051899	<1.1	1.6	330	1.2	<1.1	10	5.3	9.1	11	<1.1	22	<0.1
ZOI-3-135-051899	3.8	17	3400	11	<1.2	130	63	120	130	<1.2	220	<0.1
3FT-3-135-051899	<1.1	1.7	360	1.5	<1.1	24	8.4	12	18	<1.1	36	<0.1
BTZ-3-135-051899	<1.2	1.4	330	1.6	<1.2	6.2	4.1	10	7.6	<1.2	16	<0.1
ZOI-3-152-051899	<1.2	1.5	350	1.5	<1.2	8.5	5.3	10	11	<1.2	17	<0.1
3FT-3-152-051899	<1.1	1.4	370	1.4	<1.1	17	7	11	15	<1.1	27	<0.1
BTZ-3-152-051899	<1.1	1.1	430	<1.1	<1.1	7.8	4.7	8.5	8.8	<1.1	18	<0.1
ER-POST CELL 1-98-0518-99	<0.01	<0.01	<0.01	0.004	0.004	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.002
ZOI-2-40-051899	<1.1	20	710	<1.1	<1.1	200	9.7	87	54	<1.1	40	13
3FT-2-40-051899	<1.2	1.2	310	1.3	<1.2	7.4	4.9	9.6	9.4	<1.2	14	<0.1
BTZ-2-40-051899	<1.2	1.4	260	1.5	<1.2	17	6.9	12	15	<1.2	27	0.18
ZOI-2-41-051899	1.2	10	550	<1.2	<1.2	310	8.2	54	32	3.3	35	8.4
3FT-2-41-051899	<1.2	13	290	1.7	<1.2	18	7	13	15	<1.2	28	<0.1
BTZ-2-41-051899	<1.1	1.8	270	1.4	<1.1	18	7.1	12	15	<1.1	30	<0.1
ZOI-2-107-051899	<2.5	7.5	350	<1	0.78	220	6.2	40	24	<2.5	21	1.6

Table E-2B. ICP 6010 Metals and Mercury – ZOI, Treatment Zone, BTZ – 1999 (Continued)

Sample Number	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Nickel	Selenium	Vanadium	Mercury
3FT-2-107-051899	<2.5	<2.5	290	<1	<0.5	9.4	4.3	11	9.4	<2.5	15	<0.1
BTZ-2-107-051899	<2.5	<2.5	230	1.1	<0.5	12	5.1	10	12	<2.5	19	<0.1
ZOI-1-40-051899	<2.5	<2.5	290	<1	<0.5	190	7.1	40	28	<2.5	30	0.13
3FT-1-40-051899	16	<2.5	180	1.1	<0.5	9.5	4.1	11	9.4	<2.5	16	<0.1
BTZ-1-40-051899	<2.5	<2.5	210	<1	<0.5	12	5.2	8.9	13	<2.5	20	<0.1
ZOI-1-98-051899	<2.5	<2.5	1100	<1	<0.5	58	6.6	18	13	<2.5	13	2
3FT-1-98-051899	<2.5	<2.5	140	<1	<0.5	7	<2.5	7.9	7	<2.5	12	<0.1
BTZ-1-98-051899	<2.5	<2.5	210	1.1	<0.5	15	5.7	11	13	<2.5	19	<0.1
ZOI-1-143-051899	<2.5	14	350	<1	<0.5	140	5.7	53	39	<2.5	35	1.4
3FT-1-143-051899	<2.5	<2.5	240	<1	<0.5	14	5.7	10	13	<2.5	20	<0.1
BTZ-1-143-051899	<2.5	<2.5	240	1	<0.5	9.2	<2.5	9.1	10	<2.5	13	<0.1

NOTES:

Units are mg/Kg (ER-POST CELL-1-98-0518-99 units are µg/L).
Results are reported on a dry weight basis.

Table E-2C. Volatile Analysis by SW-846 Method 8260 – ZOI, Treatment Zone, BTZ – 1999

Sample Number	Chloromethane	Acetone	1,1-Dichloroethene	Methylene Chloride	1,4-Dioxane	1,1-Dichloroethane	Trans-1,2-Dichloroethene	2-Butanone	Carbon Disulfide	Chloroform	1,2-Dichloroethane	1,1,1-Trichloroethane	Benzene	Trichloroethane	Toluene	1,2-Dibromoethane	Tetrachloroethene	Chlorobenzene	Ethylbenzene	o-Xylene	m&p-Xylenes	Styrene	1,1,2,2-Tetrachloroethane	% Moisture
ZOI-3-38-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21
3FT-3-38-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21
BTZ-3-38-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
ZOI-3-97-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
3FT-3-97-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27
BTZ-3-97-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
ZOI-3-135-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
3FT-3-135-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
BTZ-3-135-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
TRIP BLANK COOLER 1[a]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZOI-3-152-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
3FT-3-152-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
BTZ-3-152-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10
ER-POST CELL 1-98-0518-99[a]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZOI-2-40-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
3FT-2-40-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9

Table E-2C. Volatile Analysis by SW-846 Method 8260 – ZOI, Treatment Zone, BTZ – 1999 (Continued)

Sample Number	Chloromethane	Acetone	1,1-Dichloroethene	Methylene Chloride	1,4-Dioxane	1,1-Dichloroethane	Trans-1,2-Dichloroethene	2-Butanone	Carbon Disulfide	Chloroform	1,2-Dichloroethane	1,1,1-Trichloroethane	Benzene	Trichloroethane	Toluene	1,2-Dibromoethane	Tetrachloroethene	Chlorobenzene	Ethylbenzene	o-Xylene	m&p-Xylenes	Styrene	1,1,2,2-Tetrachloroethane	% Moisture
BTZ-2-40-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
ZOI-2-41-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
3FT-2-41-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
BTZ-2-41-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
ZOI-2-107-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
3FT-2-107-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
BTZ-2-107-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
TRIP BLANK 2[a]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZOI-1-40-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
3FT-1-40-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
BTZ-1-40-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
ZOI-1-98-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
3FT-1-98-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
BTZ-1-98-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
ZOI-1-143-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19

Table E-2C. Volatile Analysis by SW-846 Method 8260 – ZOI, Treatment Zone, BTZ – 1999 (Continued)

Sample Number	Chloromethane	Acetone	1,1-Dichloroethene	Methylene Chloride	1,4-Dioxane	1,1-Dichloroethane	Trans-1,2-Dichloroethene	2-Butanone	Carbon Disulfide	Chloroform	1,2-Dichloroethane	1,1,1-Trichloroethane	Benzene	Trichloroethane	Toluene	1,2-Dibromoethane	Tetrachloroethene	Chlorobenzene	Ethylbenzene	o-Xylene	m&p-Xylenes	Styrene	1,1,2,2-Tetrachloroethane	% Moisture
3FT-1-143-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
BTZ-1-143-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13

[a] Aqueous sample

NOTES:

- Not detected above Reporting Limit

Reporting Limit varies with sample % moisture.

Reporting Limit maximum for soil samples was 0.07 mg/Kg for all analytes except 1,4 Dioxane (6.3 mg/Kg) and 2-Butanone (0.6 mg/Kg).

Reporting Limit for aqueous samples was 1.0 µg/L for all analytes except 1,4 Dioxane (100 µg/L) and Acetone and 2-Butanone (10 µg/L).

Table E-2D. Semivolatile Analysis by SW-846 Method 8270B – ZOI, Treatment Zone, BTZ – 1999

Analyte	ZOI-3-38-051899	3FT-3-38-051899	BTZ-3-38-051899	ZOI-3-97-051899	3FT-3-97-051899	BTZ-3-97-051899	ZOI-3-135-051899	3FT-3-135-051899	BTZ-3-135-051899	ZOI-3-152-051899	3FT-3-152-051899	BTZ-3-152-051899	ER-POST CELL 1-98-0518-99	ZOI-2-40-051899	3FT-2-40-051899	BTZ-2-40-051899	ZOI-2-41-051899	3FT-2-41-051899	BTZ-2-41-051899	ZOI-2-107-051899	3FT-2-107-051899	BTZ-2-107-051899	ZOI-1-40-051899	3FT-1-40-051899	BTZ-1-40-051899	ZOI-1-98-051899	3FT-1-98-051899	BTZ-1-98-051899	ZOI-1-143-051899	3FT-1-143-051899	BTZ-1-143-051899
1,2-Dichlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1-Methylnaphthalene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4,6-Trichlorophenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dimethylphenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dinitrophenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorophenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylphenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3&4-Methylphenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3-Methylcholanthrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Nitrophenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6-Methyl Chrysene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.43	-	-
7,12-Dimethylbenz(a) anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.18	-	-
Anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-

Table E-2D. Semivolatile Analysis by SW-846 Method 8270B – ZOI, Treatment Zone, BTZ – 1999 (Continued)

Analyte	ZOI-3-38-051899	3FT-3-38-051899	BTZ-3-38-051899	ZOI-3-97-051899	3FT-3-97-051899	BTZ-3-97-051899	ZOI-3-135-051899	3FT-3-135-051899	BTZ-3-135-051899	ZOI-3-152-051899	3FT-3-152-051899	BTZ-3-152-051899	ER-POST CELL 1-98-0518-99	ZOI-2-40-051899	3FT-2-40-051899	BTZ-2-40-051899	ZOI-2-41-051899	3FT-2-41-051899	BTZ-2-41-051899	ZOI-2-107-051899	3FT-2-107-051899	BTZ-2-107-051899	ZOI-1-40-051899	3FT-1-40-051899	BTZ-1-40-051899	ZOI-1-98-051899	3FT-1-98-051899	BTZ-1-98-051899	ZOI-1-143-051899	3FT-1-143-051899	BTZ-1-143-051899
Benzo(b)&(j)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.44	-	-
Benz(k)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzyl alcohol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Butyl benzyl phthalate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	2.33	-	-	-	-	-	-	-	-	-	-	-	-	3.13	-	-	-	-	-	-	-	-	2.31	-	-	3.39	-	-	-	-	-
Di-n-butyl phthalate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Di-n-octyl phthalate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)acridine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,j)acridine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diethyl phthalate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dimethyl phthalate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.32	-	-	-	-	-	-	-	-	-	-	-	5.38	-	-

Table E-2D. Semivolatile Analysis by SW-846 Method 8270B – ZOI, Treatment Zone, BTZ – 1999 (Continued)

Analyte	ZOI-3-38-051899	3FT-3-38-051899	BTZ-3-38-051899	ZOI-3-97-051899	3FT-3-97-051899	BTZ-3-97-051899	ZOI-3-135-051899	3FT-3-135-051899	BTZ-3-135-051899	ZOI-3-152-051899	3FT-3-152-051899	BTZ-3-152-051899	ER-POST CELL 1-98-0518-99	ZOI-2-40-051899	3FT-2-40-051899	BTZ-2-40-051899	ZOI-2-41-051899	3FT-2-41-051899	BTZ-2-41-051899	ZOI-2-107-051899	3FT-2-107-051899	BTZ-2-107-051899	ZOI-1-40-051899	3FT-1-40-051899	BTZ-1-40-051899	ZOI-1-98-051899	3FT-1-98-051899	BTZ-1-98-051899	ZOI-1-143-051899	3FT-1-143-051899	BTZ-1-143-051899
Phenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	0.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.63	-	-
Pyridine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Quinoline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
% Moisture	16	19	16	16	16	13	14	13	14	15	13	10	-	9	17	15	16	18	13	16	19	13	21	18	12	16	13	13	17	16	12

NOTES:

Units are mg/Kg.

- Not detected at reporting limit.

Reporting limit varies with dilution and % moisture: 0.38-4.23 mg/Kg for 2,4-Dinitrophenol, 4-Nitrophenol, and Benzyl alcohol, 0.186-2.11 mg/Kg for all other compounds.

Sample ER-POST-1-98-0518-99 is aqueous. Reporting limits are 10 μg/L for 2,4-Dinitrophenol and 4-Nitrophenol, and 5 μg/L for all other compounds reported.

Table E-3A

EPA METHOD 8015B – Gallup Refinery Z01 and TZ 2009

Fall of 2009 – 9 year Sampling Event

Sample ID	DRO 8015B	GRO 8015B	Units
Z0I-1-371-120809	ND	ND	mg/kg
Z0I-1-2521-120909	ND	ND	mg/kg
Z0I-2-8334-120909	7000	ND	mg/kg
Z0I-2-4139-120909	9400	ND	mg/kg
Z0I-3-3414-120909	1800	ND	mg/kg
Z0I-3-7544-121109	270	ND	mg/kg
TZ-1-371-121109	ND	ND	mg/kg
TZ-1-2521-121109	ND	ND	mg/kg
TZ-2-4139-121109	ND	ND	mg/kg
TZ-2-8334-121109	ND	ND	mg/kg
TZ-3-3414-121109	ND	ND	mg/kg
TZ-3-7544-121109	ND	ND	mg/kg
NMWQS	0.2		
EPA MCL			

ND = Non Detect

Table E-3B. Gallup Refinery Z0I and TZ Analytical Results 2009

FALL 2009 – 9 YEAR SAMPLING

EPA 6020A, RCRA METALS; EPA 9012B, TOTAL AND AMENABLE CYANIDE; EPA 7471A, MERCURY
(Units in mg/kg)

Sample ID	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Cyanide	Lead	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc	% Moisture
Z0I-1-371-120809	ND	1.71	314	1.51	ND	26.1	8.54	ND	13.6	ND	18.9	ND	ND	29.0	32.4	12.4
Z0I-1-2521-120909	ND	1.56	389	1.73	ND	26.4	8.99	ND	15.5	ND	19.5	ND	ND	30.8	30.1	30.1
Z0I-2-8334-120909	ND	14.5	481	1.03	ND	123	12.6	10.8	89.7	6.14	46.7	ND	ND	43.7	718	18.6
Z0I-2-4139-120909	ND	10.5	619	1.47	1.11	638	11.4	28.9	79.4	4.23	33.8	1.75	ND	43.9	924	19.4
Z0I-3-3414-120909	ND	6.96	302	1.10	ND	122	12.4	5.22	61.1	1.31	26.9	ND	ND	34.1	235	10.4
Z0I-3-7544-121109	ND	2.69	441	1.61	ND	135	9.59	6.74	23.6	0.399	24.2	ND	ND	40.9	152	14.5
TZ-1-371-121109	ND	1.49	275	1.50	ND	22.1	8.01	ND	13.3	ND	16.1	ND	ND	29.6	25.4	12.6
TZ-1-2521-121109	ND	1.72	281	1.70	ND	29.6	9.54	ND	14.6	ND	22.8	ND	ND	35.7	36.8	20
TZ-2-4139-121109	ND	1.60	326	1.91	ND	32.3	10.3	ND	15.6	ND	21.9	ND	ND	40.3	35.3	15.7
TZ-2-8334-121109	ND	1.68	328	1.53	ND	27.6	8.61	ND	16.6	0.135	17.9	ND	ND	33.2	44.7	16.9
TZ-3-3414-121109	ND	1.71	462	1.85	ND	29.5	9.93	ND	15.5	ND	20.8	ND	ND	36.2	33.2	14.7
TZ-3-7544-121109	ND	1.40	393	1.70	ND	28.3	9.20	ND	14.8	ND	18.7	ND	ND	35.7	30.5	12.9
NMWQS	.0056	.0023	2	.004	.005	0.1		0.2	0.05		0.1	.05			7.4	
EPA MCLS	..006	0.01	2	.004	.005	0.1		0.2	.015	.002		.05				

ND = Non Detect

Table E-3C Gallup Refinery Z01 and TZ Analytical Results 2009

Fall of 2009 – 9 year Sampling Event

EPA METHOD 8270C – Semi Volatiles (Units are in mg/kg)

Sample ID	ZOI-1-371-120809	ZOI-2521-120909	ZOI-8334-120909	ZOI-4139-120909	ZOI-3414-120909	ZOI-7544-121109	TZ-1-371-121109	TZ-1-2521-121109	TZ-2-4139-121109	TZ-2-8334-121109	TZ-3-3414-121109	TZ-3-7544-121109	NMWQS	EPA MCLs
1-methylnaphthalene	-	-	0.246	-	-	-	-	-	-	-	-	-		
2-methylnaphthalene	-	-	0.408	-	-	-	-	-	-	-	-	-		
3+4-Methylphenol	-	-	-	0.454	0.104	-	-	-	-		-	-		
5+6 Methylchrysene	-	-	38.5	40.8	0.740	4.73	-	-	-	0.817	-	-		
Anthracene	-	-	-	-	0.088	-	-	-	-	-	-	-	8.3	
Benzenethiole	-	-	0.292	3.04	0.292	0.401	-	-	-	-	-	-		
Benzo(a)anthracene	-	-	1.22	0.889	-	0.361	-	-	-	-	-	-	.000038	
Benzo(a)pyrene	-	-	8.18	12.1	0.701	2.60	-	-	-	0.237	-	-	.000038	.0002
Benzo(b)fluoranthene	-	-	1.27	-	-	-	-	-	-	-	-	-	.000038	
Butylbenzylphthalate	-	-	-	0.436	-	-	-	-	-	-	-	-		
bis(2-Ethylhexyl)phthalate	-	-	-	-	-	-	0.082	0.101	0.093	0.195	0.101	-	.012	.006
Chrysene	-	-	9.12	13.0	0.401	1.54	-	-	-	0.328	-	-	.000038	
Cresol(total)	-	-	-	0.454	0.104	-	-	-	-	-	-	-		
Dibenz(a,h)anthracene	-	-	0.943	-	-	0.531	-	-	-	-	-	-	.000038	
Diethylphthalate	-	0.408	0.204	-	0.378	-	0.158	0.185	0.143	0.133	0.063	-	17	
Di-n-octylphthalate	-	-	-	-	-	-	-	-	-	0.135	-	-		
Ideno(1,2.3-cd)pyrene	-	-	0.450	-	-	0.294	-	-	-	-	-	-	.000038	
Naphthalene	-	-	0.161	-	-	-	-	-	-	-	-	-		
Phenanthrene	-	-	-	-	-	0.121	-	-	-	-	-	-		
Phenol	-	-	-	0.200	0.151	-	-	-	-	-	-	-	21	
Pyrene	-	-	2.88	3.63	-	0.125	-	-	-	0.105	-	-	.83	

Table E-3D Gallup Refinery Z01 and TZ Analytical Results 2009

Fall of 2009 – 9 year Sampling Event

EPA METHOD 8260B –Volatile Organics.
(Units are in mg/kg)

Sample ID	ZOI-1-371-120809	ZOI-1-2521-120909	ZOI—2-8334-120909	ZOI-2-4139-120909	ZOI-3-414-120909	ZOI-3-7544--121109	TZ-1-371-121109	TZ-1-2521-121109	TZ-2-4139-121109	TZ-2-8334-121109	TZ-3-3414-121109	TZ-3-7544-121109	NMWQS	EPA MCLs
Benzene	-	-	.00629	-	-	-	-	-	-	-	-	-	0.01	.005
Carbon Disulfide	-	-	.00845	.00536	-	-	-	-	-	-	-	-		
Ethylbenzene	-	-	.00740	-	-	-	-	-	-	-	-	-	.75	0.7
M+p-Xylene	.00566	-	.0179	.00773	.00882	-	-	-	-	-	-	-		
0-Xylene	-	-	.00709	-	-	-	-	-	-	-	-	-		
Toluene	-	-	.0153	-	.00832	-	-	-	-	-	-	-	0.75	1

Table E-3E. Sample Results from Chinle Slope Wash and Sonsela 2009

2009 Sampling Event – July 2009

SM4500-H+B: PH; EPA 120:1, EPA Method 300.0: Anions, EPA Method 8015B DRO/GRO

Sample ID	Collection Date	pH	Specific Conductance (mhos/cm)	Fl (mg/L)	Cl (mg/L)	Nitrate (mg/L)	Phosphorous, Orthophosphate (as P) (mg/L)	Sulfate (mg/L)	DRO (mg/L)	GRO (mg/L)
MW-4	7/8/09	8.74	1200	0.37	16	-	-	160	-	-
MW-5	7/15/09	8.96	1100	0.76	66	-	-	180	-	-
MW-1	7/16/09	9.02	1100	0.76	53	-	-	160		
MW-2	7/16/09	9.00	1100	0.82	60	-	-	170	-	-
SMW-2	7/27/09	7.61	7700	0.32	2300	-	-	1700	-	0.73
SMW-4	7/27/09	8.53	1300	1.2	58	-	-	170	-	-

RCRA metals found in Chinle Slope Wash and Sonsela Wells

Sample ID	Collection Date	Method	Barium (mg/L)	Beryllium (mg/L)	Cadmium (mg/L)	Calcium (mg/L)	Chromium (mg/L)	Cobalt (mg/L)	Lead (mg/L)	Magnesium (mg/L)	Nickel (mg/L)	Potassium (mg/L)	Silver (mg/L)	Sodium (mg/L)	Vanadium (mg/L)	Zinc (mg/L)
Standards	NMWQS		2	.004	.005		0.1		.05		.01					7.4
	EPA MCLS		2	.004	.005		0.1		.015							
	RRSL															
MW-4	7/8/09	6010B	.022	-	-	1.7	-	-	-	-	-	-	-	280	-	-
MW-5	7/15/09	6010B	.017	-	-	1.5	-	-	-	-	-	-	-	260	-	-
MW-1	7/16/09	6010B	.015	-	-	2.1	-	-	-	-	-	-	-	250	-	-
MW-2	7/16/09	6010B	.019	-	-	1.6	-	-	-	-	-	-	-	250	-	-
SMW-2	7/27/09	6010B	.016	-	-	220	-	-	.0063	68	-	1.1	-	2000	-	-
SMW-4	7/27/09	6010B	.028	-	-	4.4	.0075	.010	-	1.4	-	-	-	310	-	-

Sample ID	Collection Date	Method	Antimony (mg/L)	Arsenic (mg/L)	Selenium (mg/L)	Cyanide (mg/L)	Mercury (mg/L)
Standards	NMWQS		.0056	.0023	.05	0.2	
	EPA MCLS		.006	0.01	.05	.002	.002
	RRSL						
MW-4	7/8/09	6020A/335.4/7470	.022	-		-	-
MW-5	7/15/09	6020A/335.4/7470	-	-	-	-	-
MW-1	7/16/09	6020A/335.4/7470	-	.00124	-	-	-
MW-2	7/16/09	6020A/335.4/7470	-	.00104	-	-	-
SMW-2	7/27/09	6020A/335.4/7470	-	.00384	.00474	0.0662	-
SMW-4	7/27/09	6020A/335.4/7470	-	.00297	-	-	-

Notes:
- = No Detect

Table E-3E: Sample Results from Chinle Slope Wash and Sonsela Wells

2009 Special Sampling Event

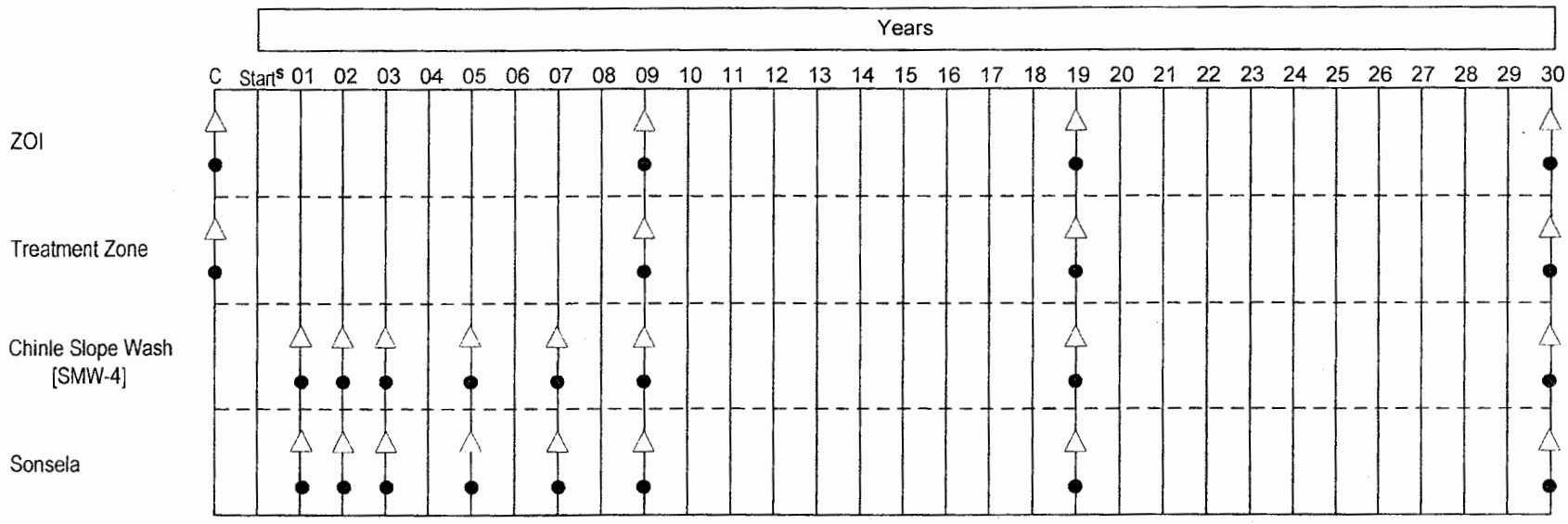
VOCs results in sample wells.

Sample ID	Collection Date	Method	Acetone (mg/L)	0-Xylene (mg/L)	Toluene (mg/L)
Standards	NMWQS				0.75
	EPA MCLS				1.0
	RRSL		22.0		0.0015
MW-4	7/8/09	8260B		.00059	.0008
MW-5	7/15/09	8260B	.00492		
MW-1	7/16/09	8260B	-	-	-
MW-2	7/16/09	8260B	-	-	-
SMW-2	7/27/09	8260B	.00625		
SMW-4	7/27/09	8260B	-	-	-

Semi-VOC results in sample wells

Sample ID	Collection Date	Method	bis(2-Ethylhexyl)phthalate (mg/L)	Diethylphthalate (mg/L)
Standards	NMWQS		.012	17
	EPA MCLS		.006	
	RRSL			
MW-4	7/8/09	8270C	No detect for all parameters	
MW-5	7/15/09	8270C	No detect for all parameters	
MW-1	7/16/09	8270C	No detect for all parameters	
MW-2	7/16/09	8270C	No detect for all parameters	
SMW-2	7/27/09	8270C	No detect for all parameters	
SMW-4	7/27/09	8270C	.00105	.00148

Notes:
- = No Detect



△ = Modified Skinner List - Metals

● = Modified Skinner List - Organics

s = Begin sample activities within 90 days of post-closure permit issuance

c = May 1999 special sample event

Figure E-1. LTU Post-Closure Sampling Schedule

Section F.0

F.0 PROCEDURES TO PREVENT HAZARDS

This section describes procedures to prevent hazards at the Gallup Refinery LTU in accordance with the applicable requirements of 20 NMAC 4.1 subpart V, §264.14, §264.15 and §264.31; and Subpart IX, §270.14(b) (8). The LTU is designed and will be operated during the post closure period to minimize the possibility of fire, explosion, or unplanned releases of hazardous constituents to any environmental medium that could potentially harm human health and the environment. Information on the procedures to prevent hazards at the LTU is provided for the following subject areas:

- Security procedures and equipment [20NMAC 4.1, subpart IX, §270.14(b)(4) and §20 NMAC 4.1, subpart V, §264.14]; and access control [20 NMAC 4.1, Subpart IX, §270.14(b)(19)(viii)]
- Preparedness and prevention requirements [20 NMAC 4.1, subpart V, Part 264, Subpart C]
- Procedures, structures and equipment for preventing hazards [20 NMAC 4.1, subpart IX, §270.14(b)(8)]

F.1 Security (20 NMAC 4.1, subpart V, §264.14; 20 NMAC 4.1, subpart IX, §270.14(b) (4)]

The Gallup Refinery prevents the unknowing entry and minimizes the possibility of unauthorized entry of persons or livestock onto the LTU through access controls to the refinery property. The refinery property boundary is fenced with a 4 feet high, three-strand, barbed wire fence. The refinery process area is fenced with an 8 feet high chain link fence and the access gate to the process area is watched 24 hours per day. Vehicle access to the LTU requires entry through the process area. The gate guard limits access to authorized personnel. The rail access into the refinery through the north boundary fence is locked closed and opened only for the scheduled switch engine. Signs legible from a distance of 25 feet are posted around the perimeter of the LTU and bear the legend "Danger – Unauthorized Personnel Keep out" in English and Spanish. Eight signs are visible from all angles of approach. In accordance with 20 NMAC 4.1, subpart IX,

§270.14(b) (19) (viii), the location of the security fence along the refinery property boundary and access gate are shown on Figure B-1.

F.2 Inspection Plan [20 NMAC 4.1, subpart V, §264.15 and subpart §270.14(b) (5)]

The Gallup Refinery Environmental Manager (EM) will assign and train personnel to inspect the LTU on a regular schedule to identify problems or potential problems and correct them before they cause harm to human health or the environment. Table F-1 summarizes the inspection schedule and frequencies and identifies components inspected and potential problems. Inspection frequencies may be increased at the discretion of the Gallup Refinery EM.

F.2.1 Weekly inspections.

Each week and following every major precipitation event, the inspector inspects the LTU for water accumulation, odors, soil condition, wind dispersion, dike condition, and warning sign condition. No record is kept of these inspections unless repairs are required. The inspector issues a work order request for any needed repairs. Work order requests are tracked by the Scheduling and Maintenance Department and then submitted to the Gallup Refinery EM for signature when work is completed. The inspector also inspects the LTU monitoring equipment, gates, and fences. The inspector records the following inspection information on the checklist (Figure F-2):

- Inspection date
- Name of person inspecting the LTU
- Observations
- Date and nature of repairs or remedial action taken

Inspection activities during post closure care ensure the early detection of structural defects that may occur. The dikes are inspected to ensure that integrity is maintained to effectively control storm water runoff and run on. The LTU is inspected for evidence of wind erosion after windstorms. A checklist used to document each inspection is provided on Figure F-2. The dikes will be maintained at the minimum height of two feet above the surface of the LTU and with 2: 1 side slopes to ensure that each dike has sufficient

capacity to control runoff during the post closure care period. If the integrity of the dikes is compromised, the Gallup Refinery EM will see that corrective action is taken promptly.

The Gallup Refinery EM maintains inspection checklists and work orders for all LTU inspections, except those inspections conducted on safety, communication, and emergency equipment (which are maintained by the Safety Department). All inspection records and work orders are maintained for at least three years following the date of inspection or latest remedial action as a result of an inspection.

F.3 Preventive Procedures, Structures, and Equipment [20NMAC 4.1, subpart IX, §270.14(b) (8)]

The design and operation of the LTU meets the requirements of 20 NMAC 4.1, subpart IX, §2170.14(b)(8) to prevent runoff from the LTU, prevent contamination of water supplies, mitigate the effects of equipment and power failure, prevent undue exposure of personnel to hazardous waste, and prevent releases to the atmosphere. This section describes the procedures, structures and equipment used to prevent hazards at the LTU during the post closure period.

F.3.1 Unloading Operations

The Gallup Refinery will not apply hazardous wastes to the LTU during the post closure care period. No unloading operations will be performed at the LTU; thus, no hazardous waste spills can occur.

F.3.2 Runoff Prevention

The structures used at the LTU and refinery process area to prevent runoff from the LTU to other areas of the refinery or environment are described in this section, as required by 20 NMAC 4.1, Subpart IX, §270.14(b)(8)(ii).

As discussed in Section B.0, the LTU does not lie within a 100 year floodplain. No major surface water bodies are within ten miles of the site, and the nearest river, the normally dry Puerco River, is approximately one mile north. Protection from flooding or

ponding caused by probable maximum precipitation events is provided by diverting water away from the LTU by a system of dikes, berms and swales (Figure B-3). Additionally, grade elevations of roads are designed so that storm water will not collect on the site under the most severe conditions.

Flood control structures, such as dikes and berms are inspected (Section F.2) regularly. During LTU inspections, the structures are checked to ensure that no wind or rain erosion or animal caused damage has caused the system to fail. Further, the areas around the LTU are also inspected to ensure that they are free of vegetation, debris, or other items that would impede the water diversion. Experience with the LTU during the operational phase has shown that weekly structural inspections are adequate for the climate and soil conditions at Gallup Refinery. However, inspections are also conducted after significant storm events.

F.3.3 Water Supplies.

Application of hazardous waste to the LTU ceased in 1990. Because the hazardous waste applied to the LTU during permitted operations has been degraded or immobilized, the risk to groundwater and/or water supplies is minimal. The geological, hydrological, and climatological features of the LTU (Section I), along with the procedures, structures, and equipment used during the operation phase activities, ensure that hazardous waste will not come in contact with the Sonsela aquifer. It is unlikely that any contaminated groundwater can migrate from the treatment zone of the LTU to the accessible environment, including water supplies, during the post closure care period. Gallup Refinery will monitor the Sonsela aquifer during the post closure care period, as described in Section E.0 and Appendix E, the Post Closure Monitoring Plan, to further protect this water body.

F.3.4 Equipment Failure and Power Outages.

LTU activities will be limited to applying fertilizer as necessary, and sampling as detailed in Section E.0, Post Closure Monitoring. If equipment fails, it will be repaired or replaced before continuing operations requiring the failed equipment. A power outage

would have no effect on LTU activities as the monitoring and maintenance activities are performed during daylight hours.

F.3.5 Personal Protective Equipment

Gallup Refinery personnel responsible for LTU activities will use personal protective equipment (PPE) to protect themselves from the hazards in the work place under normal conditions.

PPE and emergency equipment will also be used under unusual hazardous conditions. During post closure care, PPE required for personnel involved with LTU activities may include protective overalls, safety toe/steel toe shoes, and protective shoe coverings, depending on the activities being conducted.

Emergency equipment will be maintained at Gallup Refinery so that personnel and emergency response personnel can protect themselves and respond appropriately to an incident at the LTU. PPE and emergency equipment supplies are stored in the refinery warehouse. The location of PPE and emergency equipment is listed in Section G.0. The locations of fire extinguishers and communication systems are shown in Figure B-1. All personnel who may be required to use PPE and emergency equipment to respond to a LTU incident are trained to use this equipment.

F.3.6 Releases to Atmosphere [20 NMAC 4.1, subpart IX, §270.14(b) (8) (VI)]

Because the Z0I depth is 12 inches and a vegetative cover will be applied during closure activities, releases of hazardous constituents to the atmosphere can not occur.

Table F-1. Inspection Schedule

Area	Specific Items	Type of Problems	Frequency
LTU	General Conditions	Water accumulations	Weekly
		Odors	After each major storm event
		Soil Coloration changes	
		Wind Dispersion	
		Site level, needs plowing	
	Dikes/Berms	Erosion	Weekly
		Evidence of Run on	After each major storm event
	Signs	Condition and legibility	Weekly
	Water Wells	Caps in place	Weekly
		Damage to surface casing	
		Protection barriers in place	
Security	Fence	Gate property locked	In operation continually – failures immediately reported
Communication Systems	Telephones / Radio	Audibility	In operation continually – failures immediately reported
	Fire whistle	Audibility	Monthly whistle check
	Emergency Generator	East of start	Monthly by Boiler Operator and Safety Department
		Lubrication	
		Power generation	

Figure F-2
Land Treatment Unit Inspection Checklist

LTU Surface

Condition:	Water Standing?	□ Yes □ No
	Wet or Dry?	□ Yes □ No
	Odor?	□ Yes □ No
	Erosion?	□ Yes □ No
	Is vegetation growing?	□ Yes □ No

Monitoring Wells

Condition:

Caps and locks

Dikes/Berms

Condition:	Water Standing?	□ Yes □ No
	Wet or Dry?	□ Yes □ No

Vehicle, Fence, and Locks

Condition:

Signs (8)

Condition:	In Place?	□ Yes □ No
	Legible?	□ Yes □ No

Repairs Needed

Time of Day: _____ □ AM □ PM Date_____

Name of Inspector:

_____

Repairs Completed

Signature _____ Date_____

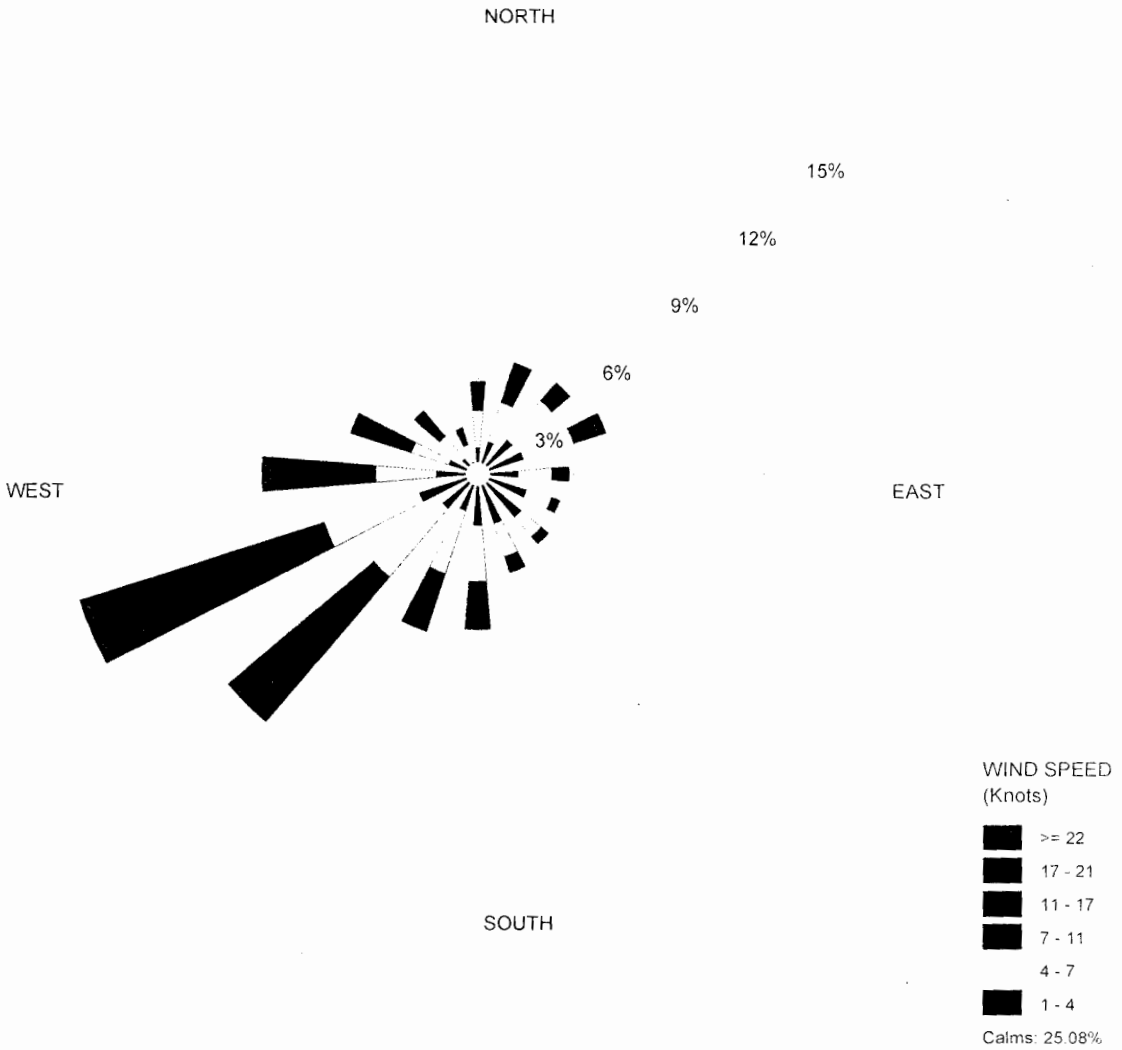
Section G.0

WIND ROSE PLOT:

Station #23081 - GALLUP/FAA AIRPORT, NM

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:

Gallup surface data.
SCRAM_GALLUP_91

DATA PERIOD:

1991
Jan 1 - Dec 31
00:00 - 23:00

COMPANY NAME:

MODELER:

CALM WINDS:

25.08%

TOTAL COUNT:

8760 hrs.

AVG. WIND SPEED:

5.51 Knots

DATE:

7/11/2007

PROJECT NO:

SCRAM_GALLUP_91

WRPLOT View - Lakes Environmental Software

Figure B-5. Wind Rose

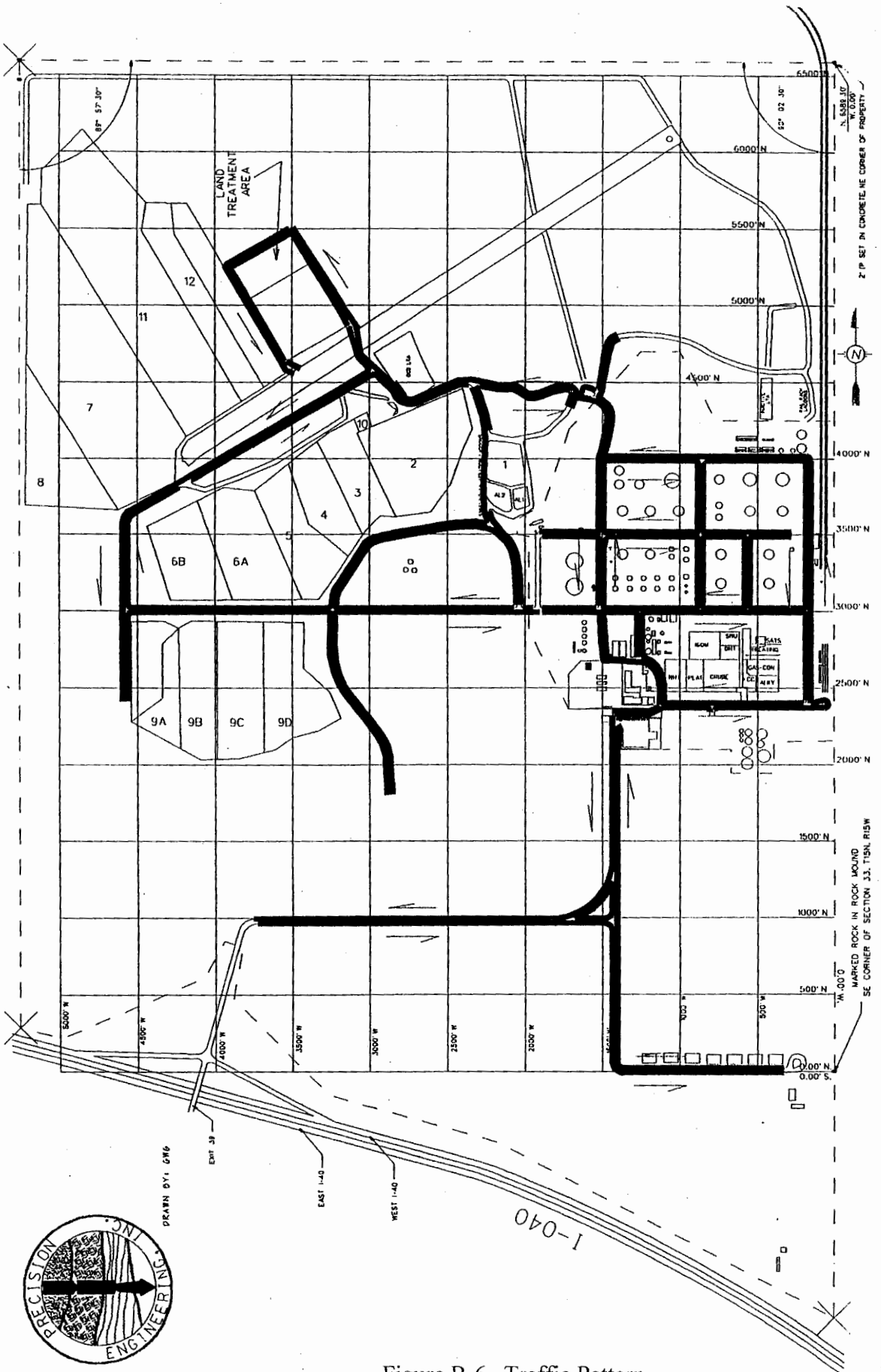


Figure B-6. Traffic Pattern

Section C.0

C.0. CHEMICAL AND PHYSICAL PROPERTIES

The information provided in this section is submitted in accordance with the applicable requirements of 20 NMAC 4.1, subpart V, §264.13, and subpart IX, §270.14(b) (2).

C.1 CHEMICAL AND PHYSICAL PROPERTIES [20 NMAC 4.1, subpart V, §264.13(a), subpart IX, §270.14(b) (2)]

The Gallup Refinery applied refinery sludge carrying the EPA hazardous waste numbers D001, D007, K049, K050, K051, and K052 to the LTU in accordance with the Ciniza Hazardous Waste Facility Permit until November 8, 1990. During this time of hazardous waste applications, Gallup Refinery treated approximately 2,600 tons of hazardous waste at the LTU. The refinery sludge treated at the LTU was viscous oil-water-solid mixtures. Appendix A describes the chemical and physical properties of the hazardous waste steams treated at the LTU. Gallup Refinery maintains laboratory reports detailing the chemical and physical analysis of representative samples of the waste.

Section D.0

D.0 LAND TREATMENT UNIT PROGRAM HISTORY

Western Refining Southwest, Inc. (a unit of Western Refining, Inc.) operates the Gallup Refinery (formerly known as *Ciniza*) in McKinley County, New Mexico. Ciniza was constructed in 1957 by the El Paso Natural Gas Company. El Paso owned and operated Ciniza from 1957 to 1964 and sold the facility to Shell Oil. Shell owned and operated the facility from 1964 to 1982. Giant Industries, Incorporated bought the facility in 1982 and operated until May 2007. All of Giant's stock (but none of the assets) was acquired by Western Refining, Inc. in May 2007. Shortly thereafter, Western Refining began referring to the refinery as the *Gallup Refinery*. Gallup Refinery is a crude oil refining facility. The refinery receives and processes crude oil and other feedstocks, and then produces various finished products. These include propane, butane, naphtha, unleaded gasoline, diesel (low sulfur and ultra-low sulfur), kerosene, and residual fuel. Crude oil, natural gasoline, intermediate feedstocks, finished products, chemicals and water are stored on-site in tanks and distributed throughout the refinery via an extensive piping system. Various wastes are generated from the Gallup Refinery operations. The Gallup Refinery established the LTU for the degradation, transformation, or immobilization of hazardous wastes generated at the facility. Over time, microbial activity occurring in the soil (enhanced with application of fertilizer) degrades the hazardous constituents in the waste. The LTU is approximately 1,500 feet northwest of the refinery process area and consists of three 480 feet x 240 feet sections, as shown on Figure B-1. The LTU received hazardous wastes from October 10, 1980 to November 8, 1990. The LTU received non-hazardous waste between 1990 and 1993. No waste has been added to the LTU since 1993.

The Gallup Refinery established the LTU for the degradation, transformation, or immobilization of hazardous wastes generated at the Gallup Refinery. The history of the LTU is summarized in Table D-1. Table D-2 lists the ZOI sample event results from 1993 to 1999. Background sample results are detailed on Table D-3. Figures D-1 and D-2 identify sample locations in the vicinity of the LTU and the sampling grid-random number system.

The 9 year soil sampling event was conducted in December 2009. ZOI (Zone of Incorporation and TZ (Treatment Zone) sample results are detailed on Table D-4. Random sampling grid numbers were generated utilizing a random integer provided by Random.Org (Figure D-4). A map of the sample locations is also provided in Figure D-3. In early July 2009 sampling of the Chinle Slope Wash and the Sonsela well sampling was conducted with the annual groundwater sampling event. Wells MW 1, 2, 4, and 5 and SMW 2 and 4 sampling results are detailed on Table D-4a.

Historical LTU information and data extracted from existing permit applications, operating permits, operating records, and other source documents are divided as Appendix C. The inclusion of this appendix does not imply that historical information and data have been verified.

Table D-2a. Ciniza ZOI Analytical Results, 1993 – 1999

Fall of 1999

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-055-101999	7.5	1.40	190	210	710	mg/kg
ZOI-1-193-101999	8.1	0.38	140	300	580	mg/kg
ZOI-2-055-101999	7.7	2.20	260	600	4400	mg/kg
ZOI-3-160-101999	8.1	0.37	210	260	180	mg/kg

Bi-Monthly Fall 1999

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-160-100799					5700	mg/kg
ZOI-1-198-100799					390	mg/kg
ZOI-2-084-100799					2600	mg/kg
ZOI-3-158-100799					360	mg/kg

Spring 1999

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-040-051899	7.6	2.8	0.1	730	6600	mg/kg
ZOI-1-098-051899	7.2	2.6	0.3	500	4900	mg/kg
ZOI-1-143-051899	7.9	5.5	0.2	230	10000	mg/kg
ZOI-2-040-051899	7.1	5.8	0.2	700	18000	mg/kg
ZOI-2-041-051899	8.1	3.2	0.2	540	4500	mg/kg
ZOI-2-107-051899	7.5	3.4	0.2	510	7000	mg/kg
ZOI-038-051899	6.6	1.7	0.1	500	3500	mg/kg
ZOI-097-051899	8.0	0.5	0.5	190	900	mg/kg
ZOI-135-051899	8.8	0.3	0.2	320	ND	mg/kg
ZOI-152-051899	8.4	0.4	0.2	300	ND	mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

[c] Total P = Total Phosphorus

[d] TKN = Total Kjeldahl Nitrogen

[e] O&G = Oil and Grease

Table D-2a. Ciniza Z01 Analytical Results, 1993 – 1999 (Continued)

Fall of 1998

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-127-011499	8.6	0.3	120	190	ND	mg/kg
ZOI-142-011499	8.0	0.4	130	190	ND	mg/kg
ZOI-113-011499	8.7	0.5	140	220	ND	mg/kg
ZOI-3-056-011499	8.8	0.4	150	220	ND	mg/kg

Bi-Monthly Summer 1998

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-176-060598					210	mg/kg
ZOI-2-014-060598					9200	mg/kg
ZOI-2-070-060598					470	mg/kg
ZOI-3-058-060598					400	mg/kg

Spring 1998

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-174-042398	8.5	0.5	230	220	120	mg/kg
ZOI-2-186-042398	8.5	0.3	190	160	ND	mg/kg
ZOI-3-036-042398	7.9	0.7	230	350	220	mg/kg
ZOI-3-119-042398	8.4	0.5	250	280	80	mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

[c] Total P = Total Phosphorus

[d] TKN = Total Kjeldahl Nitrogen

[e] O&G = Oil and Grease

Table D-2a. Ciniza Z01 Analytical Results, 1993 – 1999 (Continued)

Fall of 1997

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-039-111197	7.8	0.5	270	150	120	mg/kg
ZOI-1-163-111197	8.1	0.6	220	280	55	mg/kg
ZOI-2-114-111197	8.2	0.2	190	130	74	mg/kg
ZOI-3-153-111197	8.5	0.4	280	190	74	mg/kg

Bi-Monthly Fall 1997

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-075-091097	8.7	0.7				mg/kg
ZOI-2-198-091097	8.6	0.4				mg/kg
ZOI-3-064-091097	8.6	0.8				mg/kg
ZOI-3-142-091097	8.5	0.7				mg/kg

Bi-Monthly Summer 1997

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-068-052797	7.8	0.5			50	mg/kg
ZOI-2-037-052797	7.8	0.4			110	mg/kg
ZOI-3-079-052797	7.5	1.0			ND	mg/kg
ZOI-3-093-052797	7.6	1.0			80	mg/kg

Spring 1997

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-140-050297	7.7	<1	267	313		mg/kg
ZOI-2-068-050297	7.7	<1	139	470		mg/kg
ZOI-2-073-050297	7.7	<1	81	359		mg/kg
ZOI-3-066-050297	7.7	<1	99	455		mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

[c] Total P = Total Phosphorus

[d] TKN = Total Kjeldahl Nitrogen

[e] O&G = Oil and Grease

Table D-2a. Ciniza Z01 Analytical Results, 1993 – 1999 (Continued)

Fall of 1996

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-089-021897	7.5	0.01	0.1	400	ND	mg/kg
ZOI-2-168-021897	7.7	0.01	0.2	300	ND	mg/kg
ZOI-3-027-021897	7.8	0.01	0.2	400	ND	mg/kg
ZOI-3-186-021897	7.7	0.01	0.3	400	ND	mg/kg

Bi-Monthly Fall 1996

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-082-090396					138	mg/kg
ZOI-2-033-090396					29	mg/kg
ZOI-2-165-090396					ND	mg/kg
ZOI-3-088-090396					ND	mg/kg

Summer 1996

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-073-061196					ND	mg/kg
ZOI-2-075-061196					ND	mg/kg
ZOI-2-120-061196					ND	mg/kg
ZOI-3-148-061196					ND	mg/kg

Spring 1996 – Special Sampling

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-014-040296					3930	mg/kg
ZOI-1-091-040196					2940	mg/kg
ZOI-1-104-040196		Container broken in transit to the Lab				mg/kg
ZOI-1-178-040296					6900	mg/kg
ZOI-2-050-040196					4850	
ZOI-2-078-040196					13400	
ZOI-2-081-040196					3640	
ZOI-2-132-040296					4760	
ZOI-3-090-040296					164	
ZOI-3-092-040296					ND	
ZOI-3-163-040296					ND	
ZOI-3-198-040296					ND	

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

[c] Total P = Total Phosphorus, [d] TKN = Total Kjeldahl Nitrogen, [e] O&G = Oil and Grease

Table D-2a. Ciniza Z01 Analytical Results, 1993 – 1999 (Continued)

Fall of 1995

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-088-111595	7.7		360	470	88000	mg/kg
ZOI-2-114-111595	7.7		350	710	75000	mg/kg
ZOI-3-043-111595	8.3		220	510	14000	mg/kg
ZOI-3-134-111595	8.6		230	290	100	mg/kg

Bi-Monthly Fall 1995

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-118-083195					6590	mg/kg
ZOI-2-008-083195					10800	mg/kg
ZOI-2-178-083195					3950	mg/kg
ZOI-3-145-083195					17	mg/kg

Bi-Monthly Summer 1995

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-038-062995					5830	mg/kg
ZOI-1-085-062995					9720	mg/kg
ZOI-2-117-062995					7390	mg/kg
ZOI-3-065-062995					2870	mg/kg

Spring 1995

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-015-042895	6.0		301	1330	18000	mg/kg
ZOI-1-186-042895	7.5		297	666	14000	mg/kg
ZOI-2-064-042895	7.5		334	775	9400	mg/kg
ZOI-3-099-042895	10.1		410	49	6340	mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

[c] Total P = Total Phosphorus

[d] TKN = Total Kjeldahl Nitrogen

[e] O&G = Oil and Grease

Table D-2a. Ciniza Z01 Analytical Results, 1993 – 1999 (Continued)

Fall of 1994

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-089-080494					32000	mg/kg
ZOI-1-069-080494					16000	mg/kg
ZOI-2-132-080494					16000	mg/kg
ZOI-3-122-080494					60000	mg/kg

Bi-Monthly Summer 1994

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-056-061694					21000	mg/kg
ZOI-1-149-061694					22000	mg/kg
ZOI-2-097-061694					19000	mg/kg
ZOI-3-126-061694					2100	mg/kg

Spring 1994

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-174-052394	7.8	1.3	270	8	70	mg/kg
ZOI-2-061-052394	7.7	5.8	310	7	65	mg/kg
ZOI-2-147-052394	7.3	4.5	330	13	ND	mg/kg
ZOI-3-153-052394	7.9	2.1	270	25	160	mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

[c] Total P = Total Phosphorus

[d] TKN = Total Kjeldahl Nitrogen

[e] O&G = Oil and Grease

Table D-2a. Ciniza Z01 Analytical Results, 1993 – 1999 (Continued)

Bi-Monthly Fall 1993

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-147-092193					9300	mg/kg
ZOI-2-025-092193					9400	mg/kg
ZOI-2-124-092193					20000	mg/kg
ZOI-3-022-092193					2600	mg/kg

Fall 1993

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-179-080293					11000	mg/kg
ZOI-2-032-080293					29000	mg/kg
ZOI-2-136-080293					28000	mg/kg
ZOI-3-1089-080293					1500	mg/kg

Spring 1993

Sample ID [a]	pH	%TOC [b]	Total P [c]	TKN [d]	O & G [e]	Units
ZOI-1-039-060293	7.3		200	1700	15000	mg/kg
ZOI-2-027-060293	7.2		210	1700	17000	mg/kg
ZOI-2-062-060293	8.1		245	1000	15000	mg/kg
ZOI-3-015-060293	7.8		160	820	180	mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

[c] Total P = Total Phosphorus

[d] TKN = Total Kjeldahl Nitrogen

[e] O&G = Oil and Grease

Table D-2b. Ciniza BTZ Analytical Results, 1993 - 1999

Fall 1999

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-055-101999	8.0	0.3	Lab error -	ND	ND	ug/kg
BTZ-1-193-101999	8.1	0.3	did not run	ND	ND	ug/kg
BTZ-2-055-101999	8.8	0.1	requested	ND	ND	ug/kg
BTZ-3-160-101999	8.2	0.3	analyses	ND	ND	ug/kg

Spring 1999

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-040-051899	8.4	0.2	12	ND	ND	ug/kg
BTZ-1-098-051899	8.4	0.3	13	ND	ND	ug/kg
BTZ-1-143-051899	8.5	0.4	12	ND	ND	ug/kg
BTZ-2-040-051899	8.1	0.3	15	ND	ND	ug/kg
BTZ-2-041-051899	8.1	0.3	13	ND	ND	ug/kg
BTZ-2-107-051899	8.4	0.2	13	ND	ND	ug/kg
BTZ-3-038-051899	8.4	0.3	16	ND	ND	ug/kg
BTZ-3-097-051899	8.6	0.2	13	ND	ND	ug/kg
BTZ-3-135-051899	8.4	0.4	14	ND	ND	ug/kg
BTZ-3-152-051899	8.9	0.1	10	ND	ND	ug/kg

[a] Sample Number Identification
(1) Below Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

Table D-2b. Ciniza BTZ Analytical Results, 1993 – 1999 (Continued)

Fall 1998

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-127-011499	8.9	0.3	13	ND	ND	ug/kg
BTZ-1-142-011499	8.8	0.2	10	ND	ND	ug/kg
BTZ-2-113-011499	8.9	0.6	6	ND	ND	ug/kg
BTZ-3-056-011499	8.3	0.3	5	ND	ND	ug/kg

Summer 1998

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-058-061798				ND	ND	ug/kg
BTZ-1-189-061798				ND	ND	ug/kg
BTZ-2-089-061798				ND	ND	ug/kg
BTZ-3-047-061798				ND	ND	ug/kg

Spring 1998

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-174-042398	8.4	0.4	12	ND	ND	ug/kg
BTZ-2-186-042398	8.6	0.4	13	ND	ND	ug/kg
BTZ-3-036-042398	8.5	0.4	19	ND	ND	ug/kg
BTZ-3-119-042398	8.7	0.4	14	ND	ND	ug/kg

[a] Sample Number Identification
(1) Below Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

Table D-2b. Ciniza BTZ Analytical Results, 1993 – 1999 (Continued)

Fall 1997

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-039-111197	8.1	0.4	12	ND		ug/kg
BTZ-1-163-111197	8.6	0.1	8	ND		ug/kg
BTZ-2-114-111197	8.5	0.5	15	ND		ug/kg
BTZ-3-153-111197	8.5	0.4	11	ND		ug/kg

Summer 1997

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-140-050297	7.8	<1	10.7	ND	ND	ug/kg
BTZ-2-068-050297	7.8	<1	14.3	ND	ND	ug/kg
BTZ-2-073-050297	7.8	<1	12.9	ND	ND	ug/kg
BTZ-3-066-050297	7.8	<1	11.8	ND	ND	ug/kg

Fall 1997

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-039-111197	8.1	0.4	12	ND		ug/kg
BTZ-1163-111197	8.6	0.1	8	ND		ug/kg
BTZ-2-114-111197	8.5	0.5	15	ND		ug/kg
BTZ-3-153-111197	8.5	0.4	11	ND		ug/kg

Spring 1997

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-140-050297	7.8	<1	10.7	ND	ND	ug/kg
BTZ-2-068-050297	7.8	<1	14.3	ND	ND	ug/kg
BTZ-2-073-050297	7.8	<1	12.9	ND	ND	ug/kg
BTZ-3-066-050297	7.8	<1	11.8	ND	ND	ug/kg

[a] Sample Number Identification
(1) Below Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

Table D-2b. Ciniza BTZ Analytical Results, 1993 – 1999 (Continued)

Fall 1996

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-089-021897	7.6	0.01	13.0	ND	ND	ug/kg
BTZ-2-168-021897	7.6	0.01	13.8	ND	ND	ug/kg
BTZ-3-027-021897	7.8	0.01	18.9	ND	ND	ug/kg
BTZ-3-186-021897	7.9	0.01	11.5	ND	ND	ug/kg

Summer 1996

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-073-061196	8.1	0.3	11.5	ND	ND	ug/kg
BTZ-2-075-061196	8.0	0.2	13.9	ND	ND	ug/kg
BTZ-2-120-061196	7.8	0.2	15.4	ND	ND	ug/kg
BTZ-3-148-061196	8.1	0.2	13.8	ND	ND	ug/kg

Spring 1996 Special Sampling

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-014-040296		0.4		ND	ND	ug/kg
BTZ-1-091-040196		0.4		ND	ND	ug/kg
BTZ-1-104-040196		0.5		ND	ND	ug/kg
BTZ-1-178-040296		0.3		ND	ND	ug/kg
BTZ-2-050-040196		0.3		ND	ND	ug/kg
BTZ-2-078-040196		0.4		ND	ND	ug/kg
BTZ-2-081-040196		0.2		ND	ND	ug/kg
BTZ-2-132-040296		0.4		ND	ND	ug/kg
BTZ-3-090-040296		0.3		ND	ND	ug/kg
BTZ-3-092-040296		0.3		ND	ND	ug/kg
BTZ-3-163-040296		0.3		ND	ND	ug/kg
BTZ-3-198-040296		0.3		ND	ND	ug/kg

[a] Sample Number Identification
(1) Below Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

Table D-2b. Ciniza BTZ Analytical Results, 1993 – 1999 (Continued)

Fall 1995

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-088-111595	9.5		13	ND	ND	ug/kg
BTZ-2-114-111595	9.1		15	ND	ND	ug/kg
BTZ-3-043-111595	9.6		10	ND	ND	ug/kg
BTZ-3-134-111595	9.2		13	ND	ND	ug/kg

Spring 199

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-015-042895	8.2		14.8	ND	ND	ug/kg
BTZ-1-186-042895	8.3		14.0	ND	ND	ug/kg
BTZ-2-064-042895	8.0		16.4	ND	ND	ug/kg
BTZ-3-099-042895	7.0		17.5	ND	ND	ug/kg

[a] Sample Number Identification
(1) Below Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

Table D-2b. Ciniza BTZ Analytical Results, 1993 – 1999 (Continued)

Fall 1994

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-174-052394	8.8	0.4	14	ND	ND	ug/kg
BTZ-2-081-052394	9.0	0.3	12	ND	ND	ug/kg
BTZ-2-147-052394	9.2	0.3	13	ND	ND	ug/kg
BTZ-3-143-052394	9.5	0.3	9	ND	ND	ug/kg

[a] Sample Number Identification
(1) Below Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

Table D-2b. Ciniza BTZ Analytical Results, 1993 – 1999 (Continued)

Fall 1993

Sample ID [a]	pH	%TOC [b]	% Moisture	Vols (8021)	Semi-Vols (8270)	Units
BTZ-1-180-080393	8.3		14.8	ND	ND	ug/kg
BTZ-2-115-080393	8.4		15.1	ND	ND	ug/kg
BTZ-2-023-080393	7.9		17.8	ND	ND	ug/kg
BTZ-3-088-080393	9.2		3.2	ND	ND	ug/kg

[a] Sample Number Identification
(1) Below Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] TOC = Total Organic Carbon

Table D-2c. Ciniza LTU Characterization Studies, 1996 – 1999

SPRING 1999 RCRA METALS

Sample ID [a]	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Nickel	Selenium	Vanadium	Mercury	Units
ZOI-1-040-051899	ND	ND	290	ND	ND	190	7.1	40	28	ND	30	1	mg/kg
ZOI-1-098-051899	ND	ND	210	1.1	ND	15	5.7	11	13	ND	19	ND	mg/kg
ZOI-1-143-051899	ND	ND	240	1	ND	9.2	ND	9.1	10	ND	13	ND	mg/kg
ZOI-2-040-051899	ND	20.0	710	ND	ND	200	9.7	87	54	ND	40	13	mg/kg
ZOI-2-041-051899	1.2	10.0	550	ND	ND	310	8.2	54	32	3.3	35	8.4	mg/kg
ZOI-2-107-051899	ND	7.5	350	ND	0.8	220	6.2	40	24	ND	21	1.6	mg/kg
ZOI-3-038-051899	ND	3.9	340	ND	ND	190	5.1	21	11	ND	16	0.9	mg/kg
ZOI-3-097-051899	ND	1.6	360	1.4	ND	24	7	12	14	ND	30	ND	mg/kg
ZOI-3-135-051899	ND	1.3	330	1.6	ND	23	8.2	14	17	ND	36	ND	mg/kg
ZOI-3-152-051899	ND	1.5	350	1.5	ND	8.5	5.3	10	11	ND	17	ND	mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

Table D-2c. Ciniza LTU Characterization Studies, 1996 – 1999

SPRING 1999 RCRA METALS

Sample ID [a]	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Nickel	Selenium	Vanadium	Mercury	Units
3'-1-040-051899	16	ND	180	1.1	ND	9.5	4.1	11	9.4	ND	16	ND	mg/kg
3'-1-098-051899	ND	ND	140	ND	ND	7	ND	7.9	7	ND	12	ND	mg/kg
3'-1-143-051899	ND	ND	240	ND	ND	14	5.7	10	13	ND	20	ND	mg/kg
3'-2-040-051899	ND	1.2	310	1.3	ND	7.4	4.9	9.6	9.4	ND	14	ND	mg/kg
3'-2-041-051899	ND	1.3	290	1.7	ND	18	7	13	15	ND	28	ND	mg/kg
3'-2-107-051899	ND	ND	290	ND	ND	9.4	4.3	11	9.4	ND	15	ND	mg/kg
3'-3-038-051899	ND	1.5	200	1.4	ND	8.9	5	11	9.8	ND	18	ND	mg/kg
3'-3-097-051899	ND	1.6	360	1.8	ND	27	8.8	13	19	ND	40	ND	mg/kg
3'-3-135-051899	ND	1.7	330	1.5	ND	24	8.4	12	18	ND	36	ND	mg/kg
3'-3-152-051899	ND	1.4	370	1.4	ND	17	7	11	15	ND	27	ND	mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

Table D-2c. Ciniza LTU Characterization Studies, 1996 – 1999

SPRING 1999 RCRA METALS

Sample ID [a]	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Nickel	Selenium	Vanadium	Mercury	Units
BTZ-1-040-051899	ND	ND	210	ND	ND	12	5.2	8.9	13	ND	20	ND	mg/kg
BTZ-1-098-051899	ND	ND	210	1.1	ND	15	5.7	11	13	ND	19	ND	mg/kg
BTZ-1-143-051899	ND	ND	240	1	ND	9.2	ND	9.1	10	ND	13	ND	mg/kg
BTZ-2-040-051899	ND	1.4	260	1.5	ND	17	6.9	12	15	ND	27	0.2	mg/kg
BTZ-2-041-051899	ND	1.8	270	1.4	ND	18	7.1	12	15	ND	30	ND	mg/kg
BTZ-2-107-051899	ND	ND	230	1.1	ND	12	5.1	10	12	ND	19	ND	mg/kg
BTZ-3-038-051899	ND	2.4	300	1.4	ND	25	8.6	12	20	ND	43	ND	mg/kg
BTZ-3-097-051899	ND	1.6	330	1.2	ND	10	5.3	9.1	11	ND	22	ND	mg/kg
BTZ-3-135-051899	ND	1.4	330	1.6	ND	6.2	4.1	10	7.8	ND	16	ND	mg/kg
BTZ-3-152-051899	ND	1.1	430	ND	ND	7.8	4.7	8.5	8.8	ND	18	ND	mg/kg

[a] Sample Number Identification
(1) Below Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

Table D-2c. Ciniza LTU Characterization Studies, 1996 – 1999

SPRING 1998 RCRA METALS, VOLATILES, AND SEMI-VOLATILES

Sample ID	Silver	Arsenic	Barium	Mercury	Cadmium	Chromium	Lead	Selenium	Vols 8021	Semi-Vols 8270	Units
[a] ZOI-1-058-061798	ND	ND	210	ND	ND	9	6	ND	ND	ND	mg/kg
ZOI-1-189-061798	ND	ND	180	ND	ND	9	ND	ND	ND	ND	mg/kg
ZOI-2-089-061798	ND	ND	230	ND	ND	10	ND	ND	ND	ND	mg/kg
ZOI-3-047-061798	ND	ND	280	ND	ND	10	8	ND	ND	ND	mg/kg
[b] 2'-1-058-061798	ND	ND	160	ND	ND	10	6	ND	ND	ND	mg/kg
2'-1-189-061798	ND	ND	310	ND	ND	9	5	ND	ND	ND	mg/kg
2'-2-089-061798	ND	ND	240	ND	ND	9	6	ND	ND	ND	mg/kg
2'-3-047-061798	ND	ND	360	ND	ND	11	7	ND	ND	ND	mg/kg
4'-1-058-061798	ND	ND	170	ND	ND	8	8	ND	ND	ND	mg/kg
4'-1-189-061798	ND	ND	280	ND	ND	8	6	ND	ND	ND	mg/kg
4'-2-089-061798	ND	ND	200	ND	ND	11	8	ND	ND	ND	mg/kg
4'-3-047-061798	ND	ND	270	ND	ND	12	6	ND	ND	ND	mg/kg
[c] BTZ-1-058-061798	ND	ND	210	ND	ND	12	7	ND	ND	ND	mg/kg
BTZ-1-189-061798	ND	ND	180	ND	ND	12	ND	ND	ND	ND	mg/kg
BTZ-2-089-061798	ND	ND	160	ND	ND	11	6	ND	ND	ND	mg/kg
BTZ-3-047-061798	ND	ND	240	ND	ND	12	7	ND	ND	ND	mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] Sample Number Identification
(1) Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[c] Sample Number Identification
(1) Below Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

Table D-2c. Ciniza LTU Characterization Studies, 1996 – 1999

SPRING 1998 RCRA METALS, VOLATILES, AND SEMI-VOLATILES

Sample ID	Silver	Arsenic	Barium	Mercury	Cadmium	Chromium	Lead	Selenium	Vols 8021	Semi-Vols 8270	Units
[a] ZOI-1-174-042398	ND	ND	190	ND	ND	10	6	ND	ND	ND	mg/kg
ZOI-2-186-042398	ND	ND	350	ND	ND	16	7	ND	ND	ND	mg/kg
ZOI-3-036-042398	ND	ND	340	0.1	ND	30	9	ND	ND	ND	mg/kg
ZOI-3-119-042398	ND	ND	280	ND	ND	12	8	ND	ND	ND	mg/kg
[b] 2'-1-174-042398	ND	ND	450	ND	ND	10	ND	ND	ND	ND	mg/kg
2'-2-186-042398	ND	ND	240	ND	ND	10	ND	ND	ND	ND	mg/kg
2'-3-036-042398	ND	ND	310	ND	ND	10	6	ND	ND	ND	mg/kg
2'-3-119-042398	ND	ND	240	ND	ND	13	5	ND	ND	ND	mg/kg
4'-1-174-042398	ND	ND	350	ND	ND	9	7	ND	ND	ND	mg/kg
4'-2-186-042398	ND	ND	220	ND	ND	11	5	10	ND	ND	mg/kg
4'-3-036-042398	ND	ND	240	ND	ND	10	ND	ND	ND	ND	mg/kg
4'-3-119-042398	ND	ND	310	ND	ND	11	6	ND	ND	ND	mg/kg
[c] BTZ-1-174-042398	ND	ND	340	ND	ND	9	8	ND	ND	ND	mg/kg
BTZ-2-186-042398	ND	ND	270	0.1	6	12	6	ND	ND	ND	mg/kg
BTZ-3-036-042398	ND	ND	240	ND	ND	12	6	ND	ND	ND	mg/kg
BTZ-3-119-042398	ND	ND	270	ND	ND	13	7	ND	ND	ND	mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[b] Sample Number Identification
(1) Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

[c] Sample Number Identification
(1) Below Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

Table D-2c. Ciniza LTU Characterization Studies, 1996 – 1999

Fall 1997 RCRA METALS

Sample ID [a]	Silver	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Mercury	Units
ZOI-1-075-091097	ND	ND	270	ND	13	7	ND	ND	mg/kg
ZOI-2-198-091097	ND	ND	250	ND	7	8	ND	0.3	mg/kg
ZOI-3-064-091097	ND	ND	320	ND	8	9	ND	ND	mg/kg
ZOI-3-142-091097	ND	ND	20	ND	8	9	ND	ND	mg/kg

Summer 1997 RCRA METALS

Sample ID [a]	Silver	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Mercury	Units
ZOI-1-068-052797	ND	0.8	360	ND	9	12	ND	ND	mg/kg
ZOI-2-037-052797	ND	0.8	310	0.1	8	9	ND	0.1	mg/kg
ZOI-3-079-052797	ND	ND	280	0.1	28	15	ND	0.2	mg/kg
ZOI-3-093-052797	ND	ND	290	0.1	31	13	ND	0.5	mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

Table D-2c. Ciniza LTU Characterization Studies, 1996 – 1999

Summer 1996 RCRA METALS

Sample ID [a]	Silver	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Mercury	Units
ZOI-1-073-061196	ND	0.4	191	ND	11	6.3	ND	ND	mg/kg
ZOI-2-075-061196	0.8	0.6	227	ND	10	8.4	ND	0.3	mg/kg
ZOI-2-120-061196	ND	0.5	305	ND	10	6.9	ND	ND	mg/kg
ZOI-3-148-061196	1.7	0.5	140	ND	14	6.9	ND	ND	mg/kg

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

Table D-2c. Ciniza LTU Characterization Studies, 1996 – 1999

Spring 1996 Special Sampling

Sample ID [b]	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Nickel	Selenium	Vanadium	Mercury	Units
BTZ-1-014-040296	ND	0.4	271	1.2	ND	14.8	5.8	10	11.5	ND	18.5	ND	mg/kg
BTZ-1-091-040196	ND	0.4	301	0.9	ND	10.6	4.6	6.5	8.3	ND	17	ND	mg/kg
BTZ-1-104-040196	ND	0.5	265	1.3	ND	16.4	6.5	9.6	12.5	ND	20.7	ND	mg/kg
BTZ-1-178-040296	ND	0.5	266	0.9	ND	13.7	6.2	9.4	11.9	ND	19.8	ND	mg/kg
BTZ-2-050-040196	ND	0.6	240	1.3	ND	15.7	6	9.2	12.3	ND	19.0	ND	mg/kg
BTZ-2-078-040196	ND	0.6	260	1.3	ND	20.5	7.5	10.4	15.1	ND	26.8	ND	mg/kg
BTZ-2-081-040196	ND	0.4	253	1.3	ND	17.1	6.8	9.7	12.8	ND	20.5	ND	mg/kg
BTZ-2-132-040296	ND	0.5	268	1.3	ND	18.7	5.9	8.8	12.3	ND	22.1	ND	mg/kg
BTZ-3-090-040296	ND	1.1	337	0.9	ND	21.8	7.7	8	17.1	ND	29.5	ND	mg/kg
BTZ-3-092-040296	ND	0.7	392	1.3	ND	16.8	6.6	9	13.3	ND	23	ND	mg/kg
BTZ-3-163-040296	ND	0.7	247	1.3	ND	19.5	7.8	9	15.1	ND	27.3	ND	mg/kg
BTZ-3-198-040296	ND	0.5	243	1.3	ND	16.2	5.6	9.2	12	ND	19.2	ND	mg/kg

[b] Sample Number Identification
(1) Below Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

TABLE D-3. Background Sample Event May 18, 1997 – Results

Sample Number	Parameter	Silver	Arsenic	Barium	Cadmium	Chromium	Mercury	Lead	Selenium
	Reporting Limit	**1**	**5**	**1**	**0.5**	**1**	**0.02**	**5**	**10**
	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
705350-01		ND	ND	240	ND	8	ND	7	ND
705350-02		ND	ND	240	ND	13	ND	8	ND
705350-03		ND	ND	310	ND	13	ND	10	ND
705350-04		ND	ND	240	ND	13	ND	7	ND

Note: SW-846-6010 and 7471 RCRA Metals and Mercury

Table D-4 Gallup ZOI and TZ Analytical Results 2009

Fall of 2009 – 9 year Sampling Event

Sample ID [a]	DRO 8015B	GRO 8015B	Units
ZOI-1-371-120809	ND	ND	mg/kg
ZOI-1-2521-120909	ND	ND	mg/kg
ZOI-2-8334-120909	7000	ND	mg/kg
ZOI-2-4139-120909	9400	ND	mg/kg
ZOI-3-3414-120909	1800	ND	mg/kg
ZOI-3-7544-121109	270	ND	mg/kg
TZ-1-371-121109	ND	ND	mg/kg
TZ-1-2521-121109	ND	ND	mg/kg
TZ-2-4139-121109	ND	ND	mg/kg
TZ-2-8334-121109	ND	ND	mg/kg
TZ-3-3414-121109	ND	ND	mg/kg
TZ-3-7544-121109	ND	ND	mg/kg
NMWQS	0.2		
EPA MCL			

[a] Sample Number Identification
(1) Zone of Incorporation – upper 12 inches of soil
Treatment Zone
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number
*See Table D-4a for complete list of constituents

Table D-4 Gallup ZOI and TZ Analytical Results 2009

Fall of 2009 – 9 year Sampling Event

EPA METHOD 8270C – Semi Volatiles (Units are in mg/kg)

Sample ID [a]	Z0I-1-2521-120909	Z0I-2-8334-120909	Z0I-2-4139-120909	Z0I-3-3414-120909	Z0I-3-7544-121109	TZ-1-371-121109	TZ-1-2521-121109	TZ-2-4139-121109	TZ-2-8334-121109	TZ-3-3414-121109	NMWQS	EPA MCLs
1-methylnaphthalene		0.246										
2-methylnaphthalene		0.408										
3+4-Methylphenol			0.454	0.104								
5+6 Methylchrysene		38.5	40.8	0.740	4.73				0.817			
Anthracene				0.088							8.3	
Benzenethiole		0.292	3.04	0.292	0.401							
Benzo(a)anthracene		1.22	0.889		0.361						.000038	
Benzo(a)pyrene		8.18	12.1	0.701	2.60				0.237		.000038	.0002
Benzo(b)fluoranthene		1.27									.000038	
Butylbenzylphthalate			0.436									
bis(2-Ethylhexyl)phthalate						0.082	0.101	0.093	0.195	0.101	.012	.006
Chrysene		9.12	13.0	0.401	1.54				0.328		.000038	
Cresol(total)			0.454	0.104								
Dibenz(a,h)anthracene		0.943			0.531						.000038	
Diethylphthalate	0.408	0.204		0.378		0.158	0.185	0.143	0.133	0.063	17	
Di-n-octylphthalate									0.135			
Ideno(1,2.3-cd)pyrene		0.450			0.294						.000038	
Naphthalene		0.161										
Phenanthrene					0.121							
Phenol			0.200	0.151							21	
Pyrene		2.88	3.63		0.125				0.105		.83	

[a] Sample Number Identification
(1) Zone of Incorporation (Z0I)
Treatment Zone (TZ)
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

Table D-4 Gallup ZOI and TZ Analytical Results 2009

Sample ID – That showed Non-Detect (ND) levels on EPA Method 8270C-Semi-Volatile Analysis

Sample ID [a]	8270C Semi-Volatiles
ZOI-1-371-120809	ND
TZ-3-7544-121109	ND

[a] Sample Number Identification
(1) Zone of Incorporation (ZOI)
Treatment Zone (TZ)
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

Table D-4 Gallup ZOI and TZ Analytical Results 2009

Fall of 2009 – 9 year Sampling Event

EPA METHOD 8260B –Volatile Organics.
(Units are in mg/kg)

Sample ID [a]	Z0I-1-371-120809	Z0I-2-8334-120909	Z0I-2-4139-120909	Z0I-3-3414-120909	NMWQS	EPA MCLS
Benzene		0.00629			0.01	.005
Carbon Disulfide		0.00845	0.00536			
Ethylbenzene		0.00740			0.75	0.7
M+p-Xylene	0.00566	0.0179	0.00773	0.00882		
o-Xylene		0.00709				
Toluene		0.0153		0.00832	0.75	1

Sample ID – That showed Non-Detect (ND) on 8260B-Volatile Organics

Sample ID [a]	8260B Volatile Organics
Z0I-1-2521-120909	ND
Z0I-3-7544-121109	ND
TZ-1-371-121109	ND
TZ-1-2521-121109	ND
TZ-2-4139-121109	ND
TZ-2-8334-121109	ND
TZ-3-3414-121109	ND
TZ-3-7544-121109	ND

[a] Sample Number Identification
(1) Zone of Incorporation (Z0I)
Treatment Zone (TZ)
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

Table D-4. Gallup ZOI and TZ Analytical Results 2009

FALL 2009 – 9 YEAR SAMPLING

EPA 6020A, RCRA METALS; EPA 9012B, TOTAL AND AMENABLE CYANIDE; EPA 7471A, MERCURY
(Units in mg/kg)

Sample ID [a]	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Cyanide	Lead	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc	% Moisture
ZOI-1-371-120809	ND	1.71	314	1.51	ND	26.1	8.54	ND	13.6	ND	18.9	ND	ND	29.0	32.4	12.4
ZOI-1-2521-120909	ND	1.56	389	1.73	ND	26.4	8.99	ND	15.5	ND	19.5	ND	ND	30.8	30.1	30.1
ZOI-2-8334-120909	ND	14.5	481	1.03	ND	123	12.6	10.8	89.7	6.14	46.7	ND	ND	43.7	718	18.6
ZOI-2-4139-120909	ND	10.5	619	1.47	1.11	638	11.4	28.9	79.4	4.23	33.8	1.75	ND	43.9	924	19.4
ZOI-3-3414-120909	ND	6.96	302	1.10	ND	122	12.4	5.22	61.1	1.31	26.9	ND	ND	34.1	235	10.4
ZOI-3-7544-121109	ND	2.69	441	1.61	ND	135	9.59	6.74	23.6	0.399	24.2	ND	ND	40.9	152	14.5
TZ-1-371-121109	ND	1.49	275	1.50	ND	22.1	8.01	ND	13.3	ND	16.1	ND	ND	29.6	25.4	12.6
TZ-1-2521-121109	ND	1.72	281	1.70	ND	29.6	9.54	ND	14.6	ND	22.8	ND	ND	35.7	36.8	20
TZ-2-4139-121109	ND	1.60	326	1.91	ND	32.3	10.3	ND	15.6	ND	21.9	ND	ND	40.3	35.3	15.7
TZ-2-8334-121109	ND	1.68	328	1.53	ND	27.6	8.61	ND	16.6	0.135	17.9	ND	ND	33.2	44.7	16.9
TZ-3-3414-121109	ND	1.71	462	1.85	ND	29.5	9.93	ND	15.5	ND	20.8	ND	ND	36.2	33.2	14.7
TZ-3-7544-121109	ND	1.40	393	1.70	ND	28.3	9.20	ND	14.8	ND	18.7	ND	ND	35.7	30.5	12.9
NMWQS	.0056	.0023	2	.004	.005	0.1		0.2	0.05		0.1	.05			7.4	
EPA MCLS	.006	0.01	2	.004	.005	0.1		0.2	.015	.002		.05				

[a] Sample Number Identification
(1) Zone of Incorporation (Z0I)
Treatment Zone (TZ)
(2) LTU Cell 1, 2, or 3
(3) Grid Cell number
(4) Data Sample number

Table D-4a. Sample Results from Chinle Slope Wash and Sonsela 2009

2009 Sampling Event – July 2009

SM4500-H+B: PH; EPA 120:1, EPA Method 300.0: Anions, EPA Method 8015B DRO/GRO

Sample ID	Collection Date	pH	Specific Conductance (mhos/cm)	Fl (mg/L)	Cl (mg/L)	Nitrate (mg/L)	Phosphorous, Orthophosphate (as P) (mg/L)	Sulfate (mg/L)	DRO (mg/L)	GRO (mg/L)
MW-4	7/8/09	8.74	1200	0.37	16	-	-	160	-	-
MW-5	7/15/09	8.96	1100	0.76	66	-	-	180	-	-
MW-1	7/16/09	9.02	1100	0.76	53	-	-	160		
MW-2	7/16/09	9.00	1100	0.82	60	-	-	170	-	-
SMW-2	7/27/09	7.61	7700	0.32	2300	-	-	1700	-	0.73
SMW-4	7/27/09	8.53	1300	1.2	58	-	-	170	-	-

RCRA metals found in Chinle Slope Wash and Sonsela Wells

Sample ID	Collection Date	Method	Barium (mg/L)	Beryllium (mg/L)	Cadmium (mg/L)	Calcium (mg/L)	Chromium (mg/L)	Cobalt (mg/L)	Lead (mg/L)	Magnesium (mg/L)	Nickel (mg/L)	Potassium (mg/L)	Silver (mg/L)	Sodium (mg/L)	Vanadium (mg/L)	Zinc (mg/L)
Standards	NMWQS		2	.004	.005		0.1		.05		0.1					7.4
	EPA MCLS		2	.004	.005		0.1		.015							
	RRSL															
MW-4	7/8/09	6010B	.022	-	-	1.7	-	-	-	-	-	-	-	280	-	-
MW-5	7/15/09	6010B	.017	-	-	1.5	-	-	-	-	-	-	-	260	-	-
MW-1	7/16/09	6010B	.015	-	-	2.1	-	-	-	-	-	-	-	250	-	-
MW-2	7/16/09	6010B	.019	-	-	1.6	-	-	-	-	-	-	-	250	-	-
SMW-2	7/27/09	6010B	.016	-	-	220	-	-	.0063	68	-	1.1	-	2000	-	-
SMW-4	7/27/09	6010B	.028	-	-	4.4	.0075	.010	-	1.4	-	-	-	310	-	-

Sample ID	Collection Date	Method	Antimony (mg/L)	Arsenic (mg/L)	Selenium (mg/L)	Cyanide (mg/L)	Mercury (mg/L)
Standards	NMWQS		.0056	.0023	.05	0.2	
	EPA MCLS		.006	0.01	.05	.002	.002
	RRSL						
MW-4	7/8/09	6020A/335.4/7470	.022	-		-	-
MW-5	7/15/09	6020A/335.4/7470	-	-	-	-	-
MW-1	7/16/09	6020A/335.4/7470	-	.00124	-	-	-
MW-2	7/16/09	6020A/335.4/7470	-	.00104	-	-	-
SMW-2	7/27/09	6020A/335.4/7470	-	.00384	.00474	0.0662	-
SMW-4	7/27/09	6020A/335.4/7470	-	.00297	-	-	-

Notes:
- = No Detect

Table D-4a: Sample Results from Chinle Slope Wash and Sonsela Wells

2009 Special Sampling Event

VOCs results in sample wells.

Sample ID	Collection Date	Method	Acetone (mg/L)	0-Xylene (mg/L)	Toluene (mg/L)
Standards	NMWQS		.01		0.75
	EPA MCLS				1.0
	RRSL		22.0		0.0015
MW-4	7/8/09	8260B		.00059	.0008
MW-5	7/15/09	8260B	.00492		
MW-1	7/16/09	8260B	-	-	-
MW-2	7/16/09	8260B	-	-	-
SMW-2	7/27/09	8260B	.00625		
SMW-4	7/27/09	8260B	-	-	-

Semi-VOC results in sample wells

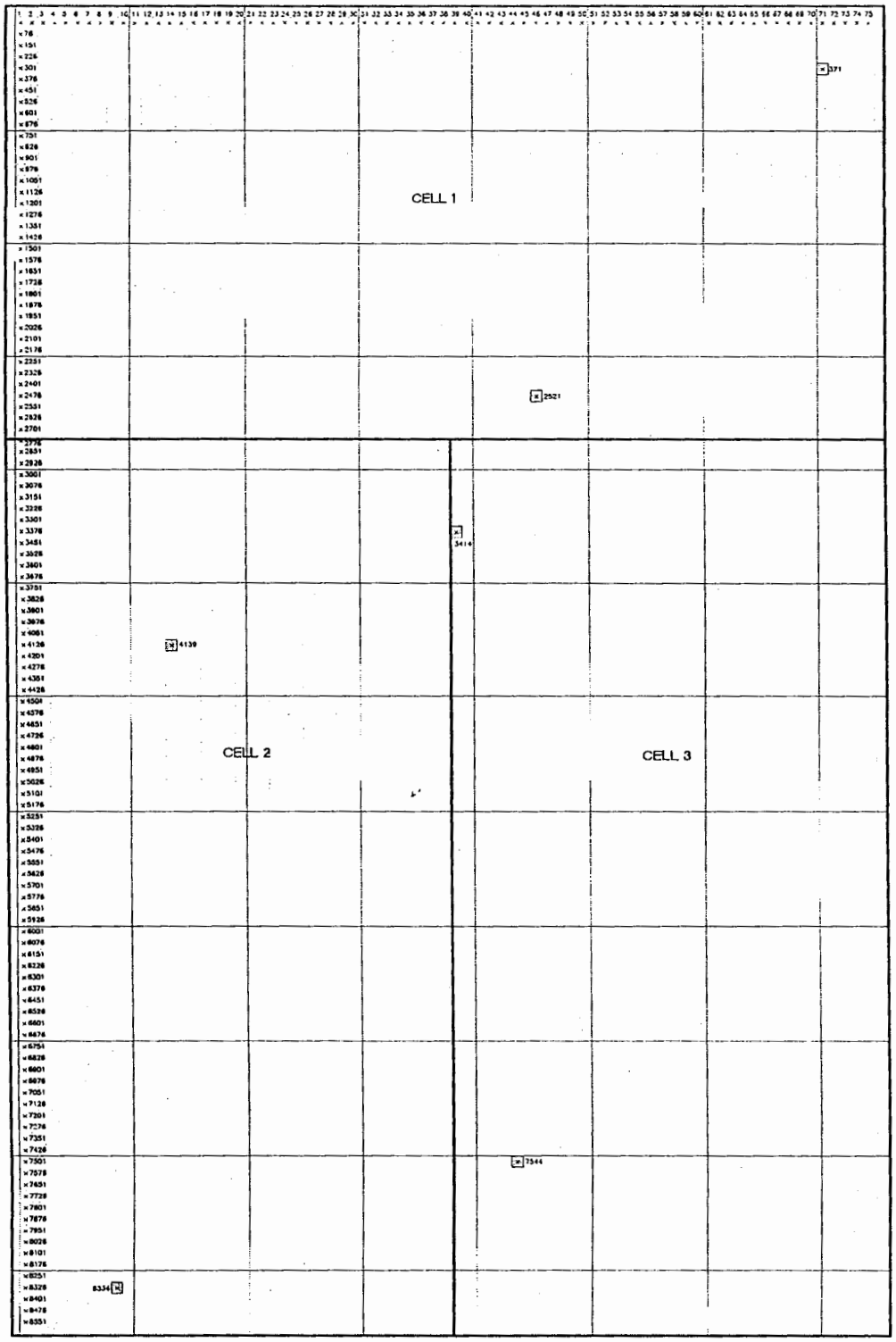
Sample ID	Collection Date	Method	bis(2-Ethylhexyl)phthalate (mg/L)	Diethylphthalate (mg/L)
Standards	NMWQS		.012	17
	EPA MCLS		.006	
	RRSL			
MW-4	7/8/09	8270C	No detect for all parameters	
MW-5	7/15/09	8270C	No detect for all parameters	
MW-1	7/16/09	8270C	No detect for all parameters	
MW-2	7/16/09	8270C	No detect for all parameters	
SMW-2	7/27/09	8270C	No detect for all parameters	
SMW-4	7/27/09	8270C	.00105	.00148

Notes:
- = No Detect

Figure D-2. Sampling Grid – Random Number system

Used for Sampling Points – Cell #1, Cell #2 and Cell #3

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130
131	132	133	134	135	136	137	138	139	140
141	142	143	144	145	146	147	148	149	150
151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170
171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189	190
191	192	193	194	195	196	197	198	199	200



EXPLANATION

- APPROXIMATE LAND TREATMENT UNIT BOUNDARY
- MAJOR GRID
- MINOR GRID
- 6551 6'X6' GRID
- 6639 6'X6' GRID TO BE SAMPLED

NOTES:

1. GRIDS TO BE SAMPLED WERE DETERMINED USING RANDOM.ORG RANDOM INTEGER GENERATOR.
2. PARTIAL 6'X6' GRIDS WERE NOT INCLUDED IN THE SAMPLE LOCATION SELECTION.

N

0 ~40' ~80'

Trihydro CORPORATION
1252 Commerce Drive
Laramie, Wyoming 82070
www.trihydro.com
(P) 307/745.7474 (F) 307/745.7729

FIGURE 1

LTU RCRA SOIL SAMPLING LOCATIONS (DECEMBER 2009)

WESTERN REFINING COMPANY L.L.C.
GALLUP REFINERY
GALLUP, NEW MEXICO

Drawn By: REP	Checked By: GP	Scale: 1" = ~40'	Date: 11/30/09	File: 697038-LTU-SOIL-20091130

Figure D-3: LTU Soil Sampling Locations for 2009

Figure D-4: Random Integer Generator for 2009 Sampling Event

Section E.0

E.0 POST CLOSURE MONITORING

The Gallup Refinery has established a post closure monitoring program in accordance with requirements of 20 NMAC 4.1, subpart IX, §270.14(c) and §270.20(b) (3). The Gallup Refinery is committed to protecting human health and the environment and therefore proposes a post closure monitoring program that consists of two monitoring sequences; early detection monitoring in the unsaturated zone, and detection monitoring in the groundwater at the point of compliance. The two monitoring sequences ensure that data obtained during all post closure monitoring activities are scientifically defensible and support regulatory compliance.

Early detection monitoring will detect whether migration of hazardous constituents from the treatment zone has occurred and to ensure that hazardous constituents within the treatment zone have been successfully treated. The number and depth of samples have been (1), selected to adequately detect potential migration of hazardous constituents, and (2), determined as successful treatment, degradation, transformation, and immobilization in the treatment zone. The details for early detection monitoring are provided in Appendix E. Post Closure Monitoring Plan, and are summarized in Section E.1.

Detection monitoring comprises the monitoring program required at 20 NMAC 4.1, subpart V, §264, and subpart F for the uppermost Sonsela aquifer. The purpose of the detection monitoring is to determine existing conditions of groundwater quality and quantity around the LTU. The number and depth of samples and analytical methods have been selected to effectively monitor the saturated zones beneath the LTU. The detection monitoring, designed to monitor conditions in the Sonsela aquifer, is provided in Appendix E, Post Closure Monitoring Plan and is summarized in Section E.2.

E.1 Early Detection Monitoring [20 NMAC 4.1, subpart V, §264,278, subpart IX, §270.20(b)]

The Gallup Refinery will sample and analyze soil and groundwater during the post closure care period to meet the requirements of 20 NMAC 4.1 subpart V, §264.278 and subpart IX §270.20(b). The early detection monitoring includes sampling soil in the zone of infiltration (ZOI), the treatment zone, and the groundwater in the Chinle slope wash. The early detection monitoring will yield samples that provide a reliable measurement of the quality of the soil and groundwater beneath the treatment zone.

Selection of analytical parameters, i.e., the *modified Skinner List* including total petroleum hydrocarbons (TPH) as gasoline range organics (GRO) and diesel range organics (DRO), and principal hazardous constituents (PHCs), is based on the hazardous constituents expected to be present in the waste and their associated degradation products. The modified Skinner List is a subset of 40 CFR 261 Appendix VIII constituents and identifies the specific hazardous constituents of concern that typically may be found in refinery waste. NMED established PHCs for the LTU in the *Ciniza Hazardous Waste Facility Permit NMD000333211-1*. PHCs are hazardous constituents contained in waste applied to the LTU. NMED determined these PHCs most difficult to treat, considering the combined effects of degradation, transformations, and immobilization. The Gallup Refinery will analyze samples for hazardous constituents from the modified Skinner List including TPH as GRO and DRO and PHCs, collectively referred to as the modified Skinner List.

The sampling schedule (Figure E-1) for the zone of incorporation (ZOI), treatment zone, and Chinle slope wash provides a sampling frequency based on maximum protection of human health and the environment, while minimizing disruption of the LTU and underlying sediments. The Gallup Refinery will analyze samples for organics and metals identified on the modified Skinner List. The sampling schedule is described for each zone in the following sub sections.

E.1.1 Zone of Incorporation Sampling.

The Gallup Refinery will sample the ZOI (upper 12 inches of the treatment zone) to confirm treatment and to ensure that hazardous constituents within the treatment zone have been successfully treated. The Gallup Refinery will obtain soil samples following the protocols in the Post Closure Monitoring Plan, which identifies procedures for obtaining soil samples, determining sampling locations, decontaminating equipment and chain of custody (COC); analytical parameters; analytical procedures; and quality assurance/quality control (QA/QC) requirements.

E.1.1.1 Sampling Frequency and Analytical Parameters.

Characterization of the ZOI was completed in 1999 during a special sampling event. The ZOI was characterized for both the organics and metals as identified on the modified Skinner List (Tables E-1A through E-1D). Tables E-2A through E-2D list the results for this sampling event. Event 1 (9th year) post closure sampling was conducted in December 2009. Tables E-3A through E-3E list the results from this sampling event. During the post closure care period, the ZOI will be sampled three times, with minimum disruption of the vegetative cover.

- Events 1, 2, and 3: The three post closure sampling events will take place in the ninth year, 19th year, and 30th year, respectively, of post-closure care. Analytical parameters selected for Events 1, 2, and 3 are both organics and metals identified on the modified Skinner List.

- Organics	Modified Skinner List (Includes TPH, GRO, DRO)	Tables E-1A thru E-1B
- Metals	Modified Skinner List	Tables E-1C thru E-1D

The sampling frequency for organics and metals during post closure care period is detailed on Figure E-1. The schedule assumes the early sampling events demonstrate that there is no statistically significant increase for any analytes in the Z0I.

If sample results from any sampling event indicate a statistically significant increase in hazardous constituents as defined in 40 CFR 264.278 and §264.97(h), then sampling frequency may be modified after consultation with NMED. If a statistically significant increase is indicated and confirmed following protocol established in Appendix E, Post Closure Monitoring Plan, appropriate notification to NMED will be provided and a permit modification may be required for further characterization of the ZOI. The characterization, if required, will include organics and metals in the modified Skinner List including TPH as GRO and DRO. Confirmation may also trigger a special sampling and analysis event of the Chinle slope wash. This special sampling event, if necessary, will provide additional information on hazardous constituents' present and potential migration out of the ZOI.

E.1.2 Treatment Zone Sampling

Gallup Refinery will sample the treatment zone following the protocols in Appendix E, Post Closure Monitoring Plan. The plan identifies procedures for obtaining soil samples, determining sampling locations, decontaminating equipment and COC; analytical parameters, analytical procedures and QA/QC requirements.

Initial characterization of the treatment zone was conducted in a 1999 special sampling event (Tables E-2A thru E-2D). The zones were characterized for both organics and metals identified in the modified Skinner List (Tables E-1A thru Tables E-1D).

The treatment zone sampling frequency is parallel to the frequency of the ZOI sampling. The treatment zone will be sampled within the 9th, 19th year, and 30th year of post closure care. The samples will be analyzed for both organics and metals in the modified Skinner List plus TPH as GRO and DRO. The sampling schedule is detailed on Figure E-1.

If a statistically significant increase is indicated and confirmed following protocol established in the Post Closure Monitoring Plan, appropriate notification to NMED will be provided and a permit modification may be required for further characterization of the treatment zone. The characterization, if required, will include all organics and metals in

the modified Skinner List plug TPH as GRO and DRO. Confirmation may also trigger a special sampling and analysis event of the Chinle slope wash. This special sampling event will provide additional information on hazardous constituents' present and potential migration out of the treatment zone.

E.1.3 Chinle Slope Wash Sampling

Beneath the LTU, a water bearing unit known as the Chinle slope wash lies on top of, but is not part of, the Chinle formation. This water bearing unit is located above the Chinle formation, and consequently, is located above the Sonsela aquifer (Figure I-1 demonstrates this stratigraphic sequence). The Sonsela is the geologic unit that meets the regulatory definition of the uppermost aquifer that must be monitored in accordance with 20 NMAC 4.1, subpart V, 264. Although the Chinle slope wash does not meet the regulatory definition of an aquifer that must be monitored, as part of early detection monitoring, the Gallup Refinery will voluntarily sample groundwater from the Chinle slope wash to be protective of human health and the environment.

The Chinle slope wash will be sampled using one down gradient stainless steel, shallow monitoring well (SMW-4). The Post Closure Monitoring Plan identifies procedures for obtaining groundwater samples from SMW-4, decontaminating equipment, and COC; analytical parameters; analytical procedures; and QA/QC requirements. If SMW-4 is dry, this observance will be reported for that sampling event and no further sampling will be conducted until the next scheduled sampling event.

E.1.3.1 Background Determination.

Background values for Chinle slope wash samples are not established. Detection of any constituents from Tables E-1A thru E-1D, above regulatory limits, may generate additional sampling after consultation with NMED.

E.1.3.2 Sampling Frequency:

The Chinle slope wash will be sampled annually for three years. After year three, the Chinle slope wash will be sampled bi-annually up to and including year nine of the post

closure care period. Then Chinle slope wash will be sampled in year 19 and 30 of post closure care period. The samples will be analyzed for the organics noted in the modified Skinner List (Tables E-1A and E-1B).

If a statistically significant increase is indicated and verified following protocol established in the Post Closure Monitoring Plan, Gallup Refinery will submit the required notification to the NMED, and a permit modification of the sampling schedule may be required to further characterize the release. Prior to submitting a modification request, Gallup Refinery may demonstrate that the release is from a source other that the LTU or is from errors in sampling, analysis, or data evaluation. Any modification request will address compliance monitoring requirements and will consist of an approach that is tailed to the specific qualities of the release (e.g. location, depth, concentration, media, constituent identified, migration characteristics expected).

E.2 Detection Monitoring [20 NMAC 4.1, subpart V, §264.97 and §264.98, subpart IX §270.14©]

The Gallup Refinery will conduct detection monitoring during the post closure care period in accordance with the requirements of 20 NMAC 4.1, subpart V, §264.97 and §264.98, subpart IX §270.14(c). The detection monitoring will yield (1), samples that represent the quality of hydraulically up gradient groundwater in the Sonsela that could not be affected by the LTU operations, and (2), samples that represent the quality of down gradient groundwater passing the point of compliance (defined in Section E.2.2).

E.2.1 Containment Plume Description [20 NMAC 4.1, subpart IX, §270.14(c) (4)]

The Gallup Refinery has routinely monitored the Sonsela aquifer as well as the Vadose zone above the Chinle formation in accordance with the *Ciniza Hazardous Waste Facility Permit* throughout the life of the LTU. This monitoring has at no time indicated that a plume of contamination has migrated from the treatment zone; therefore, the requirements of 20 NMAC 4.1, subpart IX, §270.14(c) (4) do not apply.

E.2.2 Description of Wells [20 NMAC 4.1, subpart V, §264.97(a), (b), and (c); §264.98(b); subpart IX, §270.14(c) (5)]

20 NMAC 4.1, subpart V, §264.97 requires that the quality of the groundwater passing the point of compliance in the uppermost aquifer be monitored. 20 NMAC 4.1, subpart V, §264.95 defines the point of compliance as a vertical surface located at the hydraulically down gradient limit of the waste management unit that extends down into the uppermost aquifer underlying the unit. The uppermost aquifer beneath the LTU is the Sonsela, which is a confined aquifer that generally flows to the north/northeast under the LTU. The Gallup Refinery maintains four active groundwater monitoring wells (MWs) at/near the LTU (MW-1, MW-2, MW-4, and MW-5).

Pursuant to 20 NMAC subpart V, §264.97, the Gallup Refinery measured background conditions in the Sonsela by sampling groundwater from MW-4, which is completed in the same region of the Sonsela as MW-1, MW-2, and MW-5. MW-4 is located up gradient from the LTU. Water that passes beneath the LTU in the Sonsela is sampled from MW-1, MW-2, and MW-5, which are located on the down gradient edge of the LTU. MW-1, MW-2 and MW-5 are completed in the uppermost aquifer (i.e., Sonsela) at the point of compliance.

E.2.3 Sampling and Analysis Procedures [20 NMAC 4.1, subpart V, §264.97(d), (e), (f) and §264.98(d), (e), (f); subpart IX, §270.14(c) (5), and §270.14(c) (6) (iv)]

The Gallup Refinery obtains groundwater samples following the protocols in the Post Closure Monitoring Plan. The Post Closure Monitoring Plan identifies procedures for obtaining groundwater samples, decontaminating equipment, and COC; analytical parameters; analytical procedures; and QA/QC requirements. These procedures have been designed to ensure that monitoring results provide a reliable indication of groundwater quality below the LTU. The Gallup Refinery will determine groundwater elevations in MWs prior to well evacuation each time the groundwater is sampled. The Gallup Refinery will determine the groundwater surface elevation using the electric tape method or other acceptable method prior to obtaining samples. Using the groundwater surface elevation data, The Gallup Refinery will determine the groundwater flow rate and

the direction of flow in the Sonsela aquifer at least annually to ensure that the monitoring system location is adequate.

The Sonsela aquifer will be sampled annually for three years. After year three, the Sonsela aquifer will be sampled biennially up to and including year nine of the post closure care period; then the aquifer will be sampled in years 19 and 30 of post closure care period. The samples will be analyzed for both organics and metals in the modified Skinner List provided in Tables E-1A thru E-1D.

If Sonsela sampling results indicate that there is statistically significant increase of hazardous constituents in the Sonsela aquifer, notification of the increase will be provided to the NMED in writing within seven business days indicating which concentration limits have been exceeded. At that time, the Gallup Refinery will sample MW-1, MW-2, MW-4 and MW-5, to determine whether constituents in Appendix VIII of 20 NMAC 4.1, subpart V, 264 are present and in what concentrations. Within one month after determination and notification to NMED, the Gallup Refinery will re-sample these MWs and repeat the analysis for any compounds previously detected. Prior to submitting a modification request, the Gallup Refinery may demonstrate that the release is from a source other than the LTU or is from errors in sampling, analysis, or data evaluation. If confirmation sampling verifies Appendix VIII constituents, the Gallup Refinery will, within 90 days, submit an application to the NMED to establish a compliance monitoring program for the LTU using the detected compounds as a basis for the compliance monitoring program.

E.2.4 Indicator Parameters, Waste Constituents, Reaction Products to be Monitored [20 NMAC 4.1, subpart V, §264.98(a), subpart IX, §270.14(c) (6) (i)]

Selection of analytical parameters is based on the hazardous constituents expected to be present in the waste and their associated degradation products. Expected hazardous constituents were identified from the modified Skinner List and PHCs (collectively referred to as the modified Skinner List). PHCs are those identified on the *Ciniza Hazardous Waste Facility Permit* and the Modified Skinner List is a subset of 40 CFR

261 Appendix VIII constituents and identifies the specific hazardous constituents of concern that typically may be found in refinery waste. The analytical parameters for detection monitoring are listed in Tables E-1A thru E-1D.

E.2.5 Background Groundwater Quality and Concentration Values [20 NMAC 4.1, subpart V, §264.97(a) (1) and (g), §264.98(g), subpart IX, §270.14(c) (6) (iii)]

Background groundwater quality values were established for the LTU during the Land Treatment Demonstration; however, MW-4 will continue to be sampled at the same interval as the other MWs to continuously monitor any changes in background water quality. To ensure that sampling and analytical quality control (QC) is verified, analytical results for the up gradient well (MW-4) will be compared to down gradient wells (MW-1, MW-2, and MW-5). Statistical methods will be employed to determine whether fluctuations in results represent impacts from the LTU or reflect variances in sampling and analytical procedures, natural groundwater fluctuation, or other non-LTU influences. A summary of the statistical methods used is provided in Section E.2.6.

E.2.6 Statistical Procedures [20 NMAC 4.1, subpart V, §264.97(h), §264.97(i) (1), (5) and (6).

20 NMAC 4.1, subpart V, §264.97(h) requires that groundwater monitoring data be evaluated using statistical analysis. The Gallup Refinery has evaluated groundwater monitoring data using Cochran's approximation to the Behrens-Fisher Student's T-test for its existing groundwater monitoring program. The Gallup Refinery plans to continue using this methodology to evaluate groundwater monitoring data during the post closure care period. Details about the methodology used for the detection monitoring is included as Appendix E, Post Closure Monitoring Plan.

E.2.7 Notification and Reporting [20 NMAC 4.1, subpart V, §264.97(j) and §264.98(g)]

Pursuant to the requirements of 20 NMAC 4.1, subpart V, §264.97(j), the Gallup Refinery will submit a groundwater monitoring report annually to the NMED for review.

Table E-1A. Modified Skinner List 8260 Volatile Organics and PHCs[a]

Parameter	EPA Method SW-846	Description	Containers	Preservative	Holding Time/Days	Liquid Reporting[c] Limit (µg/L)	Soil Reporting[c] Limit (mg/kg)
Benzene	8260	GC/MS	G	4EC	14	5	0.67
2-Butanone (MEK)	8260	GC/MS	G	4EC	14	1900	7000
Carbon Disulfide	8260	GC/MS	G	4EC	14	1000	350
Chlorobenzene	8260	GC/MS	G	4EC	14	39	54
Chloroform	8260	GC/MS	G	4EC	14	0.16	0.24
Chloromethane	8260	GC/MS	G	4EC	14	1.5	1.2
1,1 Dichloroethane	8260	GC/MS	G	4EC	14	25	580
1,2 Dichloroethane	8260	GC/MS	G	4EC	14	5	0.34
1,1 Dichloroethene	8260	GC/MS	G	4EC	14	5.0	0.053
trans-1,2-Dichloroethene	8260	GC/MS	G	4EC	14	100	63
1,4-Dioxane	8260	GC/MS	G	4EC	14	6.1	44
Ethylbenzene[a]	8260	GC/MS	G	4EC	14	700	230
Methylene Chloride	8260	GC/MS	G	4EC	14	4.3	8.6
Styrene	8260	GC/MS	G	4EC	14	100	1700
1,1,2,2-Tetrachloroethane[b]	8260	GC/MS	G	4EC	14	0.055	0.37
Tetrachloroethene[b]	8260	GC/MS	G	4EC	14	5	4.9
Toluene	8260	GC/MS	G	4EC	14	1000	1000
1,1,1-Trichloroethane	8260	GC/MS	G	4EC	14	60	200
Trichloroethene	8260	GC/MS	G	4EC	14	5	2.7
Total Xylene[a, d]	8260	GC/MS	G	4EC	14	10,000	860
Ethylene Dibromide[b]	8260	GC/MS	G	4EC	14	0.1	0.005
Acetone	8260	GC/MS	G	4EC	14	610	1500

[a]Principal hazardous constituent identified in Ciniza Hazardous Waste Facility Permit.
[b]Additional constituents.
[c]Based on EPA Region 6, Human Health Medium-Specific Screening Levels (1999) and NM WQCC Regulations (1996). Analytical detection limits are required to be lower than reporting limits.
[d]Regulatory limits for individual isomers combined into a 'total' limit for these compounds.

mg/kg = milligrams per kilogram
Φg/L = microgram per liter
G = glass with Teflon-lined lid
GC/MS = gas chromatography/mass spectrometry

Table E-1B. Modified Skinner List 8270 Semivolatile Organics Including TPH and PHCs[a]

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Liquid Reporting Limit (µg/L)[c]	Soil Reporting Limit (mg/kg)[c]
Anthracene	8270	GC/MS	G	4EC	14	1800	16000
Acenaphthene	8270	GC/MS	G	4EC	14	370	2800
Benzo(a)Anthracene	8270	GC/MS	G	4EC	14	0.09	0.62
Benzo(b)Fluoranthene	8270	GC/MS	G	4EC	14	0.09	0.62
Benzo(k)Fluoranthene	8270	GC/MS	G	4EC	14	0.9	6.2
Benzo(a)Pyrene[a]	8270	GC/MS	G	4EC	14	0.0007	0.062
Butyl Benzyl Phthalate	8270	GC/MS	G	4EC	14	7300	240
Chrysene[a]	8270	GC/MS	G	4EC	14	9.2	62
Diethyl Phthalate	8270	GC/MS	G	4EC	14	29000	49000
7,12-Dimethylbenz(a)-Anthracene	8270	GC/MS	G	4EC	14	[e]	[e]
Dimethyl Phthalate	8270	GC/MS	G	4EC	14	370000	100000
Di-n-Octyl Phthalate	8270	GC/MS	G	4EC	14	730	1200
Fluoranthene	8270	GC/MS	G	4EC	14	1500	2300
Fluorene	8270	GC/MS	G	4EC	14	240	2000
Indeno(1,2,3-cd)Pyrene	8270	GC/MS	G	4EC	14	0.09	0.62
2-Methylnaphthalene[a]	8270	GC/MS	G	4EC	14	30	660
2-Methylphenol (Cresol)	8270	GC/MS	G	4EC	14	1800	3000
3/4-Methylphenol (Cresol)	8270	GC/MS	G	4EC	14	1980	3300
Naphthalene[g]	8270	GC/MS	G	4EC	14	30	55
Nitrobenzene	8270	GC/MS	G	4EC	14	3.4	17
4-Nitrophenol	8270	GC/MS	G	4EC	14	2300	3800
Phenanthrene[a]	8270	GC/MS	G	4EC	14	[e]	[e]
Pyrene[a]	8270	GC/MS	G	4EC	14	180	1700
Pyridine	8270	GC/MS	G	4EC	14	37	61
Quinoline	8270	GC/MS	G	4EC	14	0.0056	0.04
Benzenethiole	8270	GC/MS	G	4EC	14	[e]	[e]
Phenol	8270	GC/MS	G	4EC	14	5	36000
Bis(2-Ethylhexyl)phthalate[b]	8270	GC/MS	G	4EC	14	6.0	35
Dibenz(a,j)acridine[b]	8270	GC/MS	G	4EC	14	[e]	[e]
Dibenz(a,h)-anthracene	8270	GC/MS	G	4EC	14	0.0092	0.062
Dichlorobenzene[b, f]	8270	GC/MS	G	4EC	14	675	410
Methyl Naphthalene	8270	GC/MS	G	4EC	14	30	[e]
2,4-Dimethylphenol	8270	GC/MS	G	4EC	14	730	1200
2,4-Dinitrotoluene	8270	GC/MS	G	4EC	14	73	120

Table E-1B. Modified Skinner List 8270 Semivolatile Organics Including TPH and PHCs[a] (Continued)

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Liquid Reporting Limit (µg/L)[c]	Soil Reporting Limit (mg/kg)[c]
2,4-Dinitrophenol[b]	8270	GC/MS	G	4EC	14	73	120
Benzo(j)Fluoranthene	8270	GC/MS	G	4EC	14	[e]	[e]
2-Chlorophenol	8270	GC/MS	G	4EC	14	30	61
2,4,6-Trichlorophenol	8270	GC/MS	G	4EC	14	6.1	44
Di-n-Butyl Phthalate	8270	GC/MS	G	4EC	14	3700	6100
Benzyl Alcohol[b]	8270	GC/MS	G	4EC	14	11000	18000
Methyl Chrysene	8270	GC/MS	G	4EC	14	[e]	[e]
Total Cresol[a, f]	8270	GC/MS	G	4EC	14	3780	6300
TPH[h]	8015m	GS	G	4EC	7	—	1000

[a]Principal hazardous constituent identified in Ciniza Hazardous Waste Facility Permit.
[b]Additional constituents.
[c]Based on EPA Region 6, Human Health Medium-Specific Screening Levels (1999) and NM WQCC Regulations (1996). Analytical detection limits are required to be lower than reporting limits.
[e]No regulatory limit provided. Laboratory detection limit will be used.
[f]Regulatory limits for individual isomers combined into a 'total' limit for these compounds.
[g]Total naphthalene plus monomethylnaphthalenes regulatory limit is < 30µg/L for aqueous samples.
[h]Total Petroleum Hydrocarbon as Gasoline Range Organics and Diesel Range Organics

Φg/L = microgram per liter
mg/kg = milligram per kilogram
G = glass with Teflon-lined lid
GC/MS = gas chromatography/mass spectrometry
GC = gas chromatography

Table E-1C. Modified Skinner List Metals and PHCs[a]

Parameter	EPA Method SW-846	Description	Container	Preservative [b]	Holding Time/Days	Aqueous Reporting Limit (µg/L)[c]	Soil Reporting Limit (mg/kg)[c]
Antimony	7060(aq), 6010	GFAA/ICP	P or G	4EC	180	6.0	31
Arsenic	6010	ICP-AES	P or G	4EC	180	50	22
Barium	6010	ICP-AES	P or G	4EC	180	2000	5400
Beryllium	6010	ICP-AES	P or G	4EC	180	4.0	150
Cadmium	6010	ICP-AES	P or G	4EC	180	5.0	39
Chromium[a]	6010	ICP-AES	P or G	4EC	180	50	210
Cobalt	6010	ICP-AES	P or G	4EC	180	50	3400
Lead[a]	6010	ICP-AES	P or G	4EC	180	15	400
Nickel	6010	ICP-AES	P or G	4EC	180	100	1600
Selenium	6010	ICP-AES	P or G	4EC	180	50	390
Silver	6010	ICP-AES	P or G	4EC	180	50	390
Vanadium	6010	ICP-AES	P or G	4EC	180	260	550
Zinc	6010	ICP-AES	P or G	4EC	180	10000	23000

[a]Principal hazardous constituent identified in Ciniza Hazardous Waste Facility Permit.
[b]Aqueous samples are field acidified to pH < 2 with HNO_3 and must not be refrigerated. Non-aqueous samples are cooled to 4°C.
[c]Based on EPA Region 6, Human Health Medium-Specific Screening Levels (1999) and NM WQCC Regulations (1996). Analytical detection limits are required to be lower than reporting limits.

µg/l = microgram per liter
mg/kg = milligram per kilogram
ICP-AES = Inductively Coupled Plasma - Atomic Emission Spectroscopy
G = glass
P = linear polyethylene, polypropylene, or Teflon

Table E-1D. Mercury[a] and Cyanide

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Aqueous Reporting Limit (µg/L)[c]	Soil Reporting Limit (mg/kg)[c]
Mercury[a]	7470/7471	CVAA	P or G	4EC[b]	28	2.0	23.
Cyanide	335.3/ 9010, 9014	Colorimetry	P or G	4EC[d]	14	200	1200

[a]Principal hazardous constituent identified in Ciniza Hazardous Waste Facility Permit.

[b]Aqueous samples are field acidified to pH < 2 with HNO_3 and must not be refrigerated. Non-aqueous samples are cooled to 4°C.

[c]Based on EPA Region 6, Human Health Medium-Specific Screening Levels and NM WQCC Regulations (1996). Analytical detection limits are required to be lower than reporting limits.

[d]Aqueous samples are field adjusted to pH >12 with NaOH and refrigerated. Non-aqueous samples are cooled to 4EC.

µg/l = microgram per liter
mg/kg = milligram per kilogram
CVAA = cold vapor atomic absorption
G = glass
P = linear polyethylene, polypropylene, or Teflon

Table E-2A. Inorganic Parameters – ZOI, Treatment Zone, BTZ – 1999

Sample Number	Analyte	pH	Total Phosphorus	Oil & Grease	Total Organic Carbon	Total Kjeldahl Nitrogen
	Reporting Limit	NA	0.025	50	0.05	50
	Units	pH units	mg/Kg	mg/Kg	%	mg/Kg
ZOI-3-38-051899		6.60	0.06	3500	1.7	500
3FT-3-38-051899		*	*	*	*	*
BTZ-3-38-051899		8.35	*	*	0.27	*
ZOI-3-97-051899		8.01	0.54	900	0.50	190
3FT-3-97-051899		*	*	*	*	*
BTZ-3-97-051899		8.57	*	*	0.18	*
ZOI-3-135-051899		8.48	0.24	<50	0.26	320
3FT-3-135-051899		*	*	*	*	*
BTZ-3-135-051899		8.41	*	*	0.32	*
ZOI-3-152-051899		8.40	0.19	<50	0.36	300
3FT-3-152-051899		*	*	*	*	*
BTZ-3-152-051899		8.93	*	*	0.14	*
ZOI-2-40-051899		7.09	0.24	18000	5.8	700
3FT-2-40-051899		*	*	*	*	*
BTZ-2-40-051899		8.05	*	*	0.31	*
ZOI-2-41-051899		8.09	0.2	4500	3.2	540
3FT-2-41-051899		*	*	*	*	*
BTZ-2-41-051899		8.10	*	*	0.31	*
ZOI-2-107-051899		7.47	0.17	7000	3.4	510
3FT-2-107-051899		*	*	*	*	*
BTZ-2-107-051899		8.40	*	*	0.22	*
ZOI-1-40-051899		7.61	0.13	6600	2.8	730
3FT-1-40-051899		*	*	*	*	*
BTZ-1-40-051899		8.39	*	*	0.22	*

Table E-2A. Inorganic Parameters – ZOI, Treatment Zone, BTZ – 1999 (Continued)

Sample Number	Analyte	pH	Total Phosphorus	Oil & Grease	Total Organic Carbon	Total Kjeldahl Nitrogen
	Reporting Limit	NA	0.025	50	0.05	50
	Units	pH units	mg/Kg	mg/Kg	%	mg/Kg
ZOI-1-98-051899		7.20	0.27	4900	2.6	500
3FT-1-98-051899		*	*	*	*	*
BTZ-1-98-051899		8.42	*	*	0.29	*
ZOI-1-143-051899		7.90	0.18	10000	5.5	230
3FT-1-143-051899		*	*	*	*	*
BTZ-1-143-051899		8.54	*	*	0.37	*

NOTE:
* Analysis not required

Table E-2B. ICP 6010 Metals and Mercury – ZOI, Treatment Zone, BTZ – 1999

Sample Number	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Nickel	Selenium	Vanadium	Mercury
ZOI-3-38-051899	<1.2	3.9	340	<1.2	<1.2	190	5.1	21	11	<1.2	16	<0.1
3FT-3-38-051899	<1.2	1.5	200	1.4	<1.2	8.9	5	11	9.8	<1.2	18	<0.1
BTZ-3-38-051899	<1.2	2.4	300	1.4	<1.2	25	8.6	12	20	<1.2	43	<0.1
ZOI-3-97-051899	<1.2	1.6	360	1.4	<1.2	24	7	12	14	<1.2	30	<0.1
3FT-3-97-051899	<1.2	1.6	310	1.8	<1.2	27	8.8	13	19	<1.2	40	<0.1
BTZ-3-97-051899	<1.1	1.6	330	1.2	<1.1	10	5.3	9.1	11	<1.1	22	<0.1
ZOI-3-135-051899	3.8	17	3400	11	<1.2	130	63	120	130	<1.2	220	<0.1
3FT-3-135-051899	<1.1	1.7	360	1.5	<1.1	24	8.4	12	18	<1.1	36	<0.1
BTZ-3-135-051899	<1.2	1.4	330	1.6	<1.2	6.2	4.1	10	7.6	<1.2	16	<0.1
ZOI-3-152-051899	<1.2	1.5	350	1.5	<1.2	8.5	5.3	10	11	<1.2	17	<0.1
3FT-3-152-051899	<1.1	1.4	370	1.4	<1.1	17	7	11	15	<1.1	27	<0.1
BTZ-3-152-051899	<1.1	1.1	430	<1.1	<1.1	7.8	4.7	8.5	8.8	<1.1	18	<0.1
ER-POST CELL 1-98-0518-99	<0.01	<0.01	<0.01	0.004	0.004	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.002
ZOI-2-40-051899	<1.1	20	710	<1.1	<1.1	200	9.7	87	54	<1.1	40	13
3FT-2-40-051899	<1.2	1.2	310	1.3	<1.2	7.4	4.9	9.6	9.4	<1.2	14	<0.1
BTZ-2-40-051899	<1.2	1.4	260	1.5	<1.2	17	6.9	12	15	<1.2	27	0.18
ZOI-2-41-051899	1.2	10	550	<1.2	<1.2	310	8.2	54	32	3.3	35	8.4
3FT-2-41-051899	<1.2	13	290	1.7	<1.2	18	7	13	15	<1.2	28	<0.1
BTZ-2-41-051899	<1.1	1.8	270	1.4	<1.1	18	7.1	12	15	<1.1	30	<0.1
ZOI-2-107-051899	<2.5	7.5	350	<1	0.78	220	6.2	40	24	<2.5	21	1.6

Table E-2B. ICP 6010 Metals and Mercury – ZOI, Treatment Zone, BTZ – 1999 (Continued)

Sample Number	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Nickel	Selenium	Vanadium	Mercury
3FT-2-107-051899	<2.5	<2.5	290	<1	<0.5	9.4	4.3	11	9.4	<2.5	15	<0.1
BTZ-2-107-051899	<2.5	<2.5	230	1.1	<0.5	12	5.1	10	12	<2.5	19	<0.1
ZOI-1-40-051899	<2.5	<2.5	290	<1	<0.5	190	7.1	40	28	<2.5	30	0.13
3FT-1-40-051899	16	<2.5	180	1.1	<0.5	9.5	4.1	11	9.4	<2.5	16	<0.1
BTZ-1-40-051899	<2.5	<2.5	210	<1	<0.5	12	5.2	8.9	13	<2.5	20	<0.1
ZOI-1-98-051899	<2.5	<2.5	1100	<1	<0.5	58	6.6	18	13	<2.5	13	2
3FT-1-98-051899	<2.5	<2.5	140	<1	<0.5	7	<2.5	7.9	7	<2.5	12	<0.1
BTZ-1-98-051899	<2.5	<2.5	210	1.1	<0.5	15	5.7	11	13	<2.5	19	<0.1
ZOI-1-143-051899	<2.5	14	350	<1	<0.5	140	5.7	53	39	<2.5	35	1.4
3FT-1-143-051899	<2.5	<2.5	240	<1	<0.5	14	5.7	10	13	<2.5	20	<0.1
BTZ-1-143-051899	<2.5	<2.5	240	1	<0.5	9.2	<2.5	9.1	10	<2.5	13	<0.1

NOTES:

Units are mg/Kg (ER-POST CELL-1-98-0518-99 units are µg/L).
Results are reported on a dry weight basis.

Table E-2C. Volatile Analysis by SW-846 Method 8260 – ZOI, Treatment Zone, BTZ – 1999

Sample Number	Chloromethane	Acetone	1,1-Dichloroethene	Methylene Chloride	1,4-Dioxane	1,1-Dichloroethane	Trans-1,2-Dichloroethene	2-Butanone	Carbon Disulfide	Chloroform	1,2-Dichloroethane	1,1,1-Trichloroethane	Benzene	Trichloroethane	Toluene	1,2-Dibromoethane	Tetrachloroethene	Chlorobenzene	Ethylbenzene	o-Xylene	m&p-Xylenes	Styrene	1,1,2,2-Tetrachloroethane	% Moisture
ZOI-3-38-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21
3FT-3-38-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21
BTZ-3-38-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
ZOI-3-97-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
3FT-3-97-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27
BTZ-3-97-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
ZOI-3-135-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
3FT-3-135-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
BTZ-3-135-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
TRIP BLANK COOLER 1[a]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZOI-3-152-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
3FT-3-152-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
BTZ-3-152-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10
ER-POST CELL 1-98-0518-99[a]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZOI-2-40-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
3FT-2-40-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9

Table E-2C. Volatile Analysis by SW-846 Method 8260 – ZOI, Treatment Zone, BTZ – 1999 (Continued)

Sample Number	Chloromethane	Acetone	1,1-Dichloroethene	Methylene Chloride	1,4-Dioxane	1,1-Dichloroethane	Trans-1,2-Dichloroethene	2-Butanone	Carbon Disulfide	Chloroform	1,2-Dichloroethane	1,1,1-Trichloroethane	Benzene	Trichloroethane	Toluene	1,2-Dibromoethane	Tetrachloroethene	Chlorobenzene	Ethylbenzene	o-Xylene	m&p-Xylenes	Styrene	1,1,2,2-Tetrachloroethane	% Moisture
BTZ-2-40-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
ZOI-2-41-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
3FT-2-41-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
BTZ-2-41-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
ZOI-2-107-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
3FT-2-107-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
BTZ-2-107-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
TRIP BLANK 2[a]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZOI-1-40-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
3FT-1-40-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
BTZ-1-40-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
ZOI-1-98-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
3FT-1-98-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
BTZ-1-98-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
ZOI-1-143-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19

Table E-2C. Volatile Analysis by SW-846 Method 8260 – ZOI, Treatment Zone, BTZ – 1999 (Continued)

Sample Number	Chloromethane	Acetone	1,1-Dichloroethene	Methylene Chloride	1,4-Dioxane	1,1-Dichloroethane	Trans-1,2-Dichloroethene	2-Butanone	Carbon Disulfide	Chloroform	1,2-Dichloroethane	1,1,1-Trichloroethane	Benzene	Trichloroethane	Toluene	1,2-Dibromoethane	Tetrachloroethene	Chlorobenzene	Ethylbenzene	o-Xylene	m&p-Xylenes	Styrene	1,1,2,2-Tetrachloroethane	% Moisture
3FT-1-143-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
BTZ-1-143-051899	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13

[a] Aqueous sample

NOTES:

- Not detected above Reporting Limit

Reporting Limit varies with sample % moisture.

Reporting Limit maximum for soil samples was 0.07 mg/Kg for all analytes except 1,4 Dioxane (6.3 mg/Kg) and 2-Butanone (0.6 mg/Kg).

Reporting Limit for aqueous samples was 1.0 µg/L for all analytes except 1,4 Dioxane (100 µg/L) and Acetone and 2-Butanone (10 µg/L).

Table E-2D. Semivolatile Analysis by SW-846 Method 8270B – ZOI, Treatment Zone, BTZ – 1999

Analyte	ZOI-3-38-051899	3FT-3-38-051899	BTZ-3-38-051899	ZOI-3-97-051899	3FT-3-97-051899	BTZ-3-97-051899	ZOI-3-135-051899	3FT-3-135-051899	BTZ-3-135-051899	ZOI-3-152-051899	3FT-3-152-051899	BTZ-3-152-051899	ER-POST CELL 1-98-0518-99	ZOI-2-40-051899	3FT-2-40-051899	BTZ-2-40-051899	ZOI-2-41-051899	3FT-2-41-051899	BTZ-2-41-051899	ZOI-2-107-051899	3FT-2-107-051899	BTZ-2-107-051899	ZOI-1-40-051899	3FT-1-40-051899	BTZ-1-40-051899	ZOI-1-98-051899	3FT-1-98-051899	BTZ-1-98-051899	ZOI-1-143-051899	3FT-1-143-051899	BTZ-1-143-051899
1,2-Dichlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1-Methylnaphthalene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4,6-Trichlorophenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dimethylphenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dinitrophenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorophenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylphenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3&4-Methylphenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3-Methylcholanthrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Nitrophenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6-Methyl Chrysene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.43	-	-
7,12-Dimethylbenz(a) anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.18	-	-
Anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-

Table E-2D. Semivolatile Analysis by SW-846 Method 8270B – ZOI, Treatment Zone, BTZ – 1999 (Continued)

Analyte	ZOI-3-38-051899	3FT-3-38-051899	BTZ-3-38-051899	ZOI-3-97-051899	3FT-3-97-051899	BTZ-3-97-051899	ZOI-3-135-051899	3FT-3-135-051899	BTZ-3-135-051899	ZOI-3-152-051899	3FT-3-152-051899	BTZ-3-152-051899	ER-POST CELL 1-98-0518-99	ZOI-2-40-051899	3FT-2-40-051899	BTZ-2-40-051899	ZOI-2-41-051899	3FT-2-41-051899	BTZ-2-41-051899	ZOI-2-107-051899	3FT-2-107-051899	BTZ-2-107-051899	ZOI-1-40-051899	3FT-1-40-051899	BTZ-1-40-051899	ZOI-1-98-051899	3FT-1-98-051899	BTZ-1-98-051899	ZOI-1-143-051899	3FT-1-143-051899	BTZ-1-143-051899
Benzo(b)&(j)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.44	-	-
Benz(k)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzyl alcohol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Butyl benzyl phthalate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	2.33	-	-	-	-	-	-	-	-	-	-	-	-	3.13	-	-	-	-	-	-	-	-	2.31	-	-	3.39	-	-	-	-	-
Di-n-butyl phthalate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Di-n-octyl phthalate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)acridine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,j)acridine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diethyl phthalate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dimethyl phthalate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.32	-	-	-	-	-	-	-	-	-	-	-	5.38	-	-

Table E-2D. Semivolatile Analysis by SW-846 Method 8270B – ZOI, Treatment Zone, BTZ – 1999 (Continued)

Analyte	ZOI-3-38-051899	3FT-3-38-051899	BTZ-3-38-051899	ZOI-3-97-051899	3FT-3-97-051899	BTZ-3-97-051899	ZOI-3-135-051899	3FT-3-135-051899	BTZ-3-135-051899	ZOI-3-152-051899	3FT-3-152-051899	BTZ-3-152-051899	ER-POST CELL 1-98-0518-99	ZOI-2-40-051899	3FT-2-40-051899	BTZ-2-40-051899	ZOI-2-41-051899	3FT-2-41-051899	BTZ-2-41-051899	ZOI-2-107-051899	3FT-2-107-051899	BTZ-2-107-051899	ZOI-1-40-051899	3FT-1-40-051899	BTZ-1-40-051899	ZOI-1-98-051899	3FT-1-98-051899	BTZ-1-98-051899	ZOI-1-143-051899	3FT-1-143-051899	BTZ-1-143-051899
Phenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	0.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.63	-	-
Pyridine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Quinoline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
% Moisture	16	19	16	16	16	13	14	13	14	15	13	10	-	9	17	15	16	18	13	16	19	13	21	18	12	16	13	13	17	16	12

NOTES:

Units are mg/Kg.

- Not detected at reporting limit.

Reporting limit varies with dilution and % moisture: 0.38-4.23 mg/Kg for 2,4-Dinitrophenol, 4-Nitrophenol, and Benzyl alcohol, 0.186-2.11 mg/Kg for all other compounds.

Sample ER-POST-1-98-0518-99 is aqueous. Reporting limits are 10 μg/L for 2,4-Dinitrophenol and 4-Nitrophenol, and 5 μg/L for all other compounds reported.

Table E-3A

EPA METHOD 8015B – Gallup Refinery Z01 and TZ 2009

Fall of 2009 – 9 year Sampling Event

Sample ID	DRO 8015B	GRO 8015B	Units
Z0I-1-371-120809	ND	ND	mg/kg
Z0I-1-2521-120909	ND	ND	mg/kg
Z0I-2-8334-120909	7000	ND	mg/kg
Z0I-2-4139-120909	9400	ND	mg/kg
Z0I-3-3414-120909	1800	ND	mg/kg
Z0I-3-7544-121109	270	ND	mg/kg
TZ-1-371-121109	ND	ND	mg/kg
TZ-1-2521-121109	ND	ND	mg/kg
TZ-2-4139-121109	ND	ND	mg/kg
TZ-2-8334-121109	ND	ND	mg/kg
TZ-3-3414-121109	ND	ND	mg/kg
TZ-3-7544-121109	ND	ND	mg/kg
NMWQS	0.2		
EPA MCL			

ND = Non Detect

Table E-3B. Gallup Refinery Z0I and TZ Analytical Results 2009

FALL 2009 – 9 YEAR SAMPLING

EPA 6020A, RCRA METALS; EPA 9012B, TOTAL AND AMENABLE CYANIDE; EPA 7471A, MERCURY
(Units in mg/kg)

Sample ID	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Cyanide	Lead	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc	% Moisture
Z0I-1-371-120809	ND	1.71	314	1.51	ND	26.1	8.54	ND	13.6	ND	18.9	ND	ND	29.0	32.4	12.4
Z0I-1-2521-120909	ND	1.56	389	1.73	ND	26.4	8.99	ND	15.5	ND	19.5	ND	ND	30.8	30.1	30.1
Z0I-2-8334-120909	ND	14.5	481	1.03	ND	123	12.6	10.8	89.7	6.14	46.7	ND	ND	43.7	718	18.6
Z0I-2-4139-120909	ND	10.5	619	1.47	1.11	638	11.4	28.9	79.4	4.23	33.8	1.75	ND	43.9	924	19.4
Z0I-3-3414-120909	ND	6.96	302	1.10	ND	122	12.4	5.22	61.1	1.31	26.9	ND	ND	34.1	235	10.4
Z0I-3-7544-121109	ND	2.69	441	1.61	ND	135	9.59	6.74	23.6	0.399	24.2	ND	ND	40.9	152	14.5
TZ-1-371-121109	ND	1.49	275	1.50	ND	22.1	8.01	ND	13.3	ND	16.1	ND	ND	29.6	25.4	12.6
TZ-1-2521-121109	ND	1.72	281	1.70	ND	29.6	9.54	ND	14.6	ND	22.8	ND	ND	35.7	36.8	20
TZ-2-4139-121109	ND	1.60	326	1.91	ND	32.3	10.3	ND	15.6	ND	21.9	ND	ND	40.3	35.3	15.7
TZ-2-8334-121109	ND	1.68	328	1.53	ND	27.6	8.61	ND	16.6	0.135	17.9	ND	ND	33.2	44.7	16.9
TZ-3-3414-121109	ND	1.71	462	1.85	ND	29.5	9.93	ND	15.5	ND	20.8	ND	ND	36.2	33.2	14.7
TZ-3-7544-121109	ND	1.40	393	1.70	ND	28.3	9.20	ND	14.8	ND	18.7	ND	ND	35.7	30.5	12.9
NMWQS	.0056	.0023	2	.004	.005	0.1		0.2	0.05		0.1	.05			7.4	
EPA MCLS	..006	0.01	2	.004	.005	0.1		0.2	.015	.002		.05				

ND = Non Detect

Table E-3C Gallup Refinery Z01 and TZ Analytical Results 2009

Fall of 2009 – 9 year Sampling Event

EPA METHOD 8270C – Semi Volatiles (Units are in mg/kg)

Sample ID	ZOI-1-371-120809	ZOI-2521-120909	ZOI-8334-120909	ZOI-4139-120909	ZOI-3414-120909	ZOI-7544-121109	TZ-1-371-121109	TZ-1-2521-121109	TZ-2-4139-121109	TZ-2-8334-121109	TZ-3-3414-121109	TZ-3-7544-121109	NMWQS	EPA MCLs
1-methylnaphthalene	-	-	0.246	-	-	-	-	-	-	-	-	-		
2-methylnaphthalene	-	-	0.408	-	-	-	-	-	-	-	-	-		
3+4-Methylphenol	-	-	-	0.454	0.104	-	-	-	-		-	-		
5+6 Methylchrysene	-	-	38.5	40.8	0.740	4.73	-	-	-	0.817	-	-		
Anthracene	-	-	-	-	0.088	-	-	-	-	-	-	-	8.3	
Benzenethiole	-	-	0.292	3.04	0.292	0.401	-	-	-	-	-	-		
Benzo(a)anthracene	-	-	1.22	0.889	-	0.361	-	-	-	-	-	-	.000038	
Benzo(a)pyrene	-	-	8.18	12.1	0.701	2.60	-	-	-	0.237	-	-	.000038	.0002
Benzo(b)fluoranthene	-	-	1.27	-	-	-	-	-	-	-	-	-	.000038	
Butylbenzylphthalate	-	-	-	0.436	-	-	-	-	-	-	-	-		
bis(2-Ethylhexyl)phthalate	-	-	-	-	-	-	0.082	0.101	0.093	0.195	0.101	-	.012	.006
Chrysene	-	-	9.12	13.0	0.401	1.54	-	-	-	0.328	-	-	.000038	
Cresol(total)	-	-	-	0.454	0.104	-	-	-	-	-	-	-		
Dibenz(a,h)anthracene	-	-	0.943	-	-	0.531	-	-	-	-	-	-	.000038	
Diethylphthalate	-	0.408	0.204	-	0.378	-	0.158	0.185	0.143	0.133	0.063	-	17	
Di-n-octylphthalate	-	-	-	-	-	-	-	-	-	0.135	-	-		
Ideno(1,2.3-cd)pyrene	-	-	0.450	-	-	0.294	-	-	-	-	-	-	.000038	
Naphthalene	-	-	0.161	-	-	-	-	-	-	-	-	-		
Phenanthrene	-	-	-	-	-	0.121	-	-	-	-	-	-		
Phenol	-	-	-	0.200	0.151	-	-	-	-	-	-	-	21	
Pyrene	-	-	2.88	3.63	-	0.125	-	-	-	0.105	-	-	.83	

Table E-3D Gallup Refinery Z01 and TZ Analytical Results 2009

Fall of 2009 – 9 year Sampling Event

EPA METHOD 8260B –Volatile Organics.
(Units are in mg/kg)

Sample ID	ZOI-1-371-120809	ZOI-1-2521-120909	ZOI—2-8334-120909	ZOI-2-4139-120909	ZOI-3-414-120909	ZOI-3-7544--121109	TZ-1-371-121109	TZ-1-2521-121109	TZ-2-4139-121109	TZ-2-8334-121109	TZ-3-3414-121109	TZ-3-7544-121109	NMWQS	EPA MCLs
Benzene	-	-	.00629	-	-	-	-	-	-	-	-	-	0.01	.005
Carbon Disulfide	-	-	.00845	.00536	-	-	-	-	-	-	-	-		
Ethylbenzene	-	-	.00740	-	-	-	-	-	-	-	-	-	.75	0.7
M+p-Xylene	.00566	-	.0179	.00773	.00882	-	-	-	-	-	-	-		
0-Xylene	-	-	.00709	-	-	-	-	-	-	-	-	-		
Toluene	-	-	.0153	-	.00832	-	-	-	-	-	-	-	0.75	1

Table E-3E. Sample Results from Chinle Slope Wash and Sonsela 2009

2009 Sampling Event – July 2009

SM4500-H+B: PH; EPA 120:1, EPA Method 300.0: Anions, EPA Method 8015B DRO/GRO

Sample ID	Collection Date	pH	Specific Conductance (mhos/cm)	Fl (mg/L)	Cl (mg/L)	Nitrate (mg/L)	Phosphorous, Orthophosphate (as P) (mg/L)	Sulfate (mg/L)	DRO (mg/L)	GRO (mg/L)
MW-4	7/8/09	8.74	1200	0.37	16	-	-	160	-	-
MW-5	7/15/09	8.96	1100	0.76	66	-	-	180	-	-
MW-1	7/16/09	9.02	1100	0.76	53	-	-	160		
MW-2	7/16/09	9.00	1100	0.82	60	-	-	170	-	-
SMW-2	7/27/09	7.61	7700	0.32	2300	-	-	1700	-	0.73
SMW-4	7/27/09	8.53	1300	1.2	58	-	-	170	-	-

RCRA metals found in Chinle Slope Wash and Sonsela Wells

Sample ID	Collection Date	Method	Barium (mg/L)	Beryllium (mg/L)	Cadmium (mg/L)	Calcium (mg/L)	Chromium (mg/L)	Cobalt (mg/L)	Lead (mg/L)	Magnesium (mg/L)	Nickel (mg/L)	Potassium (mg/L)	Silver (mg/L)	Sodium (mg/L)	Vanadium (mg/L)	Zinc (mg/L)
Standards	NMWQS		2	.004	.005		0.1		.05		.01					7.4
	EPA MCLS		2	.004	.005		0.1		.015							
	RRSL															
MW-4	7/8/09	6010B	.022	-	-	1.7	-	-	-	-	-	-	-	280	-	-
MW-5	7/15/09	6010B	.017	-	-	1.5	-	-	-	-	-	-	-	260	-	-
MW-1	7/16/09	6010B	.015	-	-	2.1	-	-	-	-	-	-	-	250	-	-
MW-2	7/16/09	6010B	.019	-	-	1.6	-	-	-	-	-	-	-	250	-	-
SMW-2	7/27/09	6010B	.016	-	-	220	-	-	.0063	68	-	1.1	-	2000	-	-
SMW-4	7/27/09	6010B	.028	-	-	4.4	.0075	.010	-	1.4	-	-	-	310	-	-

Sample ID	Collection Date	Method	Antimony (mg/L)	Arsenic (mg/L)	Selenium (mg/L)	Cyanide (mg/L)	Mercury (mg/L)
Standards	NMWQS		.0056	.0023	.05	0.2	
	EPA MCLS		.006	0.01	.05	.002	.002
	RRSL						
MW-4	7/8/09	6020A/335.4/7470	.022	-		-	-
MW-5	7/15/09	6020A/335.4/7470	-	-	-	-	-
MW-1	7/16/09	6020A/335.4/7470	-	.00124	-	-	-
MW-2	7/16/09	6020A/335.4/7470	-	.00104	-	-	-
SMW-2	7/27/09	6020A/335.4/7470	-	.00384	.00474	0.0662	-
SMW-4	7/27/09	6020A/335.4/7470	-	.00297	-	-	-

Notes:
- = No Detect

Table E-3E: Sample Results from Chinle Slope Wash and Sonsela Wells

2009 Special Sampling Event

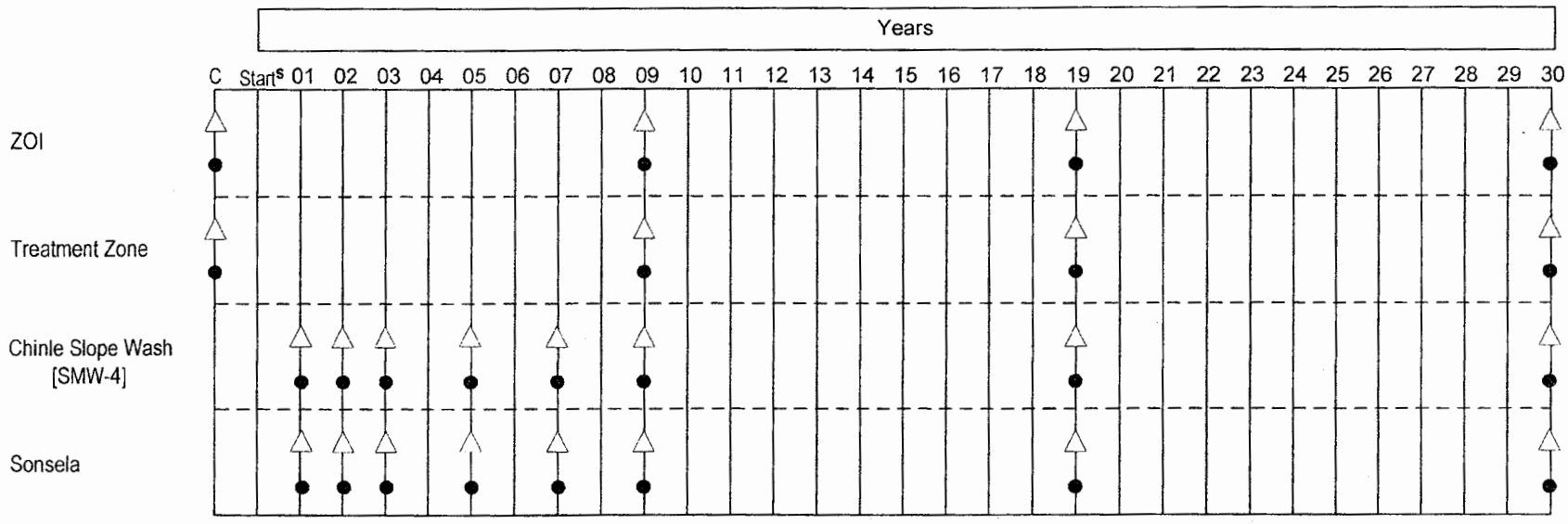
VOCs results in sample wells.

Sample ID	Collection Date	Method	Acetone (mg/L)	0-Xylene (mg/L)	Toluene (mg/L)
Standards	NMWQS				0.75
	EPA MCLS				1.0
	RRSL		22.0		0.0015
MW-4	7/8/09	8260B		.00059	.0008
MW-5	7/15/09	8260B	.00492		
MW-1	7/16/09	8260B	-	-	-
MW-2	7/16/09	8260B	-	-	-
SMW-2	7/27/09	8260B	.00625		
SMW-4	7/27/09	8260B	-	-	-

Semi-VOC results in sample wells

Sample ID	Collection Date	Method	bis(2-Ethylhexyl)phthalate (mg/L)	Diethylphthalate (mg/L)
Standards	NMWQS		.012	17
	EPA MCLS		.006	
	RRSL			
MW-4	7/8/09	8270C	No detect for all parameters	
MW-5	7/15/09	8270C	No detect for all parameters	
MW-1	7/16/09	8270C	No detect for all parameters	
MW-2	7/16/09	8270C	No detect for all parameters	
SMW-2	7/27/09	8270C	No detect for all parameters	
SMW-4	7/27/09	8270C	.00105	.00148

Notes:
- = No Detect



△ = Modified Skinner List - Metals

● = Modified Skinner List - Organics

s = Begin sample activities within 90 days of post-closure permit issuance

c = May 1999 special sample event

Figure E-1. LTU Post-Closure Sampling Schedule

Section F.0

F.0 PROCEDURES TO PREVENT HAZARDS

This section describes procedures to prevent hazards at the Gallup Refinery LTU in accordance with the applicable requirements of 20 NMAC 4.1 subpart V, §264.14, §264.15 and §264.31; and Subpart IX, §270.14(b) (8). The LTU is designed and will be operated during the post closure period to minimize the possibility of fire, explosion, or unplanned releases of hazardous constituents to any environmental medium that could potentially harm human health and the environment. Information on the procedures to prevent hazards at the LTU is provided for the following subject areas:

- Security procedures and equipment [20NMAC 4.1, subpart IX, §270.14(b)(4) and §20 NMAC 4.1, subpart V, §264.14]; and access control [20 NMAC 4.1, Subpart IX, §270.14(b)(19)(viii)]
- Preparedness and prevention requirements [20 NMAC 4.1, subpart V, Part 264, Subpart C]
- Procedures, structures and equipment for preventing hazards [20 NMAC 4.1, subpart IX, §270.14(b)(8)]

F.1 Security (20 NMAC 4.1, subpart V, §264.14; 20 NMAC 4.1, subpart IX, §270.14(b) (4)]

The Gallup Refinery prevents the unknowing entry and minimizes the possibility of unauthorized entry of persons or livestock onto the LTU through access controls to the refinery property. The refinery property boundary is fenced with a 4 feet high, three-strand, barbed wire fence. The refinery process area is fenced with an 8 feet high chain link fence and the access gate to the process area is watched 24 hours per day. Vehicle access to the LTU requires entry through the process area. The gate guard limits access to authorized personnel. The rail access into the refinery through the north boundary fence is locked closed and opened only for the scheduled switch engine. Signs legible from a distance of 25 feet are posted around the perimeter of the LTU and bear the legend "Danger – Unauthorized Personnel Keep out" in English and Spanish. Eight signs are visible from all angles of approach. In accordance with 20 NMAC 4.1, subpart IX,

§270.14(b) (19) (viii), the location of the security fence along the refinery property boundary and access gate are shown on Figure B-1.

F.2 Inspection Plan [20 NMAC 4.1, subpart V, §264.15 and subpart §270.14(b) (5)]

The Gallup Refinery Environmental Manager (EM) will assign and train personnel to inspect the LTU on a regular schedule to identify problems or potential problems and correct them before they cause harm to human health or the environment. Table F-1 summarizes the inspection schedule and frequencies and identifies components inspected and potential problems. Inspection frequencies may be increased at the discretion of the Gallup Refinery EM.

F.2.1 Weekly inspections.

Each week and following every major precipitation event, the inspector inspects the LTU for water accumulation, odors, soil condition, wind dispersion, dike condition, and warning sign condition. No record is kept of these inspections unless repairs are required. The inspector issues a work order request for any needed repairs. Work order requests are tracked by the Scheduling and Maintenance Department and then submitted to the Gallup Refinery EM for signature when work is completed. The inspector also inspects the LTU monitoring equipment, gates, and fences. The inspector records the following inspection information on the checklist (Figure F-2):

- Inspection date
- Name of person inspecting the LTU
- Observations
- Date and nature of repairs or remedial action taken

Inspection activities during post closure care ensure the early detection of structural defects that may occur. The dikes are inspected to ensure that integrity is maintained to effectively control storm water runoff and run on. The LTU is inspected for evidence of wind erosion after windstorms. A checklist used to document each inspection is provided on Figure F-2. The dikes will be maintained at the minimum height of two feet above the surface of the LTU and with 2: 1 side slopes to ensure that each dike has sufficient

capacity to control runoff during the post closure care period. If the integrity of the dikes is compromised, the Gallup Refinery EM will see that corrective action is taken promptly.

The Gallup Refinery EM maintains inspection checklists and work orders for all LTU inspections, except those inspections conducted on safety, communication, and emergency equipment (which are maintained by the Safety Department). All inspection records and work orders are maintained for at least three years following the date of inspection or latest remedial action as a result of an inspection.

F.3 Preventive Procedures, Structures, and Equipment [20NMAC 4.1, subpart IX, §270.14(b) (8)]

The design and operation of the LTU meets the requirements of 20 NMAC 4.1, subpart IX, §2170.14(b)(8) to prevent runoff from the LTU, prevent contamination of water supplies, mitigate the effects of equipment and power failure, prevent undue exposure of personnel to hazardous waste, and prevent releases to the atmosphere. This section describes the procedures, structures and equipment used to prevent hazards at the LTU during the post closure period.

F.3.1 Unloading Operations

The Gallup Refinery will not apply hazardous wastes to the LTU during the post closure care period. No unloading operations will be performed at the LTU; thus, no hazardous waste spills can occur.

F.3.2 Runoff Prevention

The structures used at the LTU and refinery process area to prevent runoff from the LTU to other areas of the refinery or environment are described in this section, as required by 20 NMAC 4.1, Subpart IX, §270.14(b)(8)(ii).

As discussed in Section B.0, the LTU does not lie within a 100 year floodplain. No major surface water bodies are within ten miles of the site, and the nearest river, the normally dry Puerco River, is approximately one mile north. Protection from flooding or

ponding caused by probable maximum precipitation events is provided by diverting water away from the LTU by a system of dikes, berms and swales (Figure B-3). Additionally, grade elevations of roads are designed so that storm water will not collect on the site under the most severe conditions.

Flood control structures, such as dikes and berms are inspected (Section F.2) regularly. During LTU inspections, the structures are checked to ensure that no wind or rain erosion or animal caused damage has caused the system to fail. Further, the areas around the LTU are also inspected to ensure that they are free of vegetation, debris, or other items that would impede the water diversion. Experience with the LTU during the operational phase has shown that weekly structural inspections are adequate for the climate and soil conditions at Gallup Refinery. However, inspections are also conducted after significant storm events.

F.3.3 Water Supplies.

Application of hazardous waste to the LTU ceased in 1990. Because the hazardous waste applied to the LTU during permitted operations has been degraded or immobilized, the risk to groundwater and/or water supplies is minimal. The geological, hydrological, and climatological features of the LTU (Section I), along with the procedures, structures, and equipment used during the operation phase activities, ensure that hazardous waste will not come in contact with the Sonsela aquifer. It is unlikely that any contaminated groundwater can migrate from the treatment zone of the LTU to the accessible environment, including water supplies, during the post closure care period. Gallup Refinery will monitor the Sonsela aquifer during the post closure care period, as described in Section E.0 and Appendix E, the Post Closure Monitoring Plan, to further protect this water body.

F.3.4 Equipment Failure and Power Outages.

LTU activities will be limited to applying fertilizer as necessary, and sampling as detailed in Section E.0, Post Closure Monitoring. If equipment fails, it will be repaired or replaced before continuing operations requiring the failed equipment. A power outage

would have no effect on LTU activities as the monitoring and maintenance activities are performed during daylight hours.

F.3.5 Personal Protective Equipment

Gallup Refinery personnel responsible for LTU activities will use personal protective equipment (PPE) to protect themselves from the hazards in the work place under normal conditions.

PPE and emergency equipment will also be used under unusual hazardous conditions. During post closure care, PPE required for personnel involved with LTU activities may include protective overalls, safety toe/steel toe shoes, and protective shoe coverings, depending on the activities being conducted.

Emergency equipment will be maintained at Gallup Refinery so that personnel and emergency response personnel can protect themselves and respond appropriately to an incident at the LTU. PPE and emergency equipment supplies are stored in the refinery warehouse. The location of PPE and emergency equipment is listed in Section G.0. The locations of fire extinguishers and communication systems are shown in Figure B-1. All personnel who may be required to use PPE and emergency equipment to respond to a LTU incident are trained to use this equipment.

F.3.6 Releases to Atmosphere [20 NMAC 4.1, subpart IX, §270.14(b) (8) (VI)]

Because the Z0I depth is 12 inches and a vegetative cover will be applied during closure activities, releases of hazardous constituents to the atmosphere can not occur.

Table F-1. Inspection Schedule

Area	Specific Items	Type of Problems	Frequency
LTU	General Conditions	Water accumulations	Weekly
		Odors	After each major storm event
		Soil Coloration changes	
		Wind Dispersion	
		Site level, needs plowing	
	Dikes/Berms	Erosion	Weekly
		Evidence of Run on	After each major storm event
	Signs	Condition and legibility	Weekly
	Water Wells	Caps in place	Weekly
		Damage to surface casing	
		Protection barriers in place	
Security	Fence	Gate property locked	In operation continually – failures immediately reported
Communication Systems	Telephones / Radio	Audibility	In operation continually – failures immediately reported
	Fire whistle	Audibility	Monthly whistle check
	Emergency Generator	East of start	Monthly by Boiler Operator and Safety Department
		Lubrication	
		Power generation	

Figure F-2
Land Treatment Unit Inspection Checklist

LTU Surface

Condition:	Water Standing?	□ Yes □ No
	Wet or Dry?	□ Yes □ No
	Odor?	□ Yes □ No
	Erosion?	□ Yes □ No
	Is vegetation growing?	□ Yes □ No

Monitoring Wells

Condition:

Caps and locks

Dikes/Berms

Condition:	Water Standing?	□ Yes □ No
	Wet or Dry?	□ Yes □ No

Vehicle, Fence, and Locks

Condition:

Signs (8)

Condition:	In Place?	□ Yes □ No
	Legible?	□ Yes □ No

Repairs Needed

Time of Day: _____ □ AM □ PM Date_____

Name of Inspector:

_____

Repairs Completed

Signature _____ Date_____

Section G.0

G.0 CONTINGENCY PLAN

This section presents general contingency measures for the Gallup Refinery LTU during the post closure care period. This contingency plan is intended to meet the requirements in 20 NMAC 4.1, subpart V, "Contingency Plan and Emergency Procedures," for RCRA facilities. This plan is consistent with the Gallup Refinery Emergency Procedures Manual; the manual is updated and maintained by the Gallup Refinery Health and Safety Department. The provisions of this contingency plan will be carried out immediately whenever there is a fire, explosion, or sudden event in the refinery process area that could threaten human health or the environment due to effects at the LTU.

G.1 General Information [20 NMAC 4.1, subpart IX, §270.14(B) (7)]

The Gallup Refinery's distance from other emergency response agencies requires that Gallup Refinery provide its own emergency first response resources. External reporting to the McKinley County 911 Dispatch Center will be reported by dialing 9-911 on a regular refinery telephone. The Shift Supervisor or the ERC will make this phone call. The report will be made as soon as possible upon discovery that a reportable release or fire has occurred based on the criteria listed in Table G-4. Depending on the size and nature of the incident, other agencies may require notification in addition to McKinley County. These notifications will be made by the Shift Supervisor on duty and should be made as soon as required by environmental regulations. In those instances when the EOC is activated, the Environmental Manager will insure that required notifications are made.

The potential for major emergencies such as spills, releases, or fires to occur in the RCRA LTU, waste storage, or accumulation sites is very low. All emergencies will be coordinated and directed through the Refinery Incident Command system. The Refinery Incident Command System will be activated immediately upon notification that an emergency is in progress. The Whispering Cedars Volunteer Fire Department and the Med-Star Ambulance Service are utilized to provide additional medical resources in the event an incident occurs which has the potential to, or may have caused injury to employees at the facility. The utilization of "outside" aid during emergencies is structured to minimize exposure to fire personnel who will be used in a tertiary mode. Life safety is the priority at all times for

outside personnel responding to emergency situations at the facility. Implementation of the contingency plan is not anticipated because post closure activities are limited to monitoring and maintenance.

G.2 Emergency Coordinator [20 NMAC 4.1, subpart V, §264.52(d) and §264.55, subpart IX, §270.14(b) (7).

The Gallup Refinery is staffed 24 hours per day, 365 days per year. The Gallup Refinery Manger has delegated the authority and responsibility for administering and implementing the Gallup Refinery's emergency response activities to the emergency response coordinator. The emergency response coordinator is responsible for coordinating all emergency responses at the refinery and the LTU. The safety manager is the primary emergency coordinator. On weekends, the weekend duty person is the initial emergency coordinator. When the primary emergency coordinator cannot be reached, persons on the weekend staff duty list serve as alternates. A qualified emergency coordinator can always be reached by contacting the Gallup Refinery Security and or the control room. The control room is staffed 24 hours per day. A list of emergency coordinators is provided in Table G-1.

G.3 Contingency Plan Implementation [20 NMAC 4.1, subpart V, §264.51, §264.273, subpart IX, §270.14(b) (7)]

The Gallup Refinery will implement the contingency plan described in this section in accordance with 20 NMAC 4.1, subpart IX, §270.14(b) (7). An emergency at the LTU during the post closure period is very unlikely due to its isolation from refining activities. Danger to the environment from the LTU is also minimal. Hazardous waste application to the LTU ceased in 1990, and non-hazardous waste application ceased in 1993. Waste applied during this time has undergone degradation, transformation, and immobilization within the treatment zone. Additionally, low precipitation, extremely low permeability of the native clay layer, addition of topsoil and a vegetative cover, and the depth to the uppermost potential aquifer all minimize any danger to the environment.

Personnel maintaining the LTU wear appropriate PPE. The Gallup Refinery Emergency Procedures Manual, designed to handle more serious refinery operations emergencies, will be followed should an emergency arise during LTU maintenance activities.

The decision to implement this contingency plan depends upon whether an imminent or actual incident involving a release of hazardous waste to the environment from the LTU area could threaten human health or the environment. The emergency coordinator uses the following guidelines to determine whether to implement the contingency plan.

G.3.1 Fire and Explosion.

Fires or explosions and the potential resultant releases of refinery waste and runoff of high volumes of water to the LTU area may result in a threat to human health and the environment. Implementation of this contingency plan is required whenever a sudden release cannot be contained in the refinery process area or threat to human health or the environment exists as a result of a fire or explosion.

If a fire or explosion occurs at Gallup Refinery, it will be controlled as described in the Gallup Refinery Emergency Procedures Manual. In fighting a fire, potentially contaminated runoff from a fire or explosion will be managed by water containment controls in the refinery area, if possible. The existing berm around the perimeter of the LTU provides further protection from water run-on due to either a fire or explosion. Water drainage is shown on Figures B-3 and B-4.

The Gallup Refinery maintains a fire brigade that draws upon resources throughout the refinery organization. The Fire Brigade is organized and managed through the Safety Department by the Emergency Response Coordinator. It is expected that no member of the Fire Brigade will function or be assigned to a task that is beyond their level of training or beyond the capabilities of the personal protective equipment that they have been assigned.

The Fire Brigade has three distinct teams:

- Shift Fire Brigade – the shift fire brigade is comprised of on shift operations personnel. The Shift Fire Brigade serves in a defensive mode only, operating water and foam monitors as well as fixed deluge systems. Shift members able

to be released to an emergency may vary but is expected to be four to six personnel.

- Emergency Response Team – the emergency response team is comprised of volunteer members from throughout the refinery organization, including operations.

- Fire and Safety Technicians – There are four Fire and Safety Technicians on shift at all times. The team is trained to act in an offensive manner, employing full bunker gear, fire apparatus and hose lines and integrates with the Emergency Response Team during emergencies. This team is trained in high angle and confined space rescue and serves as the facility rescue team. This team is also trained as emergency medical technicians and provides on-site emergency medical care.

The Shift Superintendent is the Incident Commander until relieved by another authorized incident commander. Emergency Operational Sectors are typically managed by the Fire and Safety Technicians. The Emergency Response Coordinator can institute a call-out to provide more personnel as needed.

Continued training in fire emergency response for the Shift Fire Brigade, Volunteer Emergency Response Team, and Fire and Safety Technicians constitutes at least 8 hours annually. Training includes classroom, hands-on and live fire scenarios. Fire and Safety Technicians are trained to NFPA 1081 standards within eight months of assignment. The members of the Volunteer Emergency Response Team are upgraded to meet NFPA 1081 standards as opportunities to attend courses become available.

The Gallup Refinery maintains its own firefighting force and equipment, medical transportation equipment, and first aid medical supplies at the refinery. The fire fighting equipment and fire suppression systems are owned, operated, and maintained on site at the Gallup Refinery. The fire control equipment and fire suppression systems are described in Section G-5.

G.3.2 SPILLS

During the post closure care period, no hazardous waste will be managed at the LTU; therefore no spills will occur. Should precipitation accumulate and threaten to overflow the containment berm (see Figure G-2), the contingency plan will be implemented. During the

post closure care period, surface runoff will be controlled by the existing berm around the perimeter of the LTU and by the addition of topsoil and a vegetative cover directly on top of the LTU. The berm should contain over twice the annual rainfall for the area (11 inches) in volume, assuming the average berm height of two feet and approximately 7.8 acres of surface area. According to the National Oceanic and Atmospheric Administration Atlas No.2, Precipitation Frequency Atlas for the Western United Sates, the 24 hour, 100 year storm event is 2.7 inches for the Gallup Refinery, New Mexico area. The berm meets requirements to control precipitation runoff from the LTU during a 24 hour, 25 year storm event in accordance with 20 NMAC 4.1, Subpart V, §264.273.

G.3.3 Unplanned Non-sudden Release

Non-sudden releases include those incidents that, if uncontrolled, impact the environment over a long period of time. In the unlikely event that drought or other unplanned event inhibits vegetative growth, performance will be corrected by applying fertilizer as necessary and/or water addition. The Gallup Refinery will coordinate any necessary changes to the procedures for LTU maintenance and monitoring with the NMED.

G.4 Emergency Actions [20 NMAC 4.1, subpart V, §264.52(d), subpart IX, §270.14(b)(7)]

Immediately upon discovery of an imminent or actual emergency (other than fire), the emergency response coordinator will be notified. In case of fire, personnel who first discover the fire will notify the control room by two-way radio or phone. Upon being notified the boiler house operator will manually operate the refinery whistle and will sound two five-second blasts and announce the location of the fire on the two-way radio. The emergency response coordinator will report to the fire site.

Upon notification of an emergency, the emergency response coordinator will perform the following:

- Proceed directly to the site
- Assess the nature of the incident

- Based on the guidelines in Section G.3, determine whether to implement the contingency plan.

Upon deciding to implement the contingency plan, the emergency response coordinator will perform the following:

a. Notify required response personnel by telephone or refinery radio for any incident other than fire. In case of fire, the emergency response coordinator confirms that the fire chief is aware of any special hazards associated with refinery wastes.

b. Notify NMED at (505) 476-4300 and National Response Center at 800-424-8802.

c. Warns the remaining refinery personnel of imminent or actual hazards using the refinery radio.

d. Identify the character, exact source, amount, and extent of contamination either by surface flow or aerial dispersion based on review of LTU records or, if necessary, by chemical analysis.

e. Assess the hazards to the environment and human health.

f. Determine whether evacuation of the local area is advisable.

g. Advise the response personnel as needed to minimize personnel exposure to hazards and expedite control.

Upon control of the incident, the emergency response coordinator will perform the following:

a. Arrange for site clean up.

b. Provide for treating, storing, or disposing of recovered wastes, contaminated soil, or contaminated surface waters.

c. Provide for decontamination of equipment as needed.

d. Conduct testing as needed to verify successful clean up.

e. Within 15 days of any incident involving the LTU, submit the reporting form described in Section G.8 to the NMED.

G.5 Emergency Equipment [20 NMAC 4.1, subpart V, §264.52(e), subpart IX §270.14(b) (7)]

The Gallup Refinery maintains emergency equipment to respond to emergencies in accordance with 20 NMAC 4.1, Subpart V, §264.52(e). Locations of fire and emergency equipment are shown on Figure G-1. The Gallup Refinery Emergency Procedures Manual

provides additional information on fire equipment. The major emergency equipment is listed in Table G-2.

G.6 Coordination Agreements [20 NMAC 4.1, subpart V, §264.52(c), §264.37, subpart IX, §270.14(b) (7)]

Table G-3 lists the organizations that the Gallup Refinery emergency coordinator could contact in an emergency and gives a brief definition of the coordination agreement. The Gallup Refinery provides a copy of the contingency plan to all coordinating organizations. Coordination is maintained with Rehoboth McKinley Christian Hospital (RMCH) staff to ensure that they are aware of treating special problems associated with refinery emergencies. The Gallup Refinery Fire Department, Thoreau Volunteer Fire Department, and Whispering Cedars Volunteer Fire Department have had general refinery fire fighting training.

The Gallup Refinery attempts to handle emergencies internally and maintains fire fighting equipment, a fire brigade consisting of shift fire brigade, emergency response team (approximately 25 members), fire and safety technicians who are trained as emergency medical technicians and provides on-site medial care. The fire brigade is trained to NFPA 1081 standards and receives classroom, hands-on and live fire training through drills and instructions.

G.7 Evacuation Plan [20 NMAC 4.1, subpart V, §264.52(f), subpart IX, §270.14(b) (7)]

The refinery entrance gate is staffed around the clock. In an emergency, access of non-refinery personnel is prohibited. The refinery entrance gate is equipped with outside line emergency access. No foreseeable incidents involving the LTU will result in evacuation of the refinery or surrounding area. However, evacuation as described below may result in the event of a major, uncontrolled refinery fire.

G.7.1 Visitors

Visitors are signed in at the front office and are assigned an electronic access card if they will be entering the refinery process units upon leaving the main building. Un-escorted visitors are not allowed in the refinery process units operating area. Emergencies that require evacuation will be signaled by four (4) five second blasts of the steam whistle. If the steam

whistle is disabled, notice for evacuation will be communicated by telephone, radio or other means. The supervisor or individual in charge of visitors shall be responsible for directing orderly and complete evacuation of all personnel in his/her group. A checkpoint shall be established in a safe area south of the guard house. The group leader shall account for each individual by name and report to the Gallup Refinery Security that these individuals have been evacuated.

G.7.2 Contractors

Contractors are logged in and out at the security building on the southeast side of the main office for each entry and departure. Contractors are given safety instructions during their first visit to the refinery. Emergencies that require evacuation will be signaled by four (4) five second blasts of the steam whistle. If the steam whistle is disabled, notice for evacuation will be communicated by telephone, radio or other means. The supervisor or individual in charge of contractors shall be responsible for directing orderly and complete evacuation of all personnel in his/her group. A checkpoint shall be established in a safe area south of the guard house. The group leader shall account for each individual by name and report to Gallup Refinery Security that these individuals have been evacuated.

G.7.3 Employees

All employees are assigned specific duties during emergencies and form the emergency response crews. Each crew leader has a radio and is responsible for communicating with team members. Emergencies that require evacuation will be signaled by four (4) five second blasts of the steam whistle. If the steam whistle is disabled, notice for evacuation will be communicated by telephone, radio or other means. The supervisor or individual in charge of each group shall be responsible for directing orderly and complete evacuation of all personnel in his/her group. A checkpoint shall be established in a safe area south of the guard house. The group leader shall account for each individual by name to prevent unnecessary search and rescue efforts.

G.7.4 Non-Essential Office Personnel

Emergencies that require evacuation of non-essential office personnel will be signaled by four (4) five second blasts of the steam whistle. If the steam whistle is disabled, notice for evacuation will be communicated by telephone, radio or other means. The supervisor or

individual in charge of each group shall be responsible for directing orderly and complete evacuation of all personnel in his/her group. A checkpoint shall be established in a safe area south of the guard house. The group leader shall account for each individual by name to prevent unnecessary search and rescue efforts.

G.7.5 Local Citizens

Due to the rural nature and remote location of the site, it is doubtful that evacuation of citizens will be required. The nearest non-refinery residence is more than one mile south-southwest, the second nearest is approximately 2.5 miles northwest. Should evacuation be deemed necessary, the refinery management will contact the McKinley County Sheriff, the New Mexico State Police and the Navajo Nation Police to provide assistance.

G.8 Required Reports (20 NMAC 4.1, subpart V, §264.56(j), subpart IX, §270.14(b) (7)]

Any emergency that requires implementing the contingency plan will be reported in writing within 15 days to NMED.

TABLE G-1. EMERGENCY COORDINATOR[a]

Emergency Coordinator	Gallup Refinery Telephone	Home Telephone	Home Address
This information will be supplied to NMED at the time of certification to NMAC 4.1, subpart V, §264.52(d)			

[a] To ensure immediate response, the emergency response coordinator may be reached at (505) 722-3833, 24 hours a day, and 7 days per week.

TABLE G-2 EMERGENCY EQUIPMENT

Quantity	Item	Location	Description
1	2008 Pierce Arrow Fire Truck	Fire House	The fire truck is a water and or foam pumper. Rated capacity of the water pump is 3000 gpm . The fire truck carries a tank containing 1000 gals, 1300 feet of 5" hose; 400 ft of 3" hose, 400 ft of 1.75" hose.
1	Fire Truck #2 – Foam Tanker	Fire House	The fire truck can be used as a water pumper, a foam pumper, or in combination to deliver simultaneous water and foam streams, and is capable of cross-country operation. The rated capacity of the water pump is 1000 gpm at 150 psi from draft. Capacities and pressures may be increased when water is supplied from hydrants. The fire truck is capable of drafting from static water sources (such as the evaporation ponds) and can supply up to six discharge hoses. The fire truck carries a tank containing 1000 gallons of XL3% foam, 1000 feet of 3 inch fire hose and 500 feet of 1-1/2 fire hose as well other miscellaneous fire fighting equipment.
1	Fire Truck #1 (Mini-Pumper)	Fire House	The fire truck is a water and/or foam pumper with a rated capacity of 500 gpm at 150 psi from draft. The truck carries a tank containing 50 gallons of AFFF foam, a second tank containing 250 gallons of water, 700 feet of 3 inch hose, miscellaneous fire fighting equipment and a cab-mounted monitor. The fire truck is a rural 4-wheel drive capable of cross country operation
1	Fire Water Storage and Distribution Hydrant System	See Figure G-1	Primary fire water storage is located in two tanks, The 5000 gallon fire water tank (Z86-T1) and the 5000 gallon raw water tank (Z91-T1), located near the boiler house. These tanks are directly fed by three artesian wells. The Waukesha natural gas driven fire water pump and the seam driven fire water pump draw from the artesian wells and discharge to the hydrant system. The No. 2 pond holds an estimated 1.5 million gallons. The diesel fire water pump draws from Pond 2 and discharges to the hydrant system. The hydrant system includes not only fire water supply hydrants but also turret monitors, steamers, hose reels, fog nozzles, foamite air chambers and foamite air foam respirators. The locations of this equipment are shown on Figure G-1.
1	Diesel driven pond fire water pump	No. 2 Evaporation Pond	This pump can deliver 1300 gpm and takes suction from the pond and discharges to the hydrant system.
1	Natural Gas Engine Fire Water Pump	Boiler House	This pump can deliver 1000 gpm and takes suction on the raw water and fire water tanks discharging to the hydrant system.
1	Steam turbine Driven Fire Water Pump	Boiler House	This pump can deliver 1000 gpm and takes suction from the raw water and fire water storage tank discharging to the hydrant system.
25 129 51 44 59 11	10# Cartridge Fire Extinguisher 20 # Cartridge Fire Extinguisher 30# Cartridge Fire Extinguisher 10# Pressurized Fire Extinguisher 20# Pressurized Fire Extinguisher 350 # Wheeled Extinguisher	Facility Wide	The distribution of fire extinguishers throughout the refinery allows rapid response and control of small fires. Refinery vehicles and vacuum trucks are also equipped with fire extinguishers.
20	30 Minute Scott Air Packs	Facility Wide	The air packs allow operator response prior to arrival of the fire truck and should they be needed for escape. Two additional air packs are located on the Aer-0-Foam Fire truck.
8080 ft	Fire hose in 1.5", 1.75", 2.5", 3", and 5" hoses.	Fire House	A major portion of this hose is kept on a trailer to facilitate movement and approximately 2000 feet of fire hose is maintained at key locations in the process area.
1000 gal	Spare XL 3% Foam	Fire House	
300 gal	AFFF Foam		
4	Proximity Fire Entry Suits	Fire House	
7	Level A Haz Mat Suit	Fire House	
	Miscellaneous First Aid Equipment/supplies	Facility Wide	

Table G-3 Response Groups and Agencies Available to Gallup Refinery for Guidance and/or Emergency Assistance.

Response Group	Telephone Number	Agreement
Gallup Refinery Response Group –Field Emergency Crew		
Incident Commander	Notified by 2-way radio, (505) 722-3833	Provides emergency site evaluation. Notifies shift fire crew. Specifies protective clothing and equipment. Provides support for any emergency incident and decontamination of responders and response equipment.
Fire Brigade	Notified by 2-way radio, (505) 722-3833	Provides a first response team to any emergency incident as directed by the incident commander.
Environmental Staff	Notified by 2-Way (505) 722-3833	Provides guidance on environmental problems and emergency site evaluation. Determines if field monitoring is necessary. Provides guidance on regulatory requirements. Conducts any field surveys to determine spread of contamination and adequacy of clean up.
Local Agencies		
Gallup Refinery Fire Department	911	Provides emergency response fire fighting personnel and equipment as needed
Gallup Refinery Ambulance	911	Provides ambulance service as needed
Thoreau Fire/Ambulance	(505) 862 7770	Dispatches fire fighting personnel and equipment as needed
Whispering Cedars Fire Department	(505) 863 6871	Dispatches fire fighting personnel and equipment as needed
Local Emergency Planning Committee	(505) 863-1437	Provides local emergency response planning
McKinley County Sheriff's Office	(505) 863-1410	Provides assistance in isolating the refinery, controlling traffic in emergency and evacuating local residents.
State Agencies		
NM State Police Department	(505) 334-6622	Provides assistance in isolating the refinery, controlling traffic in an emergency and evacuating local resident.
NM Department of Public Safety – Hazardous Materials Emergency Response (8 hrs/day)	(505) 476-9610	Notify NMED/HRMB if a hazardous waste release, fire, or explosion could threaten human health or the environment outside the facility
National Response Center	800-424-8802	Notify NRC immediately if a hazardous waste release, fire or explosion could threaten human health or the environment outside the facility.
Miscellaneous Assistance		
Rehoboth McKinley County Hospital (RMCH)	(505) 863-7000	Provides medical services. Provides and maintains the emergency room.
FAA Emergency Weather Information	866-835-5322	Provides information on meteorological Condition.
Solvay Fluorides	1-800-424-9300	Provides specific HF Chemical emergency information.
CHEM-TREC (MSDS information)	800 424-9300	Provides specific chemical information.

Table G-4 External Reporting Procedure

Incident Level and Type	Criteria for Reporting	Expected Off-Site Resources Response
Level 1 Release	Release of hazardous materials which does not present an alarm emergency situation, but which meets one or more of these criteria 1. A non-permitted release greater than the reportable quantity for that material onto bare soil, into the air or into refinery effluent. 2. A release of any amount which results in illness or injury to anyone requiring transport to a medial facility for treatment.	No Report No Expected Response
Level II Release	A release of hazardous materials which represents an emergency situation which requires a response by the onsite Refinery ERT. A release of any amount which impacts the community or environment outside of the Refinery such as odors, clouds or liquids leaving the plant.	Probable single alarm response and Hazmat Unit as appropriate
Level III Release	A release of hazardous materials which presents a severe emergency situation requiring a response by on-site and off-duty Refinery ERT.	Probable multiple alarm response and Hazmat Unit as appropriate
Level I Fire	An incipient stage of fire which is rapidly extinguished without the need for a response by the Refinery ERT.	No Report No expected Response
Level II Fire	A fire which requires a response by the on-site Refinery ERT.	Probable single alarm response
Level III Fire	A large out of control fire which requires a response by on-site and off-duty Refinery ERT.	Probable multiple alarm response.

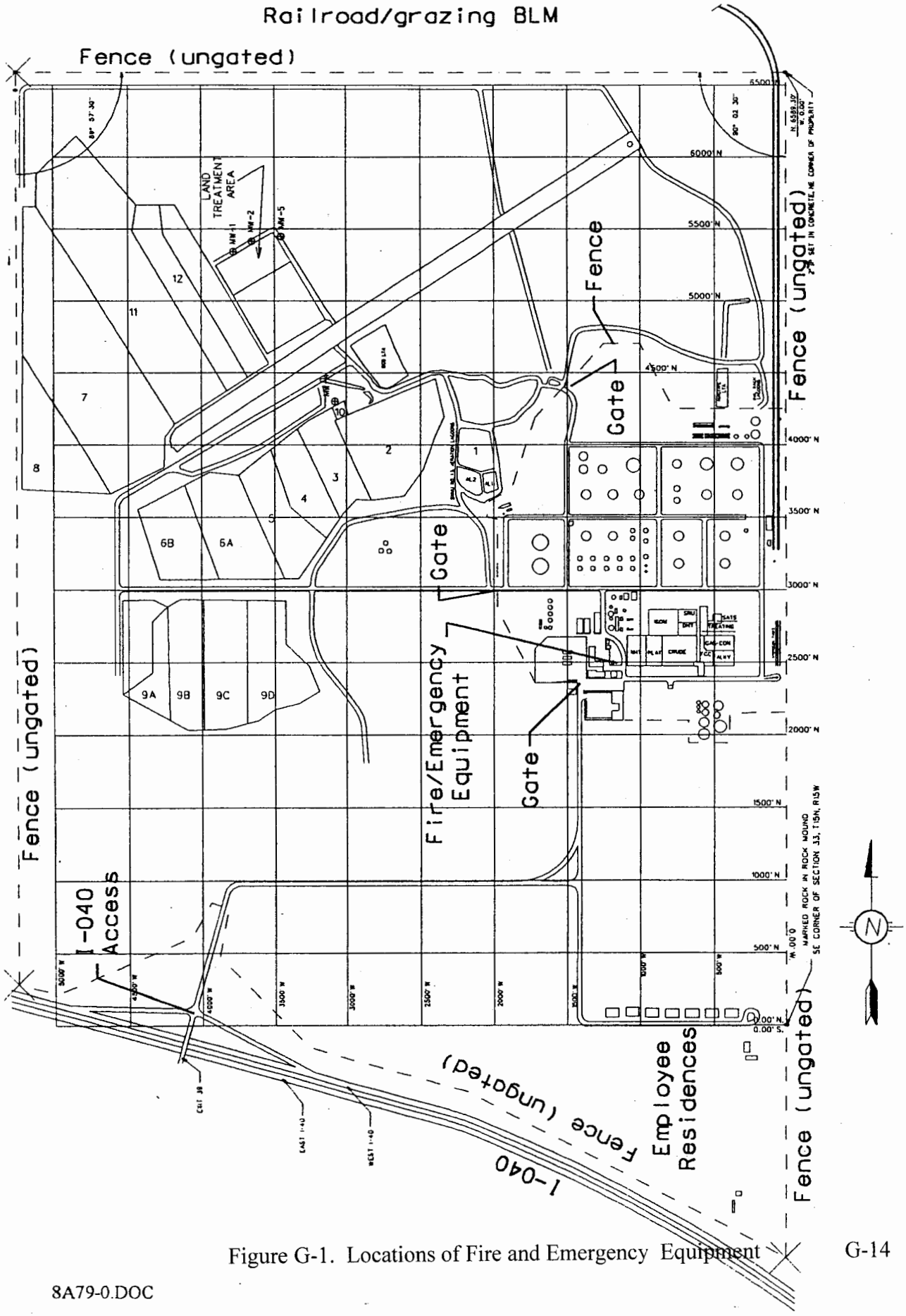


Figure G-1. Locations of Fire and Emergency Equipment

Section H.0

H.0 PERSONNEL TRAINING

This section describes the personnel training program for the Gallup Refinery during the LTU post-closure care period. Training requirements are specified in 20 NMAC 4.1, subpart V, §264.16, 20 NMAC 4.1, subpart IX, §270.14(b) (12). The primary objective of the training program is to prepare personnel to operate and maintain safely those areas managing hazardous waste in accordance with 20 NMAC 4.1, subpart V, part 264. The degree of training varies with job duties. However, all personnel who are assigned to work at the Gallup Refinery LTU receive an introduction to hazardous waste management regulations. This section includes a general description of the Gallup Refinery's personnel training program.

H.1 Training, content, Frequency, and Techniques [20 NMAC 4.1, subpart IX, §270.14(b) (12) and 20 NMAC 4.1 subpart V, §264.16 (a – e)]

The Gallup Refinery's training program consists of classroom instruction, on-the-job training, and web based Pure Safety Training. The Off-sites and Operations Department managers train individual employees on specific duties. Environmental Department personnel that are trained in hazardous waste management procedures conduct RCRA training. The Safety Department conducts first aid and fire fighting training. Specific safety procedures are described in the Safe Work Procedures Manual.

Personnel responsible for post-closure care activities are trained to maintain and inspect the LTU, perform or oversee groundwater and unsaturated zone monitoring activities, and perform sampling and/or analysis. Personnel responsible for post-closure care activities will also be trained in decontamination activities, wear appropriate PPE specified by the Gallup Refinery EM, and follow good hygiene practices.

H.1.1 Implementation of Training Program [20 NMAC 4.1, subpart V, §264.16(b) (c)]

New employees or newly assigned employees receive initial training within six months of assignment to post-closure care activities and review training annually. All personnel, excluding administrative office personnel, are trained in their RCRA related duties and the Contingency Plan. The Environmental Department conducts RCRA training during the semi-annual facility safety training sessions. Departmental training is supervised by the applicable manager on a recurring basis and consists of the following:

- All personnel, excluding administrative office personnel, receive initial and semi-annual training.
- Off-sites / Laboratory personnel receive laboratory training
- Operation/Maintenance personnel receive maintenance training.

H.1.2 Emergency Response Training [20 NMAC 4.1 subpart V, §264.16(a) (3), (c)]

To ensure maximum protection of life and property and to mitigate the consequences of an emergency situation affecting the LTU, Gallup Refinery personnel involved with emergency response receive training in process area emergency procedures. Additionally, all Gallup Refinery personnel are trained in fire fighting and emergency response as described in the Contingency Plan. Periodic emergency drills and exercises are used at the Gallup Refinery to familiarize workers with emergency procedures.

If called upon by the Gallup Refinery emergency coordinator, additional emergency response personnel may assist at the scene of a refinery emergency. These professionals are trained in their specialties (e.g. heavy equipment operation, hazardous material cleanups, traffic control and security). At all times during an emergency, these workers are under the supervision of the Gallup Refinery emergency response coordinator. The Contingency Plan provides a more detailed discussion of emergency procedures, personnel, and equipment.

In addition, personnel responsible for post-closure care activities are trained on Spill Response and Occupational and Health Administration emergency response provisions.

H.2 Training Records [20 NNAC 4,1m subpart V, §264.16(d) and (e)]

RCRA training records are maintained at the department and administrative level. Gallup Refinery Environmental Department staff maintains job titles and job descriptions of employees responsible for the LTU activities.

Section 1.0

I.0 GENERAL CLOSURE AND POST CLOSURE REQUIREMENTS

I.1 General Closure and Post Closure Requirements [20 NMAC 4.1, subpart V, §264.110 thru §264.120]

I.1.1 Applicability of Closure and Post Closure [20 NMAC 4.1, subpart V, §264.110 - §264.120]

This plan describes the activities necessary to complete final closure of the Gallup Refinery's LTU (NMD 000333211-2). Final closure refers to all closure activities such that hazardous waste management activities under Part 264 are no longer conducted. Final closure is complete at the end of the post closure care period.

The LTU is the only hazardous waste management unit located at the Gallup Refinery that is subject to the closure requirements of 20 NMAC 4.1, subpart V, 264, Subpart G. Closure of the LTU constitutes final closure of the Gallup Refinery's hazardous waste management activities at the LTU subject to 20 NMAC 4.1, subpart V and IX, as defined in 20 NMAC 4.1, subpart I, §260.10.

Final closure performance standards are included in this section. The information contained in this plan is designed to meet permit application requirements of 20 NMAC 4.1, subpart IX, §270.14(b) (13), and the closure/post closure requirements of 20 NMAC 4.1, subpart V, §264, §264.110 thru §264.120. Unit specific closure and post closure obligations of 20 NMAC 4.1 subpart V, §264.280 reflect the final closure plan's focus.

I.1.2 Site Description [20 NMAC 4.1, subpart V, §264.112]

The Gallup Refinery is a crude oil refining facility located in McKinley County, New Mexico at Township 15 North, Range 15 West, sections 28 and 33. The refinery is just north of I-40 and approximately 17 miles east of Gallup Refinery, New Mexico.

The refinery was constructed in 1957 by El Paso Natural Gas Company near a former depot location along the adjacent railroad known locally as Ciniza. The refinery was purchased and operated by Shell Oil Company until 1982. The refinery was purchased in

1982 and operated by Giant Industries Arizona, Incorporated until May 2007. In May 2007, Western Refining Southwest, Inc., acquired all of Giant's stock from Giant (but not the assests) and currently operates the refinery as Western Refining Southwest, Inc. Western Refining Southwest, Inc. refers to the refinery as the *Gallup Refinery.*

I.1.3 Land Treatment Unit Description [20 NMAC 4.1, subpart V, §264.112]

The LTU is located with the Gallup Refinery property boundary. The primary purpose of the LTU was the degradation, transformation, or immobilization of hazardous wastes using microbial activity and soil characteristics. The LTU is approximately 1,500 feet northwest of the refinery process area and is above the 100 year flood plain, as shown on Figures L-2 and L-3. The LTU consists of three 480 feet x 240 feet sections located immediately east of evaporation pond 12B. Each section is diked and contains 2.6 acres (1.0 hectare) of available treatment surface. The top 12 inches of soil was plowed and disked to encourage aerobic microbial activity and improved chemical reaction rates. During post closure treatment, soil nutrients were applied as necessary to maintain the optimum carbon: nitrogen: phosphorous (C: N: P) ratio of 50:2:1. The LTU received hazardous wastes from October 10, 1980 to November 8, 1990, with treatment confined to the upper 12 inches of natural soil (zone of incorporation). Waste management activities for the treatment program are based on the land treatment demonstration (Land Treatment Demonstration 1988) conducted by Ciniza in order to design the operating treatment parameters. Design capacity and conditional limits of the LTU include a treatment zone depth not greater than 5 feet from the original soil surface and a maximum treatment zone depth at least 3 feet above the seasonal high water table (20 NMAC 4.1, subpart V, §264.271(c) (1) and §264.271(c) (2).

I.1.4 Hydrogeology [20 NMAC 4.1, subpart V, §264.112]

A detailed description of the geologic conditions beneath the LTU is provided as Attachment I-1 of this post closure plan. The interpretation of geologic conditions is derived from the data of past investigations as well as logs from borings and well installations. Subsurface date in the LTU area have been digitized and modeled as surfaces based on general environments of deposition. The results of modeling indicate a

complex subsurface below the LTU. The modeling results are presented graphically in Section Maps, 1, 3, 4, and 5, as well as Profiles 1-1', 3-3', and 6-6' of Figures 1-1.

I.1.5 Surrounding Land Use [20 NMAC 4.1, subpart V, §264.112]

The Gallup Refinery, located in McKinley County, is in a remote, undeveloped, and sparsely populated area. The surrounding land use (as shown in Figure L-1) is cattle and sheep grazing at a density of less than six cattle or 30 sheep per section. Most of McKinley County is rural, as are adjoining portions of neighboring counties.

The Gallup Refinery maintains residences for several employees approximately 0.5 mile south of the refinery process area. A truck stop is located within one mile south-southwest of the process area at an I-40 exit. A rural residential area, Whispering Cedars, with a density of eight to 10 residents per square mile is about 1.5 miles southwest of the refinery. A railroad is within two miles to the north; the small community of Iyanbito, is within three miles to the northwest; the Fort Wingate Military Reservation is within six miles to the west and the Cibola National Forest is within two miles to the southwest. The largest residential community near the refinery is the City of Gallup, New Mexico, which is 17 miles west of the refinery.

I.1.6 Description of Waste [20 NMAC 4.1, subpart V, §264.112]

The Gallup Refinery received its Hazardous Waste Facility Permit (NMEID 1988) and has conducted activities since that date in accordance with its permit. The LTU is permitted to treat refinery sludge carrying the EPA hazardous waste numbers D001, D007, K049, K050, K051 and K052. Application of hazardous waste to the LTU ceased on November 8, 1990. Approximately 2600 tons of hazardous waste was treated at the LTU during its operating life as described in more detail in Appendix D.

The refinery sludge treated at the LTU was viscous oil-water-solid mixture. Table O-1 summarizes the wastes applied to the LTU. Records of waste inventory and analysis, as well as the operational logbook documenting any activity within the LTU, will be

maintained at the Gallup Refinery until closure of the LTU, as required by 20 NMAC 4.1, subpart V, §264.73(b) and §264.119.

Hazardous wastes generated at the Gallup Refinery are managed according to 20 NMAC 4.1, subpart III, §262.34. These wastes are shipped off site to approved treatment, storage and disposal facilities for treatment and disposal. No hazardous wastes are stored for more than 90 days pursuant to 20 NMAC 4.1, subpart III, §262.34.

I.1.7 Ancillary Equipment [20 NMAC 4.1, subpart V, §264.112]

The equipment used to manage waste and soil at the LTU during final closure activities may include, but are not limited to a tractor, disc and harrow, backhoe, dump truck, and road grader. This equipment, as well as contaminated PPE, will be decontaminated during closure as necessary to meet closure performance standards as required by 20 NMAC 4.1, subpart V, §264.114.

I.2 FINAL CLOSURE PERFORMANCE STANDARD

I.2.1 Final Closure of the Land Treatment Unit [20 NMAC 4, 1, subpart V, §264.111]

The LTU will be closed to meet the following closure and post closure performance standards.

- Minimize the need for further maintenance
- Control, minimize or eliminate, to the extent necessary to protect human health and the environment, the post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run off, or hazardous waste decomposition products to the ground, surface waters, or atmosphere.
- Comply with the final closure requirements of 20 NMAC 4.1, subpart V, §264.110 thru §264.115 (which concern closure) and §264.116 thru §264.120 (which concern post-closure care), and the requirements of 20 NMAC 4.1, subpart V, §264.280 for the closure and post closure of land treatment units.

I.2.2 Criteria to Meet Final Closure Standards [20 NMAC 4.1, subpart V, §264.280]

These performance standards will be met by conducting the following activities throughout the closure and post closure care period:

1. Maintaining the run on and run off systems of the LTU
2. Controlling wind dispersal of hazardous waste.
3. Continuing unsaturated zone monitoring
4. Maintaining the groundwater monitoring system
5. Establishing and maintaining a vegetative cover over the closed LTU.
6. Decontaminating, as necessary, equipment that comes into contact with hazardous waste and waste residue.

I.3 Administrative Requirements

I.3.1 Final Closure: Schedule for Closure and Post Closure Care Period [20 NMAC 4.1, subpart V, §264.112(b) (6), §264.117 and §264.118(b)]

Final closure activities will be conducted in accordance with the approved post closure care permit as required at 20 NMAC 4.1, subpart V, §264.112(a), §264.112(b, §264.118(a), and §264.118(b). Table 1-2A provides the final closure schedule of activities through the closure and post closure care period. Table I-2B provides final vegetative cover activities to be conducted during closure and post closure care period. Gallup Refinery will conduct post closure monitoring and reporting activities for the LTU for 30 years after initial post closure permit issuance by the Secretary of the NMED or as established in an approved permit modification. Maintenance and monitoring of waste containment systems will be implemented for the same time period. Post closure property use will not be allowed which could disturb the final cover or the monitoring, containment, or security systems, except as provided by 20 NMAC 4.1, subpart V, §264.117(b) and §264.117(c), and as approved in a permit modification.

I.3.2 Amendments of the Final Closure Plan [20 NMAC 4.1, subpart V, §264.112(c) and §264.118(d)

If final closure activities cannot be completed at the LTU in accordance with the approved schedule, the Gallup Refinery will notify the Secretary of the NMED in

accordance with the extension requirements cited in 20 NMAC 4.1, subpart V, §264.112(c) and §264.112(d), and in accordance with the extension requirements cited in 20 NMAC 4.1, subpart V, §264.112 (c) and §264.112(d), and in accordance with the time periods of 20 NMAC 4.1, subpart V, §264.112 (3) and §264.118(d) (3). The Gallup Refinery will submit a written notification of request for a permit modification to authorize change in the final closure plan. The modification request will describe the proposed change in operation or LTU design. A copy of the amended permit will be submitted with each modification or request. The Gallup

Refinery will submit a written request for a permit modification to authorize change in the approved plan if either of the following occurs.

- Changes in operating plans or LTU design affecting the final closure plan
- Unexpected events that require modification of the approved closure/post closure schedule.

A copy of the approved post closure care permit and any approved revisions will be maintained at: Western Refining Company Southwest / Gallup Refinery, Route 3 Box 7, Gallup, New Mexico, 87301. (505) 722-3833

I.3.3 Amendments Requested [20 NMAC 4.1, Subpart V, §264.112(c) (4) and §264.118(d) (4)]

If the secretary of the NMED requests a modification of the final closure plan under the conditions described in 20 NMAC 4.1, subpart X, §264.112(c) and §264.118(d), a plan modified in accordance with the request will be submitted within 30 days of notification of the request.

I.3.4 Closure Certification [20 NMAC 4.1, subpart V, §264.115]

Within 60 days after completion of the final closure activities, the Gallup Refinery will submit to the Secretary of the NMED, via certified mail, a certification that the unit has been closed in accordance with the specifications of the approved closure plan. The certification will be attested to by a registered independent professional engineer or qualified independent soil scientist and will be signed by the appropriate Gallup Refinery official in accordance with 20 NMAC 4.1, subpart V, §264.116. Documentation supporting the certification will be furnished to the Secretary of the NMED with the

original certification. A copy of the certification and supporting documentation will be maintained by Gallup Refinery in accordance with 20 NMAC 4.1, subpart V, §264.115.

I.3.5 Survey Plot [20 NMAC 4.1, subpart V, §264.116]

No later than the submission of final closure certification of the LTU, the Gallup Refinery will submit a survey plat to the local land use authority at the McKinley County Courthouse indicating the location and dimensions of the LTU with respect to permanently surveyed benchmarks. The Gallup Refinery will also submit a copy of the survey plat to the Secretary of the NMED on the date that certification of final closure is submitted. The plat will be prepared and certified as described in Section I.3.4. A note will be included with the plat to state Gallup Refinery's obligation to restrict disturbance of the LTU.

I.3.6 Certification of Completion of Post Closure Care [20 NMAC 4.1, subpart V, §264.120]

Within 60 days after completion of the post closure care period established under 20 NMAD 4.1, subpart V, §264.117 or §264.280(d), the Gallup Refinery will submit to the Secretary of the NMED by registered mail, a certification that the post closure care for the LTU was performed according to the approved post closure permit.

I.3.7 Post Closure Notice [20 NMAC 4.1, subpart V, §264.115]

Within 60 days of certification of final closure as described in Sections 3.4 and 3.5, the Gallup Refinery will certify that:

1. The land was used to manage hazardous waste
2. Its use is restricted under 20 NMAC 4.1, subpart V, subpart G regulations and
3. The survey plat described in Section 3.5 and the record of the type, location, and quantity of hazardous waste disposed in the LTU have been filed with the local zoning authority and the Secretary of the NMED.

The Gallup Refinery will submit the certification and a copy of the property deed containing the notation to the NMED Secretary as required by 20 NMAC 4.1, subpart V, §264.119(b) (2) within 60 days of final closure certification.

I.3.8 Financial and Liability Requirements [20 NMAC 4.1, subpart V, §264.140]

Financial assurance for closure and post closure will be maintained in accordance with 20 NMAC 4.1, subpart V, §264.142, §264.143(i), §264.144 and §264.145(i). Table I-3 provides final closure estimates for the LTU. Financial assurance ensures 20 NMAC 4.1, subpart V, 264, subpart G compliance through the end of the post closure care period. A copy of the *Notice of Disapproval Financial Assurance for the Gallup Refinery* from NMED, dated February 4, 2010 is attached in Appendix H. Western Refining Company, Gallup Refinery will submit a new financial assurance mechanism to NMED as required on or before March 4, 2010.

I.4 Monitoring Maintenance and Reporting

I.4.1 Activities required [20 NMAC 4.1, subpart V, §264.280 and §264.112]

Maintenance and monitoring activities will continue through the end of the post closure care period. Sections I.4.2 and I.4.3 describe maintenance and monitoring activities respectively, in support of final closure performance standards. The designed activities exhibit a commitment to sound hazardous waste management at the LTU. Focused activities are dedicated to control, minimize, or eliminate post closure escape of constituents from the LTU, as described below.

I.4.1.1 Maintenance Activities

- Provide and maintain surface soil conditions capable of maintaining growth of a low maintenance vegetative cover on the LTU.
- Inspect and maintain the surface water run on and run off systems.
- Provide necessary control for wind dispersal of hazardous waste particulate matter.
- Continue compliance with food-chain crops prohibitions.

I.4.1.2 Monitoring Activities.

The Gallup Refinery will continue soil-core and groundwater monitoring programs that supply reliable subsurface data for tacking performance of the LTU constituent

containment integrity. Monitoring activities will continue through the end of the post closure period.

I.4.2 Description of Maintenance Activities

I.4.2.1 Plant Growth Soil Conditions.

LTU soil conditioning activities in the near term, during closure activities, are to establish a vegetative cover to stabilize the six inch clean soil cover over the LTU. Gallup Refinery will conduct final surface soil tests and apply appropriate amendments, as necessary, and topsoil to the LTU. Inspections will determine maintenance activities necessary to continue optimum soil conditions for plant growth after initial soil conditioning operations. The closure schedule (Table I-2) lists the timing of these activities.

I.4.2.2 Control of Run on and Run Off [20 NMAC 4.1, subpart V, §264.280(3), §264.280(c) (4)]

Maintenance of a berm surrounding the LTU effectively controls run off, preventing potential contamination of adjacent surface water and surface water channels. The Gallup Refinery will level the LTU surface as necessary to prevent ponding of rainfall water. The climate of western New Mexico is classified as continental semi-arid. The capacity of the berm is sufficient to contain the volume of rain water from the estimated 24 hour, 100 year storm event (2.7 inches) (see section G.3.2). Likewise, the berm system prevents run on. Low rainfall rates and the generally flat surface terrain minimize run on potential as well. The Gallup Refinery will routinely inspect run on and run off controls and make any repairs that are necessary to ensure the integrity of the systems.

I.4.2.3 Control of Wind Dispersal [20 NMAC 4.1, subpart V, §264.280(c) (5)].

Potential releases of airborne particulate matter by windstorms will be controlled by the addition of a topsoil layer on the LTU. During the winter months (November thru March) snow cover and frozen ground effectively inhibit wind erosion. Vegetative cover growth, when properly dense, will control particulate lift from the soil-atmosphere interface through decreased turbulent air flow. Soil moisture supplemented by irrigation, if necessary, will also be a temporary means to control wind dispersal from any bare

areas of the vegetative cover. Routine inspections scheduled for the post closure period will evaluate the cover system's ability to control wind erosion and initiate any necessary remedies.

I.4.2.4 Compliance with Food Chain Corp Restrictions [20 NMAC 4.1, subpart V, §264.280(a) (6)]

The Gallup Refinery will not allow the cultivation of food-chain crops on the closed LTU, except for the scientific testing of such cultivation with the intent of providing data only or with the intent of plowing under such a crop for mulch to enhance top soil growth conditions of the final cover (with approval of the Secretary of the NMED). In accordance with 20 NMAC 4.1, subpart V, §264.276(b) (2) (iv), the appropriate Notice of Deed will be filed with McKinley County, New Mexico, to notify future property owners of the LTU location and the food chain crop restriction.

I.4.3 Description of Monitoring Activities

I.4.3.1 Clay Unit.

Immobility of constituents within the treatment zone are demonstrated by permeability data collected from soils in the LTU documented in the Land Treatment Demonstration Engineering Report (Appendix D). Low permeability and other soil properties make the unit an effective barrier for restricting constituent migration.

Planned monitoring activities at various subsurface depths will collect data to verify that the clay layer's effectiveness is maintained throughout the post closure care period. This monitoring system is the early detection monitoring, which includes the sampling of the ZO1, treatment zone, and Chinle slope wash.

I.4.3.2 Zone of Incorporation and Treatment Zone Soil-Core Monitoring.

The Gallup Refinery will continue a soil-core monitoring program to collect analytical data from soils in the ZOI and treatment zone at appropriate depths, locations, and numbers of samples to provide adequate detection of any statistically significant constituent concentrations in these zones. The Gallup Refinery will conduct post closure monitoring in accordance with 20 NMAC 4.1, subpart V, §264.280 and will use

consistent procedures for sample collection, preservation, and shipment; analytical methods, and chain of custody control.

If significant concentrations are confirmed, appropriate seven day notification to the New Mexico Environment Department, Hazardous Waste Bureau (NMED HWB) will be provided indicating what constituent has exceeded the concentration limits, and a permit modification request may be required for further characterization of these zones. The Gallup Refinery will conduct additional sampling, as necessary, to confirm the presence or absence of the indicated constituent and to ensure that additional constituents that are present in the location of the release area are characterized.

I.4.3.3 Chinle Slope Wash Monitoring.

Sampling and analysis of the Chinle slope wash supplements the above described soil-core monitoring program. The combination of ZOI and treatment zone soil core monitoring and Chinle slope wash monitoring provides ample means to maintain and monitor the LTU integrity in the post closure care period. Sampling frequency is described in Figure E-1.

I.4.3.4 Groundwater Detection Monitoring Program

The groundwater detection monitoring program established for the Sonsela aquifer (the uppermost aquifer) consists of program elements to meet 20 NMAC 4.1, subpart V, §264, subpart F requirements and will be conducted through the post closure care period. No hazardous constituents have been indentified in the Sonsela aquifer during the operating life of the LTU. Releases are not expected to be detected because of the physical and chemical properties of the remaining containments and due to the site's geologic characteristics. Artesian qualities of the Sonsela demonstrate geological confining layers that isolate this water supply from potential surface recharge in the Gallup Refinery vicinity. These confining shale layers minimize any surface source potential migration that could impact water quality. Nonetheless, the groundwater detection monitoring program contains provisions for responding to constituents present in the uppermost aquifer. Response for indicated constituents would be confirmation sampling to verify the presence of the indicated constituents. If constituents are confirmed, the program describes the appropriate NMED notification, preparation of a compliance monitoring

program and work plan preparation and subsequent implementation of an approved compliance monitoring program.

I.4.3.5 Administrative Amendments for Monitoring Activities.

Final closure activities for the LTU are designed to meet all regulatory requirements as they relate to the LTU. Section I.3.2 contains procedures for responding to circumstances that require administrative modifications of the final closure plan. Monitoring activities are designed to collect reliable data that will support future decisions on any modifications needed in the monitoring programs. The Gallup Refinery will maintain and monitor control systems and programs to ensure that performance standards are preserved. Activities are based on the historical data and records obtained during the operating permit term and are designed for current data needs.

I.5 Site Control Measures

I.5.1 Security. [20 NMAC 4.1, subpart V, §264.117(b)]

Restricted access to authorized personnel and warning signs will effectively safeguard potential contaminant exposure during the closure and post closure care period. These restrictions minimize unknowing exposure possibilities. Figure I-2 shows the LTU, location of the refinery fence, and warning signs. Security measures are described further in Section F-1.

I.5.2 Control of Release to Hazardous Constituents to Groundwater [NMAC 4.1, subpart V, §264.112(b) (5)]

The Gallup Refinery will continue the groundwater detection monitoring program of the Sonsela aquifer through the post closure care period, as described in Appendix E, the Post Closure Monitoring Plan. Other post closure care monitoring includes the Chinle slope wash and soil-core monitoring as described in Section E-0 and detailed in the Post Closure Monitoring Plan. The EDW is SMW-4, and detection MWs includes MW-1, MW-2, MW-4 and MW-5. Sample collection and analysis of organics and metals from the modified Skinner List and principal hazardous constituents (PHCs) (collectively referred to as the modified Skinner List) are proposed for providing a reliable indication

of the presence of hazardous constituents in the uppermost aquifer. Analytes and sample frequency are detailed in Section E-0 and Appendix E, the Post Closure Monitoring Plan.

I.5.3 Required Personal Protective Equipment [20 NMAC 4.1, subpart V, §264.112(b) (4)]

Before beginning any field activities, the Gallup Refinery Team Leader will inspect the LTU to determine the PPE and monitoring requirements for the subject activity. The level of PPE required will depend primarily upon environmental factors (wind, precipitation, temperature), field conditions (e.g., soil moisture), and type of activity being conducted. Personnel involved in final closure activities will be trained in decontamination activities, wear appropriate PPE as specified by the closure coordinator, and follow good hygiene practices to protect themselves from potential exposure to hazardous waste and residues. After use, contaminated PPE will be decontaminated and managed in accordance with 20 NMAC 4.1, subpart V, §264.114. Typical PPE is described in Section F.3.5.

I.5.4 Equipment Decontamination [20 NMAC 4.1, subpart V, §264.112(b) (4)]

Decontamination activities are proposed to meet the final closure performance standard of controlling, minimizing, or eliminating potential escape of an exposure to hazardous constituents by contaminated equipment and structures. All contaminated equipment, structures, and soils will be properly disposed of or decontaminated according to 20 NMAC 4.1, subpart V, §264.114. Any hazardous waste generated during final closure activities will be managed in compliance with the facility's generator status and as described in this application.

The Post Closure Monitoring Plan describes measures for preventing sampling and drilling equipment cross contamination during sampling events and measures for decontaminating items after use. Contaminated PPE will be disposed of off site at an approved facility. Items slated for reuse will be scrubbed with biodegradable soap and potable water, triple rinsed in clean water, then wiped dry with a clean towel, and inspected before being properly stored for reuse. Items will again be inspected before each use.

Larger equipment (see Section I.1.7) that is used in final closure activities will be moved onto an impermeable synthetic liner for decontamination. The liner will be designed, constructed, and installed to contain the wash water generated by the decontamination process, and to provide sufficient load-bearing capacity for the equipment. Activities will be conducted at the inner perimeter of the LTU so recontamination is prevented as equipment exit the site. Decontamination includes scraping, brushing, or otherwise removing soil that may be clustered on equipment. The outer surface and undercarriage will be washed with potable water and scrubbed with biodegradable soap as necessary to remove remaining residues. Items will be inspected and allowed to air dry before removal from the decontamination area. Wash waters will either be allowed to evaporate or be properly processed through the plant wastewater treatment system. The liner will be properly disposed after use.

I.5.5 Final Cover [20 NMAC 4.1, subpart V, §264.280(c) (I)]

Maintaining surface soil conditions that foster ample coverage of a vegetative growth are additional measures planned to meet the closure performance standard. The final closure schedule (Table I-2) shows how closure and post closure activities are coordinated. Activities included in vegetative cover maintenance are: inspection, testing soils, amending soils as necessary, planting, irrigating, if necessary, and cultivating young seedlings. Adjustments may be made as indicated by routine inspections of vegetative growth. The LTU surface is not toxic to the final vegetative cover; the LTU soil surface will be prepared and amended as necessary for seeding. At least a six inch topsoil cover will be applied for plant growth.

The LTU surface will be graded as necessary to eliminate local depressions and elevations and provide a flat even expanse. A level surface minimizes the ponding of precipitation and irrigation water, controlling uneven water percolation into the soil. Uniform water distribution promotes optimum nutrient distribution and enhances growth of the vegetative cover.

After considering the appropriate seeding time and making the evaluations noted the Gallup Refinery will determine the appropriate time to seed. There may be a lag time between evaluation and actual seeding in order to take advantage of seasonal weather

patterns. Optimal seeding time should occur during the fall or spring immediately following evaluation. When the correct seeding is reached, the LTU surface will be tilled as necessary to destroy any existing vegetation that may detrimentally compete with the selected plant species and to create a favorable soil density. Native plant varieties that spread naturally have been evaluated to determine whether their presence compromises performance of the vegetative cover. The County Agriculture Agent or other certified professional have been consulted for characteristics of species in question. It is possible that field tests might be performed to provide preliminary information about final selection of a particular seed mixture regarding the ability to germinate and develop in soil conditions of the LTU. The following three factors must be considered for seeding:

1. Seeding Method – Broadcasting or drilling the seeds are the principal preferred methods. Broadcasting, followed by disking, provides the best soil-seed contact for establishing seedlings.

2. Seeding Rate – the suggested seeding rate will be 12 lb/acre to provide adequate density of vegetative cover.

3. Seeding Depth – Seeding depth will be 0.25 to 0.50 inches.

Table I-4 includes the species of grasses to be sown. These grasses are known to thrive locally. They share the characteristics of rapid germination and spread; resistance to fire, insects, and diseases; depth of root system to prevent erosion; vegetative thickness to minimize percolation; and low maintenance. The final vegetative cover will be capable of maintaining growth without extensive maintenance as required by 20 NMAC 4.1, subpart V, §264.280(c) (2).

Table I-1. Approved Waste Streams Applied to the Land Treatment Unit

EPA Hazardous Waste No.	Waste Description	Annual Application Limit (Tons)
D001	Ignitable Materials	50
D007	Cooling Water Filter Sludge	5
K049	Slop Oil Emulsion Sludge	200
K050	Heat Exchanger Bundle Cleaning sludge	15
K051	API Separator Sludge	1000
K052	Tank Bottoms (leaded)	5

Table I-2A. Schedule and Vegetative Cover Activities During Closure

Closure Schedule

An estimated 180 days will be required to accomplish closure procedures and reporting requirements. The year of closure of the Land Treatment Unit is 2000. Closure will observe the sampling provided below.

Activity	Milestone Date[d]
Notify the NMED	- 90 Days
Begin vegetative cover activities	Day 30
Submit certification report to NMED	Day 60

[d] Time dependent on seed germination and vegetation maturity.

Vegetative Cover Activities During Closure

Activity	Milestone Date[a]
Microtox soil test[b] , if necessary	Day 0[c]
Receive and evaluate test results	Day 30
Soil Amendments, if necessary	Day 60
Determine seeding time	Day 60
Prepare LTU	Day 90
• Level Surface;	
• Add topsoil layer	
• Irrigate as Necessary	
Low Maintenance Vegetation	Day 120
• Seeding	1-2 years[d]
• Irrigation as necessary to establish cover system	

[d] Time is dependent upon seed germination and vegetation maturity.

[a] Completion dates are dependent on weather conditions and optimal seeding times. NMED will be notified if weather conditions delay listed activities. Under such circumstances, Gallup Refinery will negotiate the closure schedule with NMED.

[b] Microtox or other soil chemical tests may be conducted as needed. Consult with professional agronomist as needed.

[c] Day 0 = within 90 days after post-closure permit issuance (Approval of Closure Plan), weather dependent.

Table I-2B, Final Closure, Closure and Post-Closure Schedule of Activities

Day 0[1]

Activity	Years																		
	1	2	3	4	5	6	7	8	9				19					30	
Sample and Analysis									●				●					●	
Z01									●				●					●	
Treatment Zone									●				●					●	
Chinle Slope Wash	●	●	●		●		●		●				●					●	
Sonsela Aquifer	●	●	●		●		●		●				●					●	
Inspection and Maintenance[2]	═══	═══	═══	═══	═══	═══	═══	═══	═══	═══	═══	═══	═══	═══	═══	═══	═══	═══	═══
(See Table F-1 for detailed schedule)																			
Final Cover Activities[3]	●																		
Certification of Post Closure Care[4]																		●	

[1] Day 0: All post closure activities begin 90 days after post closure permit issuance.
[2] ═══ On going
[3] Final cover activities will be completed approximately 120 to 180 days after permit issuance. Completion date is dependent on weather conditions and optimal seeding times.

[4] Certification of post closure care occurs 60 days after completion of the post closure care period.

Table I-3. Final Closure Cost Estimate

Activity	Material	Cost Frequency (over 30 years)	Estimated Cost
Sample by Zone			
ZOI	4 samples at $1450	3	$ 17,400
Treatment Zone	4 samples at $1450	3	$ 17,400
Chinle Slope Wash	1 sample at $1650	8	$ 13,200
Sonsela Aquifer	4 samples at $1650	8	$ 52, 800
Sample QC	25% of $100,800		$ 25,200
Mobilization			
Z0I and Treatment Zone	3 events at $1000/event		$ 3,000
Chinle Slope Wash and Sonsela	8 events at $2000/event		$ 16,000
Field Technician	$10,000		$ 10,000
Microtox	$ 300 per test	9	$ 2,700
Soil Amendments	352,000 ft^2 at 0.02/ft^2		$ 7,040
Establish Vegetative Cover			
Top Soil	7.8 acres at $2000/acre		$ 15,600
Level LTU	7.8 acres at $950/acre		$ 7,410
Plant Seed	7.8 acres at $750/acre		$ 5,850
Water	1140 Mgal at $1/Mgal		$ 1,140
Routine Inspection, Maintenance and Repair			
Site Inspection	Weekly Inspection		$ 6,000
Security Device	$100 annually		$ 3,000
Run on/run off	$1000 annually to maintain perimeter berm		$ 30,000
Prepare Certification			
Certify LTU Closure	120 hrs at $125/hr 6		$ 15,000
Notice in Deed	hrs at $150/hr		$ 900
Certify Final Closure	120 hrs at $125/hr 6		$ 15,000
Notice in Deed	hrs at $150/hr		$ 900
Total Task			
Indirect Costs	20% closure and post closure cost		$ 53,108
Ciniza Overhead			$ 26,554
Contingency			$ 26,554
TOTAL			**$371,756**

Mgal = million gallons
ZOI = Zone of Incorporation

Table I-4. Re-vegetation Seed Mixture

Seed Type	Pls/Ac*
Blue Gramma, *Bouteloua gracilis* "Lovington"	2
Sideoats Gramma, *Bouteloua curipendula* "El Reno"	4
Buffalo Grass, *Buchloeda tyloides* "Texoka"	5
Alkali Sacaton, *sporbolus Airoides*	0.5

*Pounds of pure live seed per acre

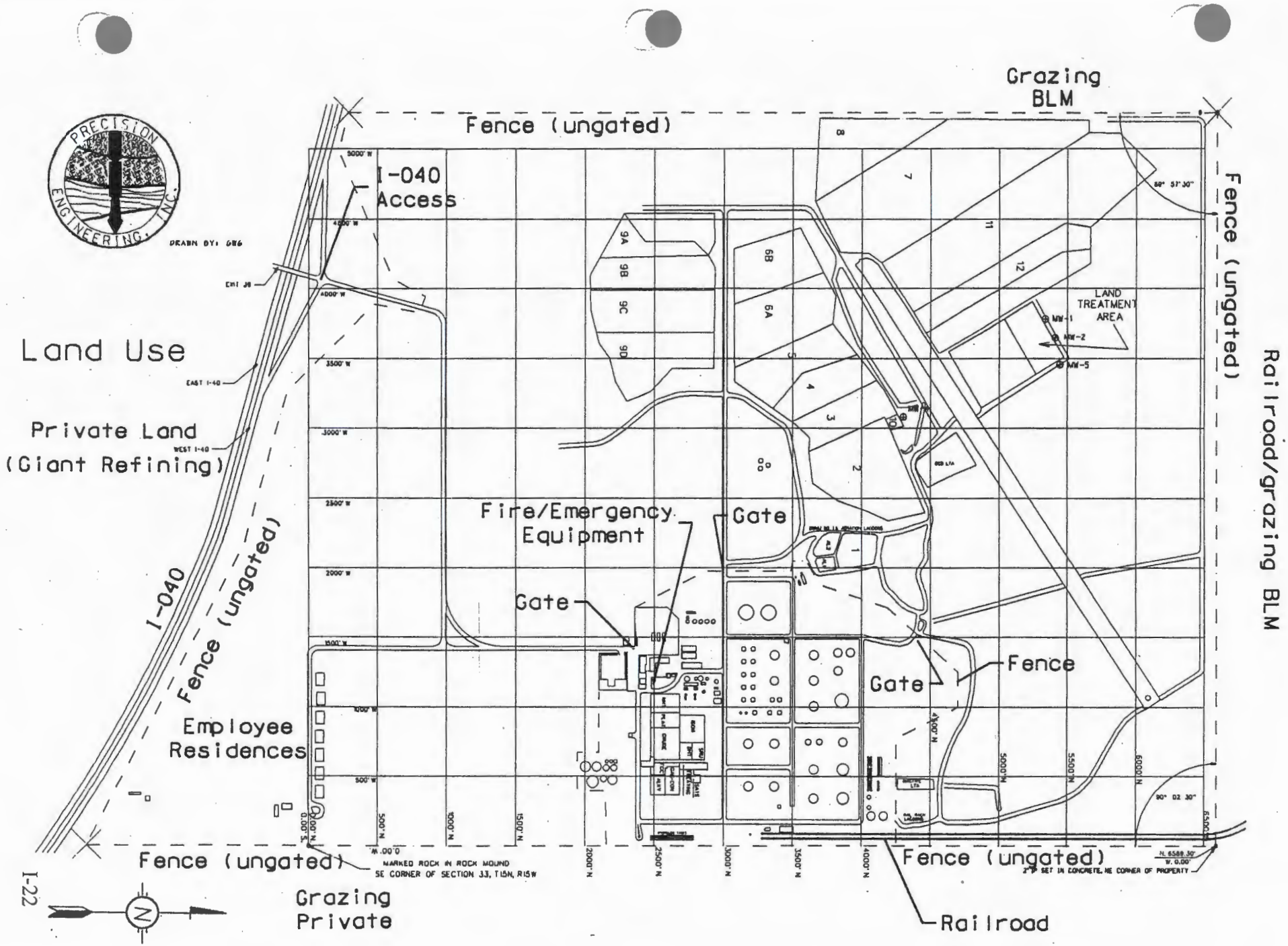
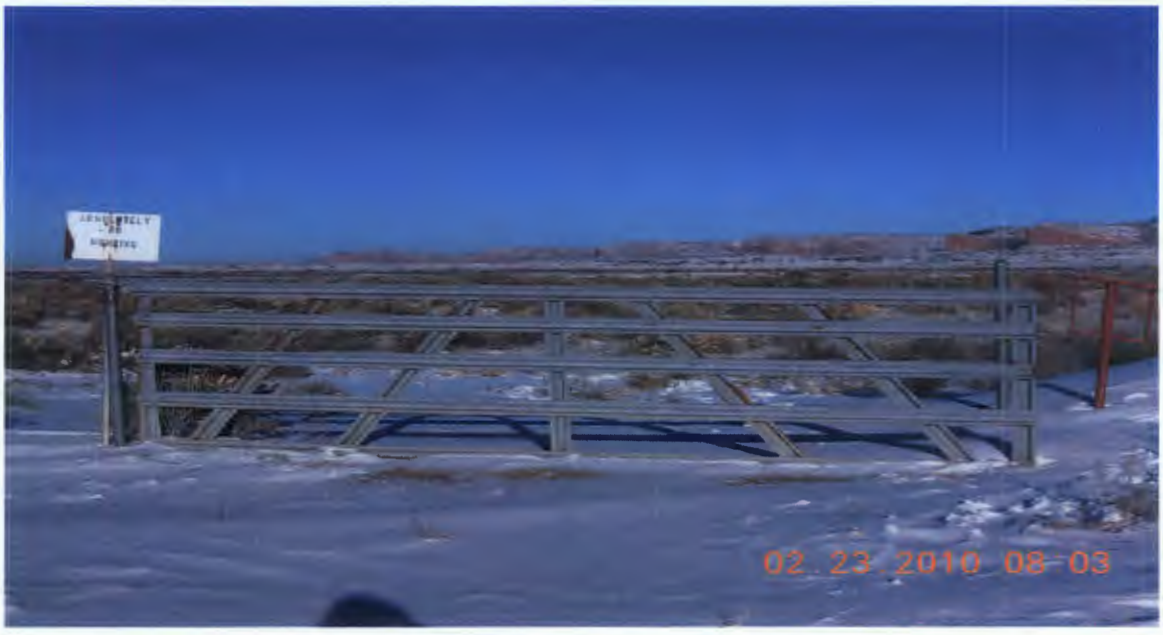


Figure I-2A. Location of LTU, Fence



Entry Gate to the northeast LTU.

Vegetation growth inside northeast cell of the LTU.

Figure I-2B: LTU Gate, berm, warning signs, vegetation growth.

Warning Signs alongside north berm of the LTU.

Warning sign on south side of LTU.

Figure I-2B: LTU Gate, berm, warning signs, vegetation growth.

Attachment I-1

PRECISION ENGINEERING, INC.
P.O. BOX 422 • LAS CRUCES, NM 88004
Ph: (505) 523-7674
FAX: (505) 523-7248 • E-mail: werpei@aol.com

June 8, 1996

Mr. Ed Horst
Giant Refining Company
Ciniza Refinery
Route 3, Box 7
Gallup, New Mexico 87301

Re: LTA Subsurface Conditions

Dear Ed,

Attached is our summary of the geologic conditions at the Land Treatment Area. As you are aware our interpretation of the conditions was derived from all previous drilling that has been performed at the site as well as our work over the course of the past six years.

We would like to express our thanks to you and the rest of the Giant environmental staff. Without your assistance and professional cooperation in accumulating past data, our interpretations of the ground conditions would not have been possible.

If you have any questions or comments concerning our interpretations plese do not hesitate calling. We will be happy to discuss the matter with any project related personnel.

Sincerely,
Precision Engineering, Inc.

William H. Kingsley, P.E.

INTRODUCTION

The intent of this report is to provide a summary of stratigraphic conditions at the Land Treatment Area located in the northwest portion of the Ciniza Refinery property. The interpretations made are derived from the data of past investigations in the area as well as logs from borings and well installations performed by Precision Engineering, Inc. in the area of the refinery as well surface studies we have made on surrounding properties. All subsurface data in the area has been digitized and modeled as surfaces based on general environments of deposition.

HISTORICAL INTERPRETATIONS

Past reports indicate the entire site is, in essence, a part of a highly weathered section of the Chinle Formation. An unconsolidated sandy stringer within this highly weathered shale formation was known to be water bearing. This unconsolidated sand was named the Ciniza Sand and is consistently referred to in reports after 1985. The nomenclature is local only and is not a documented bed name within the Chinle Formation. Some reports refer to the "Ciniza Sand" as a sandstone, however, it has never been shown to have any degree of cementation. Below the "Ciniza Sand" is a sandstone bed that lies within unweathered shale. This sandstone bed is known as the Sonsela Sandstone which is a documented unit name within the Chinle Formation. The bed is water bearing and represents a potential aquifer in the Ciniza area and is being used as an aquifer in the Bluewater area.

The Ciniza Sand was interpreted to vary in thickness below the Land Treatment Area. The zone was also thought to pinch out completely to the west and reach a maximum thickness of approximately five (5) feet in the south central portion of the Treatment Area.

The SMW well series was placed to monitor water quality in the "Ciniza Sand" since some water was encountered in the sands. The wells vary substantially in depth ranging from approximately forty six (46) feet at SMW-1 to seventy four (74) feet at SMW-5. Formation dip was used to explain the differences in depth initially, although it was later thought there may be two beds comprising the "Ciniza Sand".

The MW well series monitors the water from the Sonsela Sandstone. These wells range in depth from approximately one hundred twenty (120) to one hundred twenty seven (127) feet in depth.

CURRENT STRATIGRAPHIC INTERPRETATION

During the course of various subsurface investigations at the refinery site, including the Land Treatment Unit, inconsistencies were noted in the logs of early investigations and the findings of more recent studies. One major inconsistency noted was that the depth to unweathered shale greatly varied from the OW series wells to all other findings. It was also noted that the upper fifty (50) to sixty (60) feet of sediments in the Land Treatment Unit did not match what should have been encountered in a weathered shale section of the Chinle Formation. As a result of the inconsistencies, the Land Treatment Area was modeled based on all borings that have been drilled in the area in an effort to accurately define the stratigraphy.

The results of the modeling show a much more complex subsurface environment than had originally been assumed. The upper fifty (50) to sixty (60) feet of sediments are not weathered in place sediments of the Chinle Formation. Although the sediments have a Chinle Formation parent material, the time of deposition is believed to be much later. Although not dated, the structure of the soils suggests a relatively recent fluvial environment of deposition. Charcoal is abundant in sandy sediments and occasionally encountered in the clay sediments. Some

carbonate accumulation can be noted in the soils. No evidence of cementation of the sediments has been observed. It is believed dating would place the age of the sediments in the range of a few thousand years to a few tens of thousands of years - much younger than the Chinle Formation.

To a depth of approximately ten (10) feet the entire Land Treatment Area is comprised of a high density, high plasticity clay. Below the ten (10) foot depth and within the fluvial materials comprising the upper fifty (50) to sixty (60) feet of the valley floor below the Land Treatment Area is a sandy zone that extends roughly from the ten (10) foot depth to approximately the thirty to forty (40) foot depth. Grossly speaking the sandy unit can be subdivided in to two smaller units. The upper unit is about ten (10) feet thick and the lower unit is about ten (10) to fifteen (15) feet thick. On the south end of the Land Treatment Area the units are separated by a clay zone on the order of five (5) to ten (10) feet in thickness. On the north end of the treatment area the two zones become indistinguishable and appear as a single unit. Whether or not the upper or lower unit pinches out is not fully understood, however, it is suspected the upper unit thins and blends with the lower unit. It should be noted that the sandy zone is best described as interbedded very fine sands, silts and clays that should be expected to hydraulically interconnect. On the south end of the Treatment Area the lower sandy zone is water bearing below approximately the thirty (30) foot depth. To the north no water is encountered in this zone. The approximate extent of water in this zone may be represented by a line extending from the southwest corner of the Area to the northeast corner. Wells SMW-1, 2, and 3 derive their water from this zone. This zone is the original "Ciniza Sand" referred to in earlier work. This sandy zone represents channel deposition believed to be the result of infilling from the ancestral Rio Puerco or, more likely, derived from the Four Mile Canyon drainage system to the east of the Ciniza Refinery property. The channels of this zone trend roughly from northeast to southwest.

Below the sandy zone is a thick clay bed. The bed represents a very low energy environment likely as a result of flood plain deposits of the ancestral Rio Puerco. The clays are hard, high plasticity, moist to wet (but not water bearing) and brown to reddish brown. Occasionally sample specimens show evidence of mud cracks indicating a wetted then dry environment after the initial deposition. No free water has ever been detected in this zone.

Immediately below the clay zone is another sand bed. The sand may or may not contain gravel made up of subrounded sandstone fragments, petrified wood, and rounded to subrounded multi-colored chert fragments one to two inches in greatest dimension. In some areas this bed is composed only of fine sand. The sands are red to brown. The bed thickness ranges from three (3) inches to one foot or more. Some logs indicate this zone up to three (3) feet in thickness, although records at Precision Engineering, Inc. only show these thicknesses apparent south and east of the Land Treatment Area. The significance of this bed is two fold. First, in all locations where this zone has been penetrated it has been water bearing. Secondly, it always lies immediately above shale or sandy shale of the upper portion of the Petrified Forest Member of the Chinle Formation. Water from this zone has never been shown to penetrate more than a few inches into the Chinle Formation. The shales below the zone are typically damp to dry; more often than not they are dry. This bed most likely represents alluvial deposition on the ancient exposed Chinle surface. It is felt this bed, at least in the refinery property area, may be used as a marker to represent the boundary between younger valley infilling and true Chinle Formation shales below.

Significantly, the thin sand bed described above is derived from a different environment of deposition. Hydraulic connection to the upper fluvial sands has, as yet, not been demonstrated and the two zones may not connect. Shallow Monitoring Wells (SMW) 4, 5, and 6 produce out of this zone. This bed has also been referred to as "Ciniza Sand" in earlier reports.

Shales and sandy shales of the Chinle formation lie below the valley fill materials. Approximately, thirty (30) to fifty (50) feet of shale lies between the valley fill and the Sonsela Sandstone bed that lies within the Chinle Formation. The sandstone is on the order of ten (10) to thirty (30) feet in thickness. The Sonsela Sandstone is water bearing at the refinery site and as stated earlier meets the definition of a potential aquifer.

The lower boundary of the Sonsela Sandstone is the extent of the modeling on this site. It is known from deep well logs that the Chinle Formation is on the order of seven hundred fifty (750) feet in thickness where deeper, established aquifers are encountered.

SUMMARY

To summarize the current model of the stratigraphic section below the Land Treatment Area, a typical section through the area would be as follows:

The upper ten (10) feet of the site would be comprised of a dense dry to damp clay of high plasticity overlying two sequences of channel sands and silts separated by a clay zone on the order of five (5) to ten (10) feet in thickness. The channel sands would be expected to be on the order of ten (10) to fifteen (15) feet in thickness each. The channel sands are actually interbedded sands, silts, and clays. Below the thirty (30) foot depth in the southern part of the LTA the sandy zone is water bearing. In the northern part the zones are not water bearing. A fifteen (15) to twenty (20) foot thick section of clay is encountered next. The clay is hard, highly plastic, not water bearing, and may show shrinkage cracking structure. Below this, a thin water bearing sand, gravel, or, sandy gravel composed of aggregates of mixed sources is encountered next and represents alluviation from the higher areas to the south into the valley. Below is generally unweathered shale for thirty (30) feet. The top of the shale should be encountered at an average of sixty (60) feet below the surface but may be as shallow as fifty (50) feet to the south and as deep as seventy (70) feet to the north. The water bearing Sonsela Sandstone is then encountered and should be from ten (10) to thirty (30) feet in thickness.

Attachment I-2

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ #29; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10. c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User's Guide); s = Concentration may exceed Csat (See User's Guide); SSL values are based on DAF=1

Contaminant		Toxicity and Chemical-specific Information												Screening Levels												Protection of Groundwater Soil	
		SFO	key	IUR	key	RfDo	key	RfCi	key	voc	muta-gen	GIABS	ABS	Csat	Residential Soil		Industrial Soil		Residential Air		Industrial Air		Tapwater		MCL	Risk-based SSL	MCL-based SSL
Analyte	CAS No.	(mg/kg-day)$^{-1}$		(ug/m^3)$^{-1}$		(mg/kg-day)		(mg/m^3)						mg/kg		mg/kg		ug/m^3		ug/m^3		ug/L		ug/L	mg/kg	mg/kg
ALAR	1596-84-5	1.8E-02	C	5.1E-06	C	1.5E-01	I					1	0.1		2.7E+01	c	9.6E+01	c	4.8E-01	c	2.4E+00	c	3.7E+00	c		8.2E-04	
Acephate	30560-19-1	8.7E-03	I			4.0E-03	I					1	0.1		5.6E+01	c**	2.0E+02	c*					7.7E+00	c*		1.7E-03	
Acetaldehyde	75-07-0			2.2E-06	I			9.0E-03	I	V		1		1.1E+05	1.0E+01	c**	5.2E+01	c**	1.1E+00	c**	5.6E+00	c**	2.2E+00	c**		4.5E-04	
Acetochlor	34256-82-1					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		5.8E-01	
Acetone	67-64-1					9.0E-01	I	3.1E+01	A	V		1		1.1E+05	6.1E+04	n	6.3E+05	nms	3.2E+04	n	1.4E+05	n	2.2E+04	n		4.5E+00	
Acetone Cyanohydrin	75-86-5					3.0E-03	P	6.0E-02	P	V		1		1.1E+05	2.0E+02	n	2.1E+03	n	6.3E+01	n	2.6E+02	n	5.8E+01	n		1.2E-02	
Acetonitrile	75-05-8							6.0E-02	I	V		1		1.3E+05	8.7E+02	n	3.7E+03	n	6.3E+01	n	2.6E+02	n	1.3E+02	n		2.6E-02	
Acetophenone	98-86-2					1.0E-01	I			V		1		2.5E+03	7.8E+03	ns	1.0E+05	nms					3.7E+03	n		1.1E+00	
Acetylaminofluorene, 2-	53-96-3	3.8E+00	C	1.3E-03	C							1	0.1		1.3E-01	c	4.5E-01	c	1.9E-03	c	9.4E-03	c	1.8E-02	c		8.2E-05	
Acrolein	107-02-8					5.0E-04	I	2.0E-05	I	V		1		2.3E+04	1.5E-01	n	6.5E-01	n	2.1E-02	n	8.8E-02	n	4.2E-02	n		8.4E-06	
Acrylamide	79-06-1	4.5E+00	I	1.3E-03	I	2.0E-04	I					1	0.1		1.1E-01	c	3.8E-01	c	1.9E-03	c	9.4E-03	c	1.5E-02	c		3.2E-06	
Acrylic Acid	79-10-7					5.0E-01	I	1.0E-03	I			1	0.1		3.0E+04	n	2.9E+05	nm	1.0E+00	n	4.4E+00	n	1.8E+04	n		3.7E+00	
Acrylonitrile	107-13-1	5.4E-01	I	6.8E-05	I	4.0E-02	A	2.0E-03	I	V		1		1.1E+04	2.4E-01	c*	1.2E+00	c*	3.6E-02	c*	1.8E-01	c*	4.5E-02	c*		9.9E-06	
Adiponitrile	111-69-3							6.0E-03	P			1	0.1		8.5E+06	nm	3.6E+07	nm	6.3E+00	n	2.6E+01	n					
Alachlor	15972-60-8	5.6E-02	C			1.0E-02	I					1	0.1		8.7E+00	c*	3.1E+01	c					1.2E+00	c	2.0E+00	9.9E-04	1.6E-03
Aldicarb	116-06-3					1.0E-03	I					1	0.1		6.1E+01	n	6.2E+02	n					3.7E+01	n		9.1E-03	
Aldicarb Sulfone	1646-88-4					1.0E-03	I					1	0.1		6.1E+01	n	6.2E+02	n					3.7E+01	n		8.0E-03	
Aldrin	309-00-2	1.7E+01	I	4.9E-03	I	3.0E-05	I					1	0.1		2.9E-02	c*	1.0E-01	c	5.0E-04	c	2.5E-03	c	4.0E-03	c		6.5E-04	
Ally	74223-64-6					2.5E-01	I					1	0.1		1.5E+04	n	1.5E+05	nm					9.1E+03	n		3.5E+00	
Allyl Alcohol	107-18-6					5.0E-03	I	1.0E-04	X			1	0.1		3.0E+02	n	3.1E+03	n	1.0E-01	n	4.4E-01	n	1.8E+02	n		3.7E-02	
Allyl Chloride	107-05-1	2.1E-02	C	6.0E-06	C			1.0E-03	I	V		1		1.4E+03	6.8E-01	c**	3.4E+00	c**	4.1E-01	c**	2.0E+00	c**	6.5E-01	c**		2.1E-04	
Aluminum	7429-90-5					1.0E+00	P	5.0E-03	P			1			7.7E+04	n	9.9E+05	nm	5.2E+00	n	2.2E+01	n	3.7E+04	n		5.5E+04	
Aluminum Phosphide	20859-73-8					4.0E-04	I					1			3.1E+01	n	4.1E+02	n					1.5E+01	n			
Amdro	67485-29-4					3.0E-04	I					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n		3.9E+03	
Ametryn	834-12-8					9.0E-03	I					1	0.1		5.5E+02	n	5.5E+03	n					3.3E+02	n		3.5E-01	
Aminobiphenyl, 4-	92-67-1	2.1E+01	C	6.0E-03	C							1	0.1		2.3E-02	c	8.2E-02	c	4.1E-04	c	2.0E-03	c	3.2E-03	c		1.6E-05	
Aminophenol, m-	591-27-5					8.0E-02	P					1	0.1		4.9E+03	n	4.9E+04	n					2.9E+03	n		1.1E+00	
Aminophenol, p-	123-30-8					2.0E-02	P					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		2.8E-01	
Amitraz	33089-61-1					2.5E-03	I					1	0.1		1.5E+02	n	1.5E+03	n					9.1E+01	n		4.7E+01	
Ammonia	7664-41-7							1.0E-01	I			1							1.0E+02	n	4.4E+02	n					
Ammonium Perchlorate	7790-98-9					7.0E-04	I					1			5.5E+01	n	7.2E+02	n					2.6E+01	n			
Ammonium Sulfamate	7773-06-0					2.0E-01	I					1			1.6E+04	n	2.0E+05	nm					7.3E+03	n			
Aniline	62-53-3	5.7E-03	I	1.6E-06	C	7.0E-03	P	1.0E-03	I			1	0.1		8.5E+01	c**	3.0E+02	c*	1.0E+00	n	4.4E+00	n	1.2E+01	c*		4.0E-03	
Antimony (metallic)	7440-36-0					4.0E-04	I					0.15			3.1E+01	n	4.1E+02	n					1.5E+01	n	6.0E+00	6.6E-01	2.7E-01
Antimony Pentoxide	1314-60-9					5.0E-04	H					0.15			3.9E+01	n	5.1E+02	n					1.8E+01	n			
Antimony Potassium Tartrate	11071-15-1					9.0E-04	H					0.15			7.0E+01	n	9.2E+02	n					3.3E+01	n			
Antimony Tetroxide	1332-81-6					4.0E-04	H					0.15			3.1E+01	n	4.1E+02	n					1.5E+01	n			
Antimony Trioxide	1309-64-4							2.0E-04	I			0.15			2.8E+05	nm	1.2E+06	nm	2.1E-01	n	8.8E-01	n					
Apollo	74115-24-5					1.3E-02	I					1	0.1		7.9E+02	n	8.0E+03	n					4.7E+02	n		2.9E+01	
Aramite	140-57-8	2.5E-02	I	7.1E-06	I	5.0E-02	H					1	0.1		1.9E+01	c	6.9E+01	c	3.4E-01	c	1.7E+00	c	2.7E+00	c		3.0E-02	
Arsenic, Inorganic	7440-38-2	1.5E+00	I	4.3E-03	I	3.0E-04	I	1.5E-05	C			1	0.03		3.9E-01	c*	1.6E+00	c	5.7E-04	c*	2.9E-03	c*	4.5E-02	c	1.0E+01	1.3E-03	2.9E-01
Arsine	7784-42-1					3.5E-06	C	5.0E-05	I			1			2.7E-01	n	3.6E+00	n	5.2E-02	n	2.2E-01	n	1.3E-01	n			
Assure	76578-14-8					9.0E-03	I					1	0.1		5.5E+02	n	5.5E+03	n					3.3E+02	n		5.1E+00	
Asulam	3337-71-1					5.0E-02	I					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		4.7E-01	
Atrazine	1912-24-9	2.3E-01	C			3.5E-02	I					1	0.1		2.1E+00	c	7.5E+00	c					2.9E-01	c	3.0E+00	1.9E-04	1.9E-03
Auramine	492-80-8	8.8E-01	C	2.5E-04	C										7.3E-01	c	3.3E+00	c	9.7E-03	c	4.9E-02	c	7.6E-02	c		7.0E-04	
Avermectin B1	65195-55-3					4.0E-04	I					1	0.1		2.4E+01	n	2.5E+02	n					1.5E+01	n		2.6E+01	
Azobenzene	103-33-3	1.1E-01	I	3.1E-05	I					V		1			5.1E+00	c	2.3E+01	c	7.8E-02	c	4.0E-01	c	1.2E-01	c		9.6E-04	
Barium	7440-39-3					2.0E-01	I	5.0E-04	H			0.07			1.5E+04	n	1.9E+05	nm	5.2E-01	n	2.2E+00	n	7.3E+03	n	2.0E+03	3.0E+02	8.2E+01
Baygon	114-26-1					4.0E-03	I					1	0.1		2.4E+02	n	2.5E+03	n					1.5E+02	n		4.7E-02	
Bayleton	43121-43-3					3.0E-02	I					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n		8.7E-01	
Baythroid	68359-37-5					2.5E-02	I					1	0.1		1.5E+03	n	1.5E+04	n					9.1E+02	n		2.4E+02	
Benefin	1861-40-1					3.0E-01	I					1	0.1		1.8E+04	n	1.8E+05	nm					1.1E+04	n		3.6E+02	
Benomyl	17804-35-2					5.0E-02	I					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		1.6E+00	
Bentazon	25057-89-0					3.0E-02	I					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n		2.4E-01	
Benzaldehyde	100-52-7					1.0E-01	I			V		1		1.2E+03	7.8E+03	ns	1.0E+05	nms					3.7E+03	n		8.1E-01	
Benzene	71-43-2	5.5E-02	I	7.8E-06	I	4.0E-03	I	3.0E-02	I	V		1		1.8E+03	1.1E+00	c*	5.4E+00	c*	3.1E-01	c	1.6E+00	c*	4.1E-01	c	5.0E+00	2.1E-04	2.6E-03
Benzenethiol	108-98-5					1.0E-05	H			V		1		1.3E+03	7.8E-01	n	1.0E+01	n					3.7E-01	n		2.4E-04	
Benzidine	92-87-5	2.3E+02	I	6.7E-02	I	3.0E-03	I				M	1	0.1		5.0E-04	c	7.5E-03	c	1.4E-05	c	1.8E-04	c	9.4E-05	c		2.4E-07	
Benzoic Acid	65-85-0					4.0E+00	I					1	0.1		2.4E+05	nm	2.5E+06	nm					1.5E+05	n		3.4E+01	
Benzotrichloride	98-07-7	1.3E+01	I							V		1		3.2E+02	4.9E-02	c	2.2E-01	c					5.2E-03	c		1.1E-05	
Benzyl Alcohol	100-51-6					1.0E-01	P					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n		8.9E-01	
Benzyl Chloride	100-44-7	1.7E-01	I	4.9E-05	C	2.0E-03	P	1.0E-03	P	V		1		1.5E+03	1.0E+00	c*	4.9E+00	c*	5.0E-02	c*	2.5E-01	c*	7.9E-02	c*		8.7E-05	
Beryllium and compounds	7440-41-7			2.4E-03	I	2.0E-03	I	2.0E-05	I			0.007			1.6E+02	n	2.0E+03	n	1.0E-03	c*	5.1E-03	c*	7.3E+01	n	4.0E+00	5.8E+01	3.2E+00
Bidrin	141-66-2					1.0E-04	I					1	0.1		6.1E+00	n	6.2E+01	n					3.7E+00	n		8.5E-04	
Bifenox	42576-02-3					9.0E-03	P					1	0.1		5.5E+02	n	5.5E+03	n					3.3E+02	n		2.5E+00	
Biphenthrin	82657-04-3					1.5E-02	I					1	0.1		9.2E+02	n	9.2E+03	n					5.5E+02	n		2.5E+03	
Biphenyl, 1,1'-	92-52-4					5.0E-02	I			V		1		2.1E+02	3.9E+03	ns	5.1E+04	ns					1.8E+03	n		1.9E+01	
Bis(2-chloro-1-methylethyl) ether	108-60-1	7.0E-02	H	1.0E-05	H	4.0E-02	I			V		1		1.0E+03	4.6E+00	c	2.2E+01	c	2.4E-01	c	1.2E+00	c	3.2E-01	c		1.2E-04	
Bis(2-chloroethoxy)methane	111-91-1					3.0E-03	P					1	0.1		1.8E+02	n	1.8E+03	n					1.1E+02	n		2.5E-02	
Bis(2-chloroethyl)ether	111-44-4	1.1E+00	I	3.3E-04	I					V		1		5.1E+03	2.1E-01	c	1.0E+00	c	7.4E-03	c	3.7E-02	c	1.2E-02	c		3.1E-06	
Bis(2-ethylhexyl)phthalate	117-81-7	1.4E-02	I	2.4E-06	C	2.0E-02	I					1	0.1		3.5E+01	c*	1.2E+02	c	1.0E+00	c	5.1E+00	c	4.8E+00	c	6.0E+00	1.1E+00	1.4E+00
Bis(chloromethyl)ether	542-88-1	2.2E+02	I	6.2E-02	I					V		1		4.2E+03	7.7E-05	c	3.9E-04	c	3.9E-05	c	2.0E-04	c	6.2E-05	c		1.5E-08	
Bisphenol A	80-05-7					5.0E-02	I					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		1.4E+02	
Boron And Borates Only	7440-42-8					2.0E-01	I	2.0E-02	H			1			1.6E+04	n	2.0E+05	nm	2.1E+01	n	8.8E+01	n	7.3E+03	n		2.3E+01	
Boron Trifluoride	7637-07-2					4.0E-02	C	1.3E-02	C			1			3.1E+03	n	4.1E+04	n	1.4E+01	n	5.7E+01	n	1.5E+03	n			
Bromate	15541-45-4	7.0E-01	I			4.0E-03	I					1			9.1E-01	c	4.1E+00	c					9.6E-02	c	1.0E+01	7.4E-04	7.7E-02
Bromo-2-chloroethane, 1-	107-04-0	2.0E+00	X	6.0E-04	X					V		1		2.4E+03	2.4E-02	c	1.2E-01	c	4.1E-03	c	2.0E-02	c	6.5E-03	c		1.8E-06	
Bromobenzene	108-86-1					8.0E-03	I	6.0E-02	I	V		1		6.8E+02	3.0E+02	n	1.8E+03	ns	6.3E+01	n	2.6E+02	n	8.8E+01	n		5.9E-02	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ #29; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10 c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User's Guide); s = Concentration may exceed Csat (See User's Guide); SSL values are based on DAF=1

Contaminant		Toxicity and Chemical-specific Information												Screening Levels												Protection of Groundwater Soil	
		SFO	key	IUR	key	RfDo	key	RfCi	key	voc	muta-gen	GIABS	ABS	Csat	Residential Soil		Industrial Soil		Residential Air		Industrial Air		Tapwater		MCL	Risk-based SSL	MCL-based SSL
Analyte	CAS No.	(mg/kg-day)$^{-1}$		(ug/m^3)$^{-1}$		(mg/kg-day)		(mg/m^3)						mg/kg		mg/kg		ug/m^3		ug/m^3		ug/L		ug/L	mg/kg	mg/kg
Bromodichloromethane	75-27-4	6.2E-02	I	3.7E-05	C	2.0E-02	I			V		1		9.3E+02	2.7E-01	c	1.4E+00	c	6.6E-02	c	3.3E-01	c	1.2E-01	c		3.2E-05	
Bromoform	75-25-2	7.9E-03	I	1.1E-06	I	2.0E-02	I					1	0.1		6.1E+01	c*	2.2E+02	c*	2.2E+00	c	1.1E+01	c	8.5E+00	c*		2.3E-03	
Bromomethane	74-83-9					1.4E-03	I	5.0E-03	I	V		1		3.6E+03	7.3E+00	n	3.2E+01	n	5.2E+00	n	2.2E+01	n	8.7E+00	n		2.2E-03	
Bromophos	2104-96-3					5.0E-03	H					1	0.1		3.1E+02	n	3.1E+03	n					1.8E+02	n		7.7E-01	
Bromoxynil	1689-84-5					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		6.3E-01	
Bromoxynil Octanoate	1689-99-2					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		6.4E+00	
Butadiene, 1,3-	106-99-0	3.4E+00	C	3.0E-05	I			2.0E-03	I	V		1		6.7E+02	5.4E-02	c*	2.6E-01	c*	8.1E-02	c*	4.1E-01	c*	1.8E-02	c		9.7E-06	
Butanol, N-	71-36-3					1.0E-01	I					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n		7.6E-01	
Butyl Benzyl Phthlate	85-68-7	1.9E-03	P			2.0E-01	I					1	0.1		2.6E+02	c*	9.1E+02	c					3.5E+01	c		5.1E-01	
Butyl alcohol, sec-	78-92-2					2.0E+00	P	3.0E+01	P						1.6E+05	nm	2.0E+06	nm	3.1E+04	n	1.3E+05	n	7.3E+04	n		1.5E+01	
Butylate	2008-41-5					5.0E-02	I					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		1.8E+00	
Butylated hydroxyanisole	25013-16-5	2.0E-04	C	5.7E-08	C										3.2E+03	c	1.4E+04	c	4.3E+01	c	2.2E+02	c	3.4E+02	c		6.3E-01	
Butylphthalyl Butylglycolate	85-70-1					1.0E+00	I					1	0.1		6.1E+04	n	6.2E+05	nm					3.7E+04	n		8.3E+02	
Cacodylic Acid	75-60-5					2.0E-02	A					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n			
Cadmium (Diet)	7440-43-9			1.8E-03	I	1.0E-03	I	1.0E-05	A			0.025	0.001		7.0E+01	n	8.0E+02	n									
Cadmium (Water)	7440-43-9			1.8E-03	I	5.0E-04	I	1.0E-05	A			0.05	0.001						1.4E-03	c**	6.8E-03	c**	1.8E+01	n	5.0E+00	1.4E+00	3.8E-01
Caprolactam	105-60-2					5.0E-01	I					1	0.1		3.1E+04	n	3.1E+05	nm					1.8E+04	n		4.5E+00	
Captafol	2425-06-1	1.5E-01	C	4.3E-05	C	2.0E-03	I					1	0.1		3.2E+00	c*	1.1E+01	c	5.7E-02	c	2.9E-01	c	4.5E-01	c		7.9E-04	
Captan	133-06-2	2.3E-03	C	6.6E-07	C	1.3E-01	I					1	0.1		2.1E+02	c*	7.5E+02	c	3.7E+00	c	1.9E+01	c	2.9E+01	c		2.1E-02	
Carbaryl	63-25-2					1.0E-01	I					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n		3.3E+00	
Carbofuran	1563-66-2					5.0E-03	I					1	0.1		3.1E+02	n	3.1E+03	n					1.8E+02	n	4.0E+01	7.1E-02	1.6E-02
Carbon Disulfide	75-15-0					1.0E-01	I	7.0E-01	I	V		1		7.4E+02	8.2E+02	ns	3.7E+03	ns	7.3E+02	n	3.1E+03	n	1.0E+03	n		3.1E-01	
Carbon Tetrachloride	56-23-5	1.3E-01	I	1.5E-05	I	7.0E-04	I	1.9E-01	A	V		1		4.6E+02	2.5E-01	c	1.2E+00	c	1.6E-01	c	8.2E-01	c	2.0E-01	c	5.0E+00	7.7E-05	1.9E-03
Carbosulfan	55285-14-8					1.0E-02	I					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		8.8E+00	
Carboxin	5234-68-4					1.0E-01	I					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n		2.0E+00	
Ceric oxide	1306-38-3							9.0E-04	I			1			1.3E+06	nm	5.4E+06	nm	9.4E-01	n	3.9E+00	n					
Chloral Hydrate	302-17-0					1.0E-01	I					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n		7.4E-01	
Chloramben	133-90-4					1.5E-02	I					1	0.1		9.2E+02	n	9.2E+03	n					5.5E+02	n		1.3E-01	
Chloranil	118-75-2	4.0E-01	H									1	0.1		1.2E+00	c	4.3E+00	c					1.7E-01	c		1.4E-04	
Chlordane	12789-03-6	3.5E-01	I	1.0E-04	I	5.0E-04	I	7.0E-04	I			1	0.04		1.6E+00	c*	6.5E+00	c*	2.4E-02	c*	1.2E-01	c*	1.9E-01	c*	2.0E+00	1.3E-02	1.4E-01
Chlordecone (Kepone)	143-50-0	1.0E+01	I	4.6E-03	C	3.0E-04	I					1	0.1		4.9E-02	c	1.7E-01	c	5.3E-04	c	2.7E-03	c	6.7E-03	c		2.4E-04	
Chlorfenvinphos	470-90-6					7.0E-04	A					1	0.1		4.3E+01	n	4.3E+02	n					2.6E+01	n		7.0E-02	
Chlorimuron, Ethyl-	90982-32-4					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		2.5E-01	
Chlorine	7782-50-5					1.0E-01	I	1.5E-04	A			1			7.5E+03	n	9.1E+04	n	1.5E-01	n	6.4E-01	n	3.7E+03	n		1.6E+00	
Chlorine Dioxide	10049-04-4					3.0E-02	I	2.0E-04	I			1			2.3E+03	n	3.0E+04	n	2.1E-01	n	8.8E-01	n	1.1E+03	n			
Chlorite (Sodium Salt)	7758-19-2					3.0E-02	I					1			2.3E+03	n	3.1E+04	n					1.1E+03	n			
Chloro-1,1-difluoroethane, 1-	75-68-3							5.0E+01	I	V		1		1.2E+03	5.8E+04	ns	2.4E+05	nms	5.2E+04	n	2.2E+05	n	1.0E+05	n		5.2E+01	
Chloro-1,3-butadiene, 2-	126-99-8					2.0E-02	H	7.0E-03	H	V		1		7.5E+02	8.4E+00	n	3.6E+01	n	7.3E+00	n	3.1E+01	n	1.4E+01	n		7.5E-03	
Chloro-2-methylaniline HCl, 4-	3165-93-3	4.6E-01	H									1	0.1		1.1E+00	c	3.7E+00	c					1.5E-01	c		8.3E-05	
Chloroacetic Acid	79-11-8					2.0E-03	H					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		1.5E-02	
Chloroacetophenone, 2-	532-27-4							3.0E-05	I			1	0.1		4.3E+04	n	1.8E+05	nm	3.1E-02	n	1.3E-01	n					
Chloroaniline, p-	106-47-8	2.0E-01	P			4.0E-03	I					1	0.1		2.4E+00	c	8.6E+00	c					3.4E-01	c		1.4E-04	
Chlorobenzene	108-90-7					2.0E-02	I	5.0E-02	P	V		1		7.6E+02	2.9E+02	n	1.4E+03	ns	5.2E+01	n	2.2E+02	n	9.1E+01	n	1.0E+02	6.2E-02	6.8E-02
Chlorobenzilate	510-15-6	1.1E-01	C	3.1E-05	C	2.0E-02	I					1	0.1		4.4E+00	c	1.6E+01	c	7.8E-02	c	4.0E-01	c	6.1E-01	c		2.0E-03	
Chlorobenzoic Acid, p-	74-11-3					3.0E-02	X					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n		2.8E-01	
Chlorobenzotrifluoride, 4-	98-56-6					3.0E-03	P	3.0E-01	P	V		1		1.2E+02	2.1E+02	ns	2.3E+03	ns	3.1E+02	n	1.3E+03	n	9.3E+01	n		3.3E-01	
Chlorobutane, 1-	109-69-3					4.0E-02	P			V		1		7.3E+02	3.1E+03	ns	4.1E+04	ns					1.5E+03	n		5.9E-01	
Chlorodifluoromethane	75-45-6							5.0E+01	I	V		1		1.7E+03	5.3E+04	ns	2.2E+05	nms	5.2E+04	n	2.2E+05	n	1.0E+05	n		4.3E+01	
Chloroform	67-66-3	3.1E-02	C	2.3E-05	I	1.0E-02	I	9.8E-02	A	V		1		2.5E+03	2.9E-01	c	1.5E+00	c	1.1E-01	c	5.3E-01	c	1.9E-01	c		5.3E-05	
Chloromethane	74-87-3							9.0E-02	I	V		1		1.3E+03	1.2E+02	n	5.0E+02	n	9.4E+01	n	3.9E+02	n	1.9E+02	n		4.9E-02	
Chloromethyl Methyl Ether	107-30-2	2.4E+00	C	6.9E-04	C					V		1		2.6E+04	1.9E-02	c	9.4E-02	c	3.5E-03	c	1.8E-02	c	5.6E-03	c		1.2E-06	
Chloronaphthalene, Beta-	91-58-7					8.0E-02	I			V		1		1.8E+02	6.3E+03	ns	8.2E+04	ns					2.9E+03	n		1.5E+01	
Chloronitrobenzene, o-	88-73-3	3.0E-01	P			3.0E-03	P	1.0E-05	X			1	0.1		1.6E+00	c	5.7E+00	c	1.0E-02	n	4.4E-02	n	2.2E-01	c		2.1E-04	
Chloronitrobenzene, p-	100-00-5	6.3E-03	P			1.0E-03	P	6.0E-04	P			1	0.1		6.1E+01	n	2.7E+02	c**	6.3E-01	n	2.6E+00	n	1.1E+01	c**		9.9E-03	
Chlorophenol, 2-	95-57-8					5.0E-03	I			V		1		2.2E+04	3.9E+02	n	5.1E+03	n					1.8E+02	n		1.5E-01	
Chloropicrin	76-06-2							4.0E-04	C						5.7E+05	nm	2.4E+06	nm	4.2E-01	n	1.8E+00	n					
Chlorothalonil	1897-45-6	3.1E-03	C	8.9E-07	C	1.5E-02	I					1	0.1		1.6E+02	c**	5.6E+02	c*	2.7E+00	c	1.4E+01	c	2.2E+01	c*		4.9E-02	
Chlorotoluene, o-	95-49-8					2.0E-02	I			V		1		9.1E+02	1.6E+03	ns	2.0E+04	ns					7.3E+02	n		7.1E-01	
Chlorotoluene, p-	106-43-4					7.0E-02	P			V		1		2.5E+02	5.5E+03	ns	7.2E+04	ns					2.6E+03	n		2.5E+00	
Chlorozotocin	54749-90-5	2.4E+02	C	6.9E-02	C										2.7E-03	c	1.2E-02	c	3.5E-05	c	1.8E-04	c	2.8E-04	c		6.2E-08	
Chlorpropham	101-21-3					2.0E-01	I					1	0.1		1.2E+04	n	1.2E+05	nm					7.3E+03	n		6.6E+00	
Chlorpyrifos	2921-88-2					3.0E-03	I					1	0.1		1.8E+02	n	1.8E+03	n					1.1E+02	n		1.6E+00	
Chlorpyrifos Methyl	5598-13-0					1.0E-02	H					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		1.7E+00	
Chlorsulfuron	64902-72-3					5.0E-02	I					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		1.5E+00	
Chlorthiophos	60238-56-4					8.0E-04	H					1	0.1		4.9E+01	n	4.9E+02	n					2.9E+01	n		7.5E-01	
Chromium(III), Insoluble Salts	16065-83-1					1.5E+00	I					0.013			1.2E+05	nm	1.5E+06	nm					5.5E+04	n		9.9E+07	
Chromium(VI)	18540-29-9	5.0E-01	J	8.4E-02	I	3.0E-03	I	1.0E-04	I		M	0.025			2.9E-01	c	5.6E+00	c	1.1E-05	c	1.5E-04	c	4.3E-02	c		8.3E-04	
Chromium, Total	7440-47-3											0.013													1.0E+02		1.8E+05
Cobalt	7440-48-4			9.0E-03	P	3.0E-04	P	6.0E-06	P			1			2.3E+01	n	3.0E+02	n	2.7E-04	c*	1.4E-03	c*	1.1E+01	n		4.9E-01	
Coke Oven Emissions	8007-45-2			6.2E-04	I						M	1	0.1						1.5E-03	c	2.0E-02	c					
Copper	7440-50-8					4.0E-02	H					1			3.1E+03	n	4.1E+04	n					1.5E+03	n	1.3E+03	5.1E+01	4.6E+01
Cresol, m-	108-39-4					5.0E-02	I	6.0E-01	C			1	0.1		3.1E+03	n	3.1E+04	n	6.3E+02	n	2.6E+03	n	1.8E+03	n		1.5E+00	
Cresol, o-	95-48-7					5.0E-02	I	6.0E-01	C			1	0.1		3.1E+03	n	3.1E+04	n	6.3E+02	n	2.6E+03	n	1.8E+03	n		1.5E+00	
Cresol, p-	106-44-5					5.0E-03	H	6.0E-01	C			1	0.1		3.1E+02	n	3.1E+03	n	6.3E+02	n	2.6E+03	n	1.8E+02	n		1.5E-01	
Cresol, p-chloro-m-	59-50-7					1.0E-01	X					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n		4.3E+00	
Cresols	1319-77-3					1.0E-01	A	6.0E-01	C	V		1		5.0E+04	7.5E+03	n	9.1E+04	ns	6.3E+02	n	2.6E+03	n	9.3E+02	n		7.6E-01	
Crotonaldehyde, trans-	123-73-9	1.9E+00	H							V		1		1.7E+04	3.4E-01	c	1.5E+00	c					3.5E-02	c		7.2E-06	
Cumene	98-82-8					1.0E-01	I	4.0E-01	I	V		1		2.7E+02	2.1E+03	ns	1.1E+04	ns	4.2E+02	n	1.8E+03	n	6.8E+02	n		1.1E+00	
Cupferron	135-20-6	2.2E-01	C	6.3E-05	C										2.9E+00	c	1.3E+01	c	3.9E-02	c	1.9E-01	c	3.1E-01	c		5.3E-04	

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Contaminant		Toxicity and Chemical-specific Information												Screening Levels										Protection of Groundwater Soil	
Analyte	CAS No.	SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfDo (mg/kg-day)	key	RfCi (mg/m^3)	key	voc	muta-gen	GIABS	ABS	Csat mg/kg	Residential Soil mg/kg	key	Industrial Soil mg/kg	key	Residential Air ug/m^3	key	Industrial Air ug/m^3	key	Tapwater ug/L	key	MCL ug/L	Risk-based SSL mg/kg	MCL-based SSL mg/kg
Cyanazine	21725-46-2	8.4E-01	H			2.0E-03	H					1	0.1		5.8E-01	c	2.1E+00	c					8.0E-02	c		3.7E-05	
Cyanides																											
~Calcium Cyanide	592-01-8					4.0E-02	I					1			3.1E+03	n	4.1E+04	n					1.5E+03	n			
~Copper Cyanide	544-92-3					5.0E-03	I					1			3.9E+02	n	5.1E+03	n					1.8E+02	n			
~Cyanide (CN-)	57-12-5					2.0E-02	I			V		1		1.0E+07	1.6E+03	n	2.0E+04	n					7.3E+02	n	2.0E+02	7.4E+00	2.0E+00
~Cyanogen	460-19-5					4.0E-02	I			V		1		1.5E+03	3.1E+03	ns	4.1E+04	ns					1.5E+03	n		3.0E-01	
~Cyanogen Bromide	506-68-3					9.0E-02	I			V		1		1.0E+05	7.0E+03	n	9.2E+04	n					3.3E+03	n		6.9E-01	
~Cyanogen Chloride	506-77-4					5.0E-02	I			V		1		4.3E+03	3.9E+03	n	5.1E+04	ns					1.8E+03	n		3.8E-01	
~Hydrogen Cyanide	74-90-8					2.0E-02	I	3.0E-03	I	V		1		1.2E+05	1.9E+01	n	8.0E+01	n	3.1E+00	n	1.3E+01	n	6.2E+00	n		1.3E-03	
~Potassium Cyanide	151-50-8					5.0E-02	I					1			3.9E+03	n	5.1E+04	n					1.8E+03	n			
~Potassium Silver Cyanide	506-61-6					2.0E-01	I					0.04			1.6E+04	n	2.0E+05	nm					7.3E+03	n			
~Silver Cyanide	506-64-9					1.0E-01	I					0.04			7.8E+03	n	1.0E+05	nm					3.7E+03	n			
~Sodium Cyanide	143-33-9					4.0E-02	I					1			3.1E+03	n	4.1E+04	n					1.5E+03	n			
~Thiocyanate	463-56-9					2.0E-04	P			V		1		4.6E+03	1.6E+01	n	2.0E+02	n					7.3E+00	n		1.5E-03	
~Zinc Cyanide	557-21-1					5.0E-02	I					1			3.9E+03	n	5.1E+04	n					1.8E+03	n			
Cyclohexane	110-82-7							6.0E+00	I	V		1		1.2E+02	7.0E+03	ns	2.9E+04	ns	6.3E+03	n	2.6E+04	n	1.3E+04	n		1.3E+01	
Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro-	87-84-3	2.3E-02	H									1	0.1		2.1E+01	c	7.5E+01	c					2.9E+00	c		1.7E-02	
Cyclohexanone	108-94-1					5.0E+00	I					1	0.1		3.1E+05	nm	3.1E+06	nm					1.8E+05	n		4.3E+01	
Cyclohexylamine	108-91-8					2.0E-01	I					1	0.1		1.2E+04	n	1.2E+05	nm					7.3E+03	n		1.9E+00	
Cyhalothrin/karate	68085-85-8					5.0E-03	I					1	0.1		3.1E+02	n	3.1E+03	n					1.8E+02	n		1.2E+02	
Cypermethrin	52315-07-8					1.0E-02	I					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		5.8E+01	
Cyromazine	66215-27-8					7.5E-03	I					1	0.1		4.6E+02	n	4.6E+03	n					2.7E+02	n		7.0E-02	
DDD	72-54-8	2.4E-01	I	6.9E-05	C							1	0.1		2.0E+00	c	7.2E+00	c	3.5E-02	c	1.8E-01	c	2.8E-01	c		6.6E-02	
DDE, p,p'-	72-55-9	3.4E-01	I	9.7E-05	C							1	0.1		1.4E+00	c	5.1E+00	c	2.5E-02	c	1.3E-01	c	2.0E-01	c		4.7E-02	
DDT	50-29-3	3.4E-01	I	9.7E-05	I	5.0E-04	I					1	0.03		1.7E+00	c*	7.0E+00	c*	2.5E-02	c	1.3E-01	c	2.0E-01	c*		6.7E-02	
Dacthal	1861-32-1					1.0E-02	I					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		4.5E-01	
Dalapon	75-99-0					3.0E-02	I					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n	2.0E+02	2.3E-01	4.1E-02
Decabromodiphenyl ether, 2,2',3,3',4,4',5,5',6,6'- (BDE-209)	1163-19-5	7.0E-04	I			7.0E-03	I					1	0.1		4.3E+02	n	2.5E+03	c**					9.6E+01	c**		5.3E+01	
Demeton	8065-48-3					4.0E-05	I					1	0.1		2.4E+00	n	2.5E+01	n					1.5E+00	n			
Di(2-ethylhexyl)adipate	103-23-1	1.2E-03	I			6.0E-01	I					1	0.1		4.0E+02	c*	1.4E+03	c					5.6E+01	c	4.0E+02	4.0E+00	2.9E+01
Diallate	2303-16-4	6.1E-02	H									1	0.1		8.0E+00	c	2.8E+01	c					1.1E+00	c		1.6E-03	
Diazinon	333-41-5					7.0E-04	A					1	0.1		4.3E+01	n	4.3E+02	n					2.6E+01	n		1.6E-01	
Dibromo-3-chloropropane, 1,2-	96-12-8	8.0E-01	P	6.0E-03	P	2.0E-04	P	2.0E-04	I	V	M	1		9.8E+02	5.4E-03	c	6.9E-02	c	1.6E-04	c	2.0E-03	c	3.2E-04	c	2.0E-01	1.4E-07	8.6E-05
Dibromobenzene, 1,4-	106-37-6					1.0E-02	I					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		3.5E-01	
Dibromochloromethane	124-48-1	8.4E-02	I	2.7E-05	C	2.0E-02	I			V		1	0.1	8.0E+02	6.8E-01	c	3.3E+00	c	9.0E-02	c	4.5E-01	c	1.5E-01	c		3.9E-05	
Dibromoethane, 1,2-	106-93-4	2.0E+00	I	6.0E-04	I	9.0E-03	I	9.0E-03	I	V		1		1.3E+03	3.4E-02	c	1.7E-01	c	4.1E-03	c	2.0E-02	c	6.5E-03	c	5.0E-02	1.8E-06	1.4E-05
Dibromomethane (Methylene Bromide)	74-95-3					1.0E-02	H	4.0E-03	X	V		1		2.8E+03	2.5E+01	n	1.1E+02	n	4.2E+00	n	1.8E+01	n	8.2E+00	n		2.0E-03	
Dibutyl Phthalate	84-74-2					1.0E-01	I					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n		9.2E+00	
Dibutyltin Compounds	NA					3.0E-04	P					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n			
Dicamba	1918-00-9					3.0E-02	I					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n		2.8E-01	
Dichloro-2-butene, 1,4-	764-41-0			4.2E-03	P					V		1		5.2E+02	6.5E-03	c	3.3E-02	c	5.8E-04	c	2.9E-03	c	1.2E-03	c		5.4E-07	
Dichloro-2-butene, cis-1,4-	1476-11-5			4.2E-03	P					V		1	0.1	5.2E+02	6.9E-03	c	3.5E-02	c	5.8E-04	c	2.9E-03	c	1.2E-03	c		5.4E-07	
Dichloro-2-butene, trans-1,4-	110-57-6			4.2E-03	P					V		1	0.1	7.6E+02	6.9E-03	c	3.5E-02	c	5.8E-04	c	2.9E-03	c	1.2E-03	c		5.4E-07	
Dichloroacetic Acid	79-43-6	5.0E-02	I			4.0E-03	I					1	0.1		9.7E+00	c*	3.4E+01	c*					1.3E+00	c		2.8E-04	
Dichlorobenzene, 1,2-	95-50-1					9.0E-02	I	2.0E-01	H	V		1		3.8E+02	1.9E+03	ns	9.8E+03	ns	2.1E+02	n	8.8E+02	n	3.7E+02	n	6.0E+02	3.6E-01	5.8E-01
Dichlorobenzene, 1,4-	106-46-7	5.4E-03	C	1.1E-05	C	7.0E-02	A	8.0E-01	I	V		1			2.4E+00	c	1.2E+01	c	2.2E-01	c	1.1E+00	c	4.3E-01	c	7.5E+01	4.1E-04	7.2E-02
Dichlorobenzidine, 3,3'-	91-94-1	4.5E-01	I	3.4E-04	C							1	0.1		1.1E+00	c	3.8E+00	c	7.2E-03	c	3.6E-02	c	1.5E-01	c		9.8E-04	
Dichlorobenzophenone, 4,4'-	90-98-2					9.0E-03	X					1	0.1		5.5E+02	n	5.5E+03	n					3.3E+02	n		2.0E+00	
Dichlorodifluoromethane	75-71-8					2.0E-01	I	2.0E-01	H	V		1		8.5E+02	1.8E+02	n	7.8E+02	n	2.1E+02	n	8.8E+02	n	3.9E+02	n		6.1E-01	
Dichloroethane, 1,1-	75-34-3	5.7E-03	C	1.6E-06	C	2.0E-01	P			V		1		1.7E+03	3.3E+00	c	1.7E+01	c	1.5E+00	c	7.7E+00	c	2.4E+00	c		6.9E-04	
Dichloroethane, 1,2-	107-06-2	9.1E-02	I	2.6E-05	I	2.0E-02	P	2.4E+00	A	V		1		3.0E+03	4.3E-01	c	2.2E+00	c	9.4E-02	c	4.7E-01	c	1.5E-01	c	5.0E+00	4.2E-05	1.4E-03
Dichloroethylene, 1,1-	75-35-4					5.0E-02	I	2.0E-01	I	V		1		1.2E+03	2.4E+02	n	1.1E+03	n	2.1E+02	n	8.8E+02	n	3.4E+02	n	7.0E+00	1.2E-01	2.5E-03
Dichloroethylene, 1,2- (Mixed Isomers)	540-59-0					9.0E-03	H			V		1		1.3E+03	7.0E+02	n	9.2E+03	ns					3.3E+02	n		9.7E-02	
Dichloroethylene, 1,2-cis-	156-59-2					1.0E-02	P			V		1		2.4E+03	7.8E+02	n	1.0E+04	ns					3.7E+02	n	7.0E+01	1.1E-01	2.1E-02
Dichloroethylene, 1,2-trans-	156-60-5					2.0E-02	I	6.0E-02	P	V		1		1.7E+03	1.5E+02	n	6.9E+02	n	6.3E+01	n	2.6E+02	n	1.1E+02	n	1.0E+02	3.1E-02	2.9E-02
Dichlorophenol, 2,4-	120-83-2					3.0E-03	I					1	0.1		1.8E+02	n	1.8E+03	n					1.1E+02	n		1.3E-01	
Dichlorophenoxy Acetic Acid, 2,4-	94-75-7					1.0E-02	I					1	0.05		6.9E+02	n	7.7E+03	n					3.7E+02	n	7.0E+01	9.5E-02	1.8E-02
Dichlorophenoxybutyric Acid, 4-(2,4-	94-82-6					8.0E-03	I					1	0.1		4.9E+02	n	4.9E+03	n					2.9E+02	n		1.2E-01	
Dichloropropane, 1,2-	78-87-5	3.6E-02	C	1.0E-05	C	9.0E-02	A	4.0E-03	I	V		1		1.4E+03	8.9E-01	c*	4.5E+00	c*	2.4E-01	c*	1.2E+00	c*	3.9E-01	c*	5.0E+00	1.3E-04	1.7E-03
Dichloropropane, 1,3-	142-28-9					2.0E-02	P			V		1		1.5E+03	1.6E+03	ns	2.0E+04	ns					7.3E+02	n		2.5E-01	
Dichloropropanol, 2,3-	616-23-9					3.0E-03	I					1	0.1		1.8E+02	n	1.8E+03	n					1.1E+02	n		2.3E-02	
Dichloropropene, 1,3-	542-75-6	1.0E-01	I	4.0E-06	I	3.0E-02	I	2.0E-02	I	V		1		1.6E+03	1.7E+00	c*	8.1E+00	c*	6.1E-01	c*	3.1E+00	c*	4.3E-01	c*		1.5E-04	
Dichlorvos	62-73-7	2.9E-01	I	8.3E-05	C	5.0E-04	I	5.0E-04	I			1	0.1		1.7E+00	c*	5.9E+00	c*	2.9E-02	c*	1.5E-01	c*	2.3E-01	c*		7.1E-05	
Dicyclopentadiene	77-73-6					8.0E-03	P	7.0E-03	P	V		1		1.3E+02	2.7E+01	n	1.2E+02	n	7.3E+00	n	3.1E+01	n	1.4E+01	n		4.8E-02	
Dieldrin	60-57-1	1.6E+01	I	4.6E-03	I	5.0E-05	I					1	0.1		3.0E-02	c	1.1E-01	c	5.3E-04	c	2.7E-03	c	4.2E-03	c		1.7E-04	
Diesel Engine Exhaust	NA			3.0E-04	C			5.0E-03	I			1	0.1						8.1E-03	c	4.1E-02	c					
Diethanolamine	111-42-2							3.0E-03	C						4.3E+06	nm	1.8E+07	nm	3.1E+00	n	1.3E+01	n					
Diethyl Phthalate	84-66-2					8.0E-01	I					1	0.1		4.9E+04	n	4.9E+05	nm					2.9E+04	n		1.2E+01	
Diethylene Glycol Monobutyl Ether	112-34-5					3.0E-02	P	1.0E-04	P			1	0.1		1.8E+03	n	1.8E+04	n	1.0E-01	n	4.4E-01	n	1.1E+03	n		2.4E-01	
Diethylene Glycol Monoethyl Ether	111-90-0					6.0E-02	P	3.0E-04	P			1	0.1		3.6E+03	n	3.6E+04	n	3.1E-01	n	1.3E+00	n	2.2E+03	n		4.4E-01	
Diethylformamide	617-84-5					1.0E-03	P					1	0.1		6.1E+01	n	6.2E+02	n					3.7E+01	n		7.5E-03	
Diethylstilbestrol	56-53-1	3.5E+02	C	1.0E-01	C							1	0.1		1.4E-03	c	4.9E-03	c	2.4E-05	c	1.2E-04	c	1.9E-04	c		1.1E-04	
Difenzoquat	43222-48-6					8.0E-02	I					1	0.1		4.9E+03	n	4.9E+04	n					2.9E+03	n			
Diflubenzuron	35367-38-5					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		8.2E-01	
Difluoroethane, 1,1-	75-37-6							4.0E+01	I	V		1		1.4E+03	5.2E+04	ns	2.2E+05	nms	4.2E+04	n	1.8E+05	n	8.3E+04	n		2.8E+01	
Dihydrosafrole	94-58-6	4.4E-02	C	1.3E-05	C										1.5E+01	c	6.5E+01	c	1.9E-01	c	9.4E-01	c	1.5E+00	c		1.9E-03	
Diisopropyl Ether	108-20-3							4.0E-01	P	V		1		2.3E+03	1.4E+03	n	5.8E+03	ns	4.2E+02	n	1.8E+03	n	8.3E+02	n		2.1E-01	
Diisopropyl Methylphosphonate	1445-75-6					8.0E-02	I			V		1		5.3E+02	6.3E+03	ns	8.2E+04	ns					2.9E+03	n		8.3E-01	
Dimethipin	55290-64-7					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		1.6E-01	

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Contaminant		Toxicity and Chemical-specific Information											Screening Levels											Protection of Groundwater Soil	
		SFO	k e y	IUR	k e y	RfDo	k e y	RfCi	k e y	v o c	muta-gen	GIABS	ABS	Csat	Residential Soil		Industrial Soil		Residential Air		Industrial Air		Tapwater		MCL	Risk-based SSL	MCL-based SSL
Analyte	CAS No.	(mg/kg-day)$^{-1}$		(ug/m^3)$^{-1}$		(mg/kg-day)		(mg/m^3)						mg/kg	mg/kg	key	mg/kg	key	ug/m^3	key	ug/m^3	key	ug/L	key	ug/L	mg/kg	mg/kg
Dimethoate	60-51-5					2.0E-04	I					1	0.1		1.2E+01	n	1.2E+02	n					7.3E+00	n		1.6E-03	
Dimethoxybenzidine, 3,3'-	119-90-4	1.4E-02	H									1	0.1		3.5E+01	c	1.2E+02	c					4.8E+00	c		5.8E-03	
Dimethyl methylphosphonate	756-79-6	1.7E-03	P			6.0E-02	P					1	0.1		2.9E+02	c*	1.0E+03	c*					4.0E+01	c*		8.3E-03	
Dimethylamino azobenzene [p-]	60-11-7	4.6E+00	C	1.3E-03	C							1	0.1		1.1E-01	c	3.7E-01	c	1.9E-03	c	9.4E-03	c	1.5E-02	c		6.2E-05	
Dimethylaniline HCl, 2,4-	21436-96-4	5.8E-01	H									1	0.1		8.4E-01	c	3.0E+00	c					1.2E-01	c		6.6E-05	
Dimethylaniline, 2,4-	95-68-1	7.5E-01	H									1	0.1		6.5E-01	c	2.3E+00	c					9.0E-02	c		5.1E-05	
Dimethylaniline, N,N-	121-69-7					2.0E-03	I			V		1		8.3E+02	1.6E+02	n	2.0E+03	ns					7.3E+01	n		2.6E-02	
Dimethylbenzidine, 3,3'-	119-93-7	1.1E+01	P									1	0.1		4.4E-02	c	1.6E-01	c					6.1E-03	c		4.0E-05	
Dimethylformamide	68-12-2					1.0E-01	P	3.0E-02	I			1	0.1		6.1E+03	n	6.2E+04	n	3.1E+01	n	1.3E+02	n	3.7E+03	n		7.4E-01	
Dimethylhydrazine, 1,1-	57-14-7					1.0E-04	X	2.0E-06	X			1	0.1		6.1E+00	n	6.1E+01	n	2.1E-03	n	8.8E-03	n	3.7E+00	n		8.2E-04	
Dimethylhydrazine, 1,2-	540-73-8	5.5E+02	C	1.6E-01	C							1	0.1		8.8E-04	c	3.1E-03	c	1.5E-05	c	7.7E-05	c	1.2E-04	c		2.8E-08	
Dimethylphenol, 2,4-	105-67-9					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		8.6E-01	
Dimethylphenol, 2,6-	576-26-1					6.0E-04	I					1	0.1		3.7E+01	n	3.7E+02	n					2.2E+01	n		2.6E-02	
Dimethylphenol, 3,4-	95-65-8					1.0E-03	I					1	0.1		6.1E+01	n	6.2E+02	n					3.7E+01	n		4.3E-02	
Dimethylterephthalate	120-61-6					1.0E-01	I			V		1		5.5E+00	7.8E+03	ns	1.0E+05	nms					3.7E+03	n		9.6E-01	
Dimethylvinylchloride	513-37-1	4.5E-02	C	1.3E-05	C										1.4E+01	c	6.4E+01	c	1.9E-01	c	9.4E-01	c	1.5E+00	c		9.2E-04	
Dinitro-o-cresol, 4,6-	534-52-1					1.0E-04	P					1	0.1		6.1E+00	n	6.2E+01	n					3.7E+00	n		6.2E-03	
Dinitro-o-cyclohexyl Phenol, 4,6-	131-89-5					2.0E-03	I					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		2.4E+00	
Dinitrobenzene, 1,2-	528-29-0					1.0E-04	P					1	0.1		6.1E+00	n	6.2E+01	n					3.7E+00	n		3.3E-03	
Dinitrobenzene, 1,3-	99-65-0					1.0E-04	I					1	0.1		6.1E+00	n	6.2E+01	n					3.7E+00	n		3.3E-03	
Dinitrobenzene, 1,4-	100-25-4					1.0E-04	P					1	0.1		6.1E+00	n	6.2E+01	n					3.7E+00	n		3.3E-03	
Dinitrophenol, 2,4-	51-28-5					2.0E-03	I					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		8.2E-02	
Dinitrotoluene Mixture, 2,4/2,6-	25321-14-6	6.8E-01	I									1	0.1		7.1E-01	c	2.5E+00	c					9.9E-02	c		1.4E-04	
Dinitrotoluene, 2,4-	121-14-2	3.1E-01	C	8.9E-05	C	2.0E-03	I					1	0.102		1.6E+00	c*	5.5E+00	c	2.7E-02	c	1.4E-01	c	2.2E-01	c		2.9E-04	
Dinitrotoluene, 2,6-	606-20-2					1.0E-03	P					1	0.099		6.1E+01	n	6.2E+02	n					3.7E+01	n		5.0E-02	
Dinitrotoluene, 2-Amino-4,6-	35572-78-2					2.0E-03	S					1	0.006		1.5E+02	n	2.0E+03	n					7.3E+01	n		5.6E-02	
Dinitrotoluene, 4-Amino-2,6-	19406-51-0					2.0E-03	S					1	0.009		1.5E+02	n	1.9E+03	n					7.3E+01	n		5.6E-02	
Dinoseb	88-85-7					1.0E-03	I					1	0.1		6.1E+01	n	6.2E+02	n					3.7E+01	n	7.0E+00	3.2E-01	6.2E-02
Dioxane, 1,4-	123-91-1	1.1E-02	I	7.7E-06	C	1.0E-01	A	3.6E+00	A			1	0.1		4.4E+01	c	1.6E+02	c	3.2E-01	c	1.6E+00	c	6.1E+00	c		1.3E-03	
Dioxins																											
~Hexachlorodibenzo-p-dioxin, Mixture	NA	6.2E+03	I	1.3E+00	I							1	0.03		9.4E-05	c	3.9E-04	c	1.9E-06	c	9.4E-06	c	1.1E-05	c		9.0E-06	
~TCDD, 2,3,7,8-	1746-01-6	1.3E+05	C	3.8E+01	C	1.0E-09	A	4.0E-08	C			1	0.03		4.5E-06	c*	1.8E-05	c*	6.4E-08	c	3.2E-07	c	5.2E-07	c*	3.0E-05	2.6E-07	1.5E-05
Diphenamid	957-51-7					3.0E-02	I					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n		1.1E+01	
Diphenyl Sulfone	127-63-9					8.0E-04	X					1	0.1		4.9E+01	n	4.9E+02	n					2.9E+01	n		7.1E-02	
Diphenylamine	122-39-4					2.5E-02	I					1	0.1		1.5E+03	n	1.5E+04	n					9.1E+02	n		1.7E+00	
Diphenylhydrazine, 1,2-	122-66-7	8.0E-01	I	2.2E-04	I							1	0.1		6.1E-01	c	2.2E+00	c	1.1E-02	c	5.6E-02	c	8.4E-02	c		2.7E-04	
Diquat	85-00-7					2.2E-03	I					1	0.1		1.3E+02	n	1.4E+03	n					8.0E+01	n	2.0E+01	1.5E+00	3.7E-01
Direct Black 38	1937-37-7	7.4E+00	C	2.1E-03	C							1	0.1		6.6E-02	c	2.3E-01	c	1.2E-03	c	5.8E-03	c	9.1E-03	c		4.4E+00	
Direct Blue 6	2602-46-2	7.4E+00	C	2.1E-03	C							1	0.1		6.6E-02	c	2.3E-01	c	1.2E-03	c	5.8E-03	c	9.1E-03	c		1.4E+01	
Direct Brown 95	16071-86-6	6.7E+00	C	1.9E-03	C							1	0.1		7.2E-02	c	2.6E-01	c	1.3E-03	c	6.5E-03	c	1.0E-02	c			
Disulfoton	298-04-4					4.0E-05	I					1	0.1		2.4E+00	n	2.5E+01	n					1.5E+00	n		2.7E-03	
Dithiane, 1,4-	505-29-3					1.0E-02	I					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		1.8E-01	
Diuron	330-54-1					2.0E-03	I					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		3.1E-02	
Dodine	2439-10-3					4.0E-03	I					1	0.1		2.4E+02	n	2.5E+03	n					1.5E+02	n		7.5E-01	
EPTC	759-94-4					2.5E-02	I			V		1		4.1E+02	2.0E+03	ns	2.6E+04	ns					9.1E+02	n		4.8E-01	
Endosulfan	115-29-7					6.0E-03	I					1	0.1		3.7E+02	n	3.7E+03	n					2.2E+02	n		3.0E+00	
Endothall	145-73-3					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n	1.0E+02	1.7E-01	2.4E-02
Endrin	72-20-8					3.0E-04	I					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n	2.0E+00	4.4E-01	8.1E-02
Epichlorohydrin	106-89-8	9.9E-03	I	1.2E-06	I	6.0E-03	P	1.0E-03	I	V		1		1.1E+04	2.0E+01	n	8.8E+01	n	1.0E+00	n	4.4E+00	n	2.1E+00	n		4.5E-04	
Epoxybutane, 1,2-	106-88-7							2.0E-02	I	V		1		1.5E+04	1.7E+02	n	7.2E+02	n	2.1E+01	n	8.8E+01	n	4.2E+01	n		9.2E-03	
Ethephon	16672-87-0					5.0E-03	I					1	0.1		3.1E+02	n	3.1E+03	n					1.8E+02	n		3.8E-02	
Ethion	563-12-2					5.0E-04	I					1	0.1		3.1E+01	n	3.1E+02	n					1.8E+01	n		3.6E-02	
Ethoxyethanol Acetate, 2-	111-15-9					3.0E-01	H	3.0E-01	C			1	0.1		1.8E+04	n	1.8E+05	nm	3.1E+02	n	1.3E+03	n	1.1E+04	n		2.3E+00	
Ethoxyethanol, 2-	110-80-5					4.0E-01	H	2.0E-01	I			1	0.1		2.4E+04	n	2.5E+05	nm	2.1E+02	n	8.8E+02	n	1.5E+04	n		2.9E+00	
Ethyl Acetate	141-78-6					9.0E-01	I			V		1		1.1E+04	7.0E+04	ns	9.2E+05	nms					3.3E+04	n		7.0E+00	
Ethyl Acrylate	140-88-5	4.8E-02	H							V		1		2.5E+03	1.3E+01	c	6.0E+01	c					1.4E+00	c		3.1E-04	
Ethyl Chloride	75-00-3							1.0E+01	I	V		1		2.1E+03	1.5E+04	ns	6.1E+04	ns	1.0E+04	n	4.4E+04	n	2.1E+04	n		5.9E+00	
Ethyl Ether	60-29-7					2.0E-01	I			V		1		1.0E+04	1.6E+04	ns	2.0E+05	nms					7.3E+03	n		1.6E+00	
Ethyl Methacrylate	97-63-2					9.0E-02	H			V		1		1.1E+03	7.0E+03	ns	9.2E+04	ns					3.3E+03	n		7.7E-01	
Ethyl-p-nitrophenyl Phosphonate	2104-64-5					1.0E-05	I					1	0.1		6.1E-01	n	6.2E+00	n					3.7E-01	n		1.1E-02	
Ethylbenzene	100-41-4	1.1E-02	C	2.5E-06	C	1.0E-01	I	1.0E+00	I	V		1		4.8E+02	5.4E+00	c	2.7E+01	c	9.7E-01	c	4.9E+00	c	1.5E+00	c	7.0E+02	1.7E-03	7.8E-01
Ethylene Cyanohydrin	109-78-4					3.0E-02	P					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n		2.2E-01	
Ethylene Diamine	107-15-3					9.0E-02	P					1	0.1		5.5E+03	n	5.5E+04	n					3.3E+03	n		7.5E-01	
Ethylene Glycol	107-21-1					2.0E+00	I	4.0E-01	C			1	0.1		1.2E+05	nm	1.2E+06	nm	4.2E+02	n	1.8E+03	n	7.3E+04	n		1.5E+01	
Ethylene Glycol Monobutyl Ether	111-76-2					5.0E-01	I	1.3E+01	I			1	0.1		3.1E+04	n	3.1E+05	nm	1.4E+04	n	5.7E+04	n	1.8E+04	n		3.8E+00	
Ethylene Oxide	75-21-8	3.1E-01	C	8.8E-05	C			3.0E-02	C	V		1		1.2E+05	1.7E-01	c	8.3E-01	c	2.8E-02	c	1.4E-01	c	4.4E-02	c		9.1E-06	
Ethylene Thiourea	96-45-7	4.5E-02	C	1.3E-05	C	8.0E-05	I					1	0.1		4.9E+00	n	3.8E+01	c**	1.9E-01	c	9.4E-01	c	1.5E+00	c**		3.4E-04	
Ethyleneimine	151-56-4	6.5E+01	C	1.9E-02	C										9.8E-03	c	4.4E-02	c	1.3E-04	c	6.5E-04	c	1.0E-03	c		2.3E-07	
Ethylphthalyl Ethyl Glycolate	84-72-0					3.0E+00	I					1	0.1		1.8E+05	nm	1.8E+06	nm					1.1E+05	n		2.5E+02	
Express	101200-48-0					8.0E-03	I					1	0.1		4.9E+02	n	4.9E+03	n					2.9E+02	n		1.1E-01	
Fenamiphos	22224-92-6					2.5E-04	I					1	0.1		1.5E+01	n	1.5E+02	n					9.1E+00	n		9.1E-03	
Fenpropathrin	39515-41-8					2.5E-02	I					1	0.1		1.5E+03	n	1.5E+04	n					9.1E+02	n		4.1E+01	
Fluometuron	2164-17-2					1.3E-02	I					1	0.1		7.9E+02	n	8.0E+03	n					4.7E+02	n		3.7E-01	
Fluoride	16984-48-8					4.0E-02	C	1.3E-02	C						3.1E+03	n	4.1E+04	n	1.4E+01	n	5.7E+01	n	1.5E+03	n			
Fluorine (Soluble Fluoride)	7782-41-4					6.0E-02	I	1.3E-02	C			1			4.7E+03	n	6.1E+04	n	1.4E+01	n	5.7E+01	n	2.2E+03	n	4.0E+03	3.3E+02	6.0E+02
Fluridone	59756-60-4					8.0E-02	I					1	0.1		4.9E+03	n	4.9E+04	n					2.9E+03	n		3.3E+02	
Flurprimidol	56425-91-3					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		3.3E+00	
Flutolanil	66332-96-5					6.0E-02	I					1	0.1		3.7E+03	n	3.7E+04	n					2.2E+03	n		1.2E+01	
Fluvalinate	69409-94-5					1.0E-02	I					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		5.3E+02	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ #29; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10 c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User's Guide); s = Concentration may exceed Csat (See User's Guide); SSL values are based on DAF=1

Contaminant		Toxicity and Chemical-specific Information											Screening Levels												Protection of Groundwater Soil	
		SFO	k e y	IUR	k e y	RfDo	k e y	RfCi	k e y	v o c	muta-gen	GIABS	ABS	Csat	Residential Soil		Industrial Soil		Residential Air		Industrial Air		Tapwater		MCL	Risk-based SSL	MCL-based SSL
Analyte	CAS No.	(mg/kg-day)$^{-1}$		(ug/m^3)$^{-1}$		(mg/kg-day)		(mg/m^3)						mg/kg	mg/kg	key	mg/kg	key	ug/m^3	key	ug/m^3	key	ug/L	key	ug/L	mg/kg	mg/kg
Folpet	133-07-3	3.5E-03	I			1.0E-01	I					1	0.1		1.4E+02	c*	4.9E+02	c					1.9E+01	c		4.5E-03	
Fomesafen	72178-02-0	1.9E-01	I									1	0.1		2.6E+00	c	9.1E+00	c					3.5E-01	c		1.2E-03	
Fonofos	944-22-9					2.0E-03	I					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		1.4E-01	
Formaldehyde	50-00-0			1.3E-05	I	2.0E-01	I	9.8E-03	A			1	0.1		1.2E+04	n	1.2E+05	nm	1.9E-01	c*	9.4E-01	c*	7.3E+03	n		1.5E+00	
Formic Acid	64-18-6					2.0E+00	H	3.0E-03	P			1	0.1		1.2E+05	nm	1.2E+06	nm	3.1E+00	n	1.3E+01	n	7.3E+04	n		1.5E+01	
Fosetyl-AL	39148-24-8					3.0E+00	I					1	0.1		1.8E+05	nm	1.8E+06	nm					1.1E+05	n			
Furans																											
~Dibenzofuran	132-64-9					1.0E-03	X			V		1		1.7E+02	7.8E+01	n	1.0E+03	ns					3.7E+01	n		6.8E-01	
~Furan	110-00-9					1.0E-03	I			V		1		6.2E+03	7.8E+01	n	1.0E+03	n					3.7E+01	n		1.4E-02	
Furazolidone	67-45-8	3.8E+00	H									1	0.1		1.3E-01	c	4.5E-01	c					1.8E-02	c		3.4E-05	
Furfural	98-01-1					3.0E-03	I	5.0E-02	H			1	0.1		1.8E+02	n	1.8E+03	n	5.2E+01	n	2.2E+02	n	1.1E+02	n		2.3E-02	
Furium	531-82-8	1.5E+00	C	4.3E-04	C							1	0.1		3.2E-01	c	1.1E+00	c	5.7E-03	c	2.9E-02	c	4.5E-02	c		6.1E-05	
Furmecyclox	60568-05-0	3.0E-02	I	8.6E-06	C							1	0.1		1.6E+01	c	5.7E+01	c	2.8E-01	c	1.4E+00	c	2.2E+00	c		2.4E-03	
Glufosinate, Ammonium	77182-82-2					4.0E-04	I					1	0.1		2.4E+01	n	2.5E+02	n					1.5E+01	n		3.2E-03	
Glutaraldehyde	111-30-8							8.0E-05	C						1.1E+05	nm	4.8E+05	nm	8.3E-02	n	3.5E-01	n					
Glycidyl	765-34-4					4.0E-04	I	1.0E-03	H			1	0.1		2.4E+01	n	2.5E+02	n	1.0E+00	n	4.4E+00	n	1.5E+01	n		2.9E-03	
Glyphosate	1071-83-6					1.0E-01	I					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n	7.0E+02	7.4E-01	1.4E-01
Goal	42874-03-3					3.0E-03	I					1	0.1		1.8E+02	n	1.8E+03	n					1.1E+02	n		8.8E+00	
Guthion	86-50-0					3.0E-03	A	1.0E-02	A			1	0.1		1.8E+02	n	1.8E+03	n	1.0E+01	n	4.4E+01	n	1.1E+02	n		3.3E-02	
Haloxyfop, Methyl	69806-40-2					5.0E-05	I					1	0.1		3.1E+00	n	3.1E+01	n					1.8E+00	n		2.0E-02	
Harmony	79277-27-3					1.3E-02	I					1	0.1		7.9E+02	n	8.0E+03	n					4.7E+02	n		1.4E-01	
Heptachlor	76-44-8	4.5E+00	I	1.3E-03	I	5.0E-04	I					1	0.1		1.1E-01	c	3.8E-01	c	1.9E-03	c	9.4E-03	c	1.5E-02	c	4.0E-01	1.2E-03	3.3E-02
Heptachlor Epoxide	1024-57-3	9.1E+00	I	2.6E-03	I	1.3E-05	I					1	0.1		5.3E-02	c*	1.9E-01	c*	9.4E-04	c	4.7E-03	c	7.4E-03	c*	2.0E-01	1.5E-04	4.1E-03
Hexabromobenzene	87-82-1					2.0E-03	I					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		4.2E-01	
Hexabromodiphenyl ether, 2,2',4,4',5,5'- (BDE-153)	68631-49-2					2.0E-04	I								1.6E+01	n	2.0E+02	n					7.3E+00	n			
Hexachlorobenzene	118-74-1	1.6E+00	I	4.6E-04	I	8.0E-04	I					1	0.1		3.0E-01	c	1.1E+00	c	5.3E-03	c	2.7E-02	c	4.2E-02	c	1.0E+00	5.3E-04	1.3E-02
Hexachlorobutadiene	87-68-3	7.8E-02	I	2.2E-05	I	1.0E-03	P					1	0.1		6.2E+00	c**	2.2E+01	c*	1.1E-01	c	5.6E-01	c	8.6E-01	c*		1.7E-03	
Hexachlorocyclohexane, Alpha-	319-84-6	6.3E+00	I	1.8E-03	I	8.0E-03	A					1	0.1		7.7E-02	c	2.7E-01	c	1.4E-03	c	6.8E-03	c	1.1E-02	c		6.2E-05	
Hexachlorocyclohexane, Beta-	319-85-7	1.8E+00	I	5.3E-04	I							1	0.1		2.7E-01	c	9.6E-01	c	4.6E-03	c	2.3E-02	c	3.7E-02	c		2.2E-04	
Hexachlorocyclohexane, Gamma- (Lindane)	58-89-9	1.1E+00	C	3.1E-04	C	3.0E-04	I					1	0.04		5.2E-01	c*	2.1E+00	c	7.8E-03	c	4.0E-02	c	6.1E-02	c	2.0E-01	3.6E-04	1.2E-03
Hexachlorocyclohexane, Technical	608-73-1	1.8E+00	I	5.1E-04	I							1	0.1		2.7E-01	c	9.6E-01	c	4.8E-03	c	2.4E-02	c	3.7E-02	c		2.2E-04	
Hexachlorocyclopentadiene	77-47-4					6.0E-03	I	2.0E-04	I			1	0.1		3.7E+02	n	3.7E+03	n	2.1E-01	n	8.8E-01	n	2.2E+02	n	5.0E+01	6.8E-01	1.6E-01
Hexachloroethane	67-72-1	1.4E-02	I	4.0E-06	I	1.0E-03	I					1	0.1		3.5E+01	c**	1.2E+02	c**	6.1E-01	c	3.1E+00	c	4.8E+00	c**		2.9E-03	
Hexachlorophene	70-30-4					3.0E-04	I					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n		1.5E+01	
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	1.1E-01	I			3.0E-03	I					1	0.015		5.5E+00	c*	2.4E+01	c					6.1E-01	c		2.3E-04	
Hexamethylene Diisocyanate, 1,6-	822-06-0							1.0E-05	I	V		1		5.2E+03	3.4E+00	n	1.4E+01	n	1.0E-02	n	4.4E-02	n	2.1E-02	n		2.1E-04	
Hexane, N-	110-54-3					6.0E-02	H	7.0E-01	I	V		1		1.4E+02	5.7E+02	ns	2.6E+03	ns	7.3E+02	n	3.1E+03	n	8.8E+02	n		6.2E+00	
Hexanedioic Acid	124-04-9					2.0E+00	P					1	0.1		1.2E+05	nm	1.2E+06	nm					7.3E+04	n		1.8E+01	
Hexanone, 2-	591-78-6					5.0E-03	I	3.0E-02	I	V		1		3.3E+03	2.1E+02	n	1.4E+03	n	3.1E+01	n	1.3E+02	n	4.7E+01	n		1.1E-02	
Hexazinone	51235-04-2					3.3E-02	I					1	0.1		2.0E+03	n	2.0E+04	n					1.2E+03	n		5.5E-01	
Hydrazine	302-01-2	3.0E+00	I	4.9E-03	I			3.0E-05	P			1			2.1E-01	c	9.5E-01	c	5.0E-04	c*	2.5E-03	c*	2.2E-02	c			
Hydrazine Sulfate	10034-93-2	3.0E+00	I	4.9E-03	I							1			2.1E-01	c	9.5E-01	c	5.0E-04	c	2.5E-03	c	2.2E-02	c			
Hydrogen Chloride	7647-01-0							2.0E-02	I			1			2.8E+07	nm	1.2E+08	nm	2.1E+01	n	8.8E+01	n					
Hydrogen Fluoride	7664-39-3					4.0E-02	C	1.4E-02	C			1			3.1E+03	n	4.1E+04	n	1.5E+01	n	6.1E+01	n	1.5E+03	n			
Hydrogen Sulfide	7783-06-4							2.0E-03	I			1			2.8E+06	nm	1.2E+07	nm	2.1E+00	n	8.8E+00	n					
Hydroquinone	123-31-9	6.0E-02	P			4.0E-02	P					1	0.1		8.1E+00	c	2.9E+01	c					1.1E+00	c		7.6E-04	
Imazalil	35554-44-0					1.3E-02	I					1	0.1		7.9E+02	n	8.0E+03	n					4.7E+02	n		8.2E+00	
Imazaquin	81335-37-7					2.5E-01	I					1	0.1		1.5E+04	n	1.5E+05	nm					9.1E+03	n		4.5E+01	
Iodine	7553-56-2					1.0E-02	A								7.8E+02	n	1.0E+04	n					3.7E+02	n			
Iprodione	36734-19-7					4.0E-02	I					1	0.1		2.4E+03	n	2.5E+04	n					1.5E+03	n		4.5E-01	
Iron	7439-89-6					7.0E-01	P					1			5.5E+04	n	7.2E+05	nm					2.6E+04	n		6.4E+02	
Isobutyl Alcohol	78-83-1					3.0E-01	I			V		1		1.0E+04	2.3E+04	ns	3.1E+05	nms					1.1E+04	n		2.3E+00	
Isophorone	78-59-1	9.5E-04	I			2.0E-01	I	2.0E+00	C			1	0.1		5.1E+02	c*	1.8E+03	c*	2.1E+03	n	8.8E+03	n	7.1E+01	c		2.3E-02	
Isopropalin	33820-53-0					1.5E-02	I					1	0.1		9.2E+02	n	9.2E+03	n					5.5E+02	n		1.3E+01	
Isopropanol	67-63-0							7.0E+00	C			1	0.1		9.9E+09	nm	4.2E+10	nm	7.3E+03	n	3.1E+04	n					
Isopropyl Methyl Phosphonic Acid	1832-54-8					1.0E-01	I					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n		7.9E-01	
Isoxaben	82558-50-7					5.0E-02	I					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		5.0E+00	
JP-7	NA							3.0E-01	A	V		1			4.3E+08	nm	1.8E+09	nm	3.1E+02	n	1.3E+03	n	6.3E+02	n			
Kerb	23950-58-5					7.5E-02	I					1	0.1		4.6E+03	n	4.6E+04	n					2.7E+03	n		2.8E+00	
Lactofen	77501-63-4					2.0E-03	I					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		3.4E+00	
Lead Compounds																											
~Lead and Compounds	7439-92-1											1			4.0E+02	nL	8.0E+02	nL							1.5E+01		1.4E+01
~Tetraethyl Lead	78-00-2					1.0E-07	I					1	0.1		6.1E-03	n	6.2E-02	n					3.7E-03	n		1.3E-05	
Lead acetate	301-04-2	2.8E-01	C	8.0E-05	C										2.3E+00	c	1.0E+01	c	3.0E-02	c	1.5E-01	c	2.4E-01	c			
Lead subacetate	1335-32-6	3.8E-02	C	1.1E-05	C										1.7E+01	c	7.5E+01	c	2.2E-01	c	1.1E+00	c	1.8E+00	c			
Linuron	330-55-2					2.0E-03	I					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		6.4E-02	
Lithium	7439-93-2					2.0E-03	P					1			1.6E+02	n	2.0E+03	n					7.3E+01	n		2.2E+01	
Lithium Perchlorate	7791-03-9					7.0E-04	I					1			5.5E+01	n	7.2E+02	n					2.6E+01	n			
Londax	83055-99-6					2.0E-01	I					1	0.1		1.2E+04	n	1.2E+05	nm					7.3E+03	n		1.9E+00	
MCPA	94-74-6					5.0E-04	I					1	0.1		3.1E+01	n	3.1E+02	n					1.8E+01	n		4.7E-03	
MCPB	94-81-5					1.0E-02	I					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		1.4E-01	
MCPP	93-65-2					1.0E-03	I					1	0.1		6.1E+01	n	6.2E+02	n					3.7E+01	n		1.1E-02	
Malathion	121-75-5					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		1.9E-01	
Maleic Anhydride	108-31-6					1.0E-01	I	7.0E-04	C			1	0.1		6.1E+03	n	6.1E+04	n	7.3E-01	n	3.1E+00	n	3.7E+03	n		7.4E-01	
Maleic Hydrazide	123-33-1					5.0E-01	I					1	0.1		3.1E+04	n	3.1E+05	nm					1.8E+04	n		3.8E+00	
Malononitrile	109-77-3					1.0E-04	P					1	0.1		6.1E+00	n	6.2E+01	n					3.7E+00	n		7.5E-04	
Mancozeb	8018-01-7					3.0E-02	H					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n		1.5E+00	
Maneb	12427-38-2					5.0E-03	I					1	0.1		3.1E+02	n	3.1E+03	n					1.8E+02	n		2.6E-01	
Manganese (Diet)	7439-96-5					1.4E-01	I	5.0E-05	I			1															

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ #29; c = cancer, * = where: n SL < 100X c SL; ** = where n SL < 10 c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User's Guide); s = Concentration may exceed Csat (See User's Guide); SSL values are based on DAF=1

Contaminant		Toxicity and Chemical-specific Information											Screening Levels												Protection of Groundwater Soil	
		SFO	k e y	IUR	k e y	RfDo	k e y	RfCi	k e y	v o c	muta-gen	GIABS	ABS	Csat	Residential Soil		Industrial Soil		Residential Air		Industrial Air		Tapwater		MCL	Risk-based SSL	MCL-based SSL
Analyte	CAS No.	(mg/kg-day)$^{-1}$		(ug/m^3)$^{-1}$		(mg/kg-day)		(mg/m^3)						mg/kg	mg/kg	key	mg/kg	key	ug/m^3	key	ug/m^3	key	ug/L	key	ug/L	mg/kg	mg/kg
Manganese (Water)	7439-96-5					2.4E-02	I	5.0E-05	I			0.04			1.8E+03	n	2.3E+04	n	5.2E-02	n	2.2E-01	n	8.8E+02	n		5.7E+01	
Mephosfolan	950-10-7					9.0E-05	H					1	0.1		5.5E+00	n	5.5E+01	n					3.3E+00	n		4.8E-03	
Mepiquat Chloride	24307-26-4					3.0E-02	I					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n		3.6E-01	
Mercury Compounds																											
~Mercuric Chloride	7487-94-7					3.0E-04	I	3.0E-05	C			0.07			2.3E+01	n	3.1E+02	n	3.1E-02	n	1.3E-01	n	1.1E+01	n			
~Mercuric Sulfide	1344-48-5					3.0E-04	S					1			2.3E+01	n	3.1E+02	n					1.1E+01	n			
~Mercury (elemental)	7439-97-6					1.6E-04	C	3.0E-04	I	V		1		3.1E+00	5.6E+00	ns	3.4E+01	ns	3.1E-01	n	1.3E+00	n	5.7E-01	n	2.0E+00	3.0E-02	1.0E-01
~Mercury, Inorganic Salts	NA					3.0E-04	S					0.07			2.3E+01	n	3.1E+02	n					1.1E+01	n		5.7E-01	
~Methyl Mercury	22967-92-6					1.0E-04	I					1			7.8E+00	n	1.0E+02	n					3.7E+00	n			
~Phenylmercuric Acetate	62-38-4					8.0E-05	I					1	0.1		4.9E+00	n	4.9E+01	n					2.9E+00	n		9.1E-04	
Merphos	150-50-5					3.0E-05	I					1	0.1		1.8E+00	n	1.8E+01	n					1.1E+00	n		1.1E-01	
Merphos Oxide	78-48-8					3.0E-05	I					1	0.1		1.8E+00	n	1.8E+01	n					1.1E+00	n		5.4E-03	
Metalaxyl	57837-19-1					6.0E-02	I					1	0.1		3.7E+03	n	3.7E+04	n					2.2E+03	n		6.1E-01	
Methacrylonitrile	126-98-7					1.0E-04	I	7.0E-04	H	V		1		4.6E+03	3.2E+00	n	1.8E+01	n	7.3E-01	n	3.1E+00	n	1.0E+00	n		2.4E-04	
Methamidophos	10265-92-6					5.0E-05	I					1	0.1		3.1E+00	n	3.1E+01	n					1.8E+00	n		3.8E-04	
Methanol	67-56-1					5.0E-01	I	4.0E+00	C			1	0.1		3.1E+04	n	3.1E+05	nm	4.2E+03	n	1.8E+04	n	1.8E+04	n		3.7E+00	
Methidathion	950-37-8					1.0E-03	I					1	0.1		6.1E+01	n	6.2E+02	n					3.7E+01	n		8.9E-03	
Methomyl	16752-77-5					2.5E-02	I					1	0.1		1.5E+03	n	1.5E+04	n					9.1E+02	n		2.0E-01	
Methoxy-5-nitroaniline, 2-	99-59-2	4.9E-02	C	1.4E-05	C							1	0.1		9.9E+00	c	3.5E+01	c	1.7E-01	c	8.8E-01	c	1.4E+00	c		4.7E-04	
Methoxychlor	72-43-5					5.0E-03	I					1	0.1		3.1E+02	n	3.1E+03	n					1.8E+02	n	4.0E+01	9.9E+00	2.2E+00
Methoxyethanol Acetate, 2-	110-49-6					2.0E-03	H	9.0E-02	C			1	0.1		1.2E+02	n	1.2E+03	n	9.4E+01	n	3.9E+02	n	7.3E+01	n		1.5E-02	
Methoxyethanol, 2-	109-86-4					3.0E-03	P	2.0E-02	I			1	0.1		1.8E+02	n	1.8E+03	n	2.1E+01	n	8.8E+01	n	1.1E+02	n		2.2E-02	
Methyl Acetate	79-20-9					1.0E+00	H			V		1		2.9E+04	7.8E+04	ns	1.0E+06	nms					3.7E+04	n		7.5E+00	
Methyl Acrylate	96-33-3					3.0E-02	H			V		1		6.8E+03	2.3E+03	n	3.1E+04	ns					1.1E+03	n		2.3E-01	
Methyl Ethyl Ketone (2-Butanone)	78-93-3					6.0E-01	I	5.0E+00	I	V		1		2.8E+04	2.8E+04	n	2.0E+05	nms	5.2E+03	n	2.2E+04	n	7.1E+03	n		1.5E+00	
Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1					8.0E-02	H	3.0E+00	I	V		1		3.4E+03	5.3E+03	ns	5.3E+04	ns	3.1E+03	n	1.3E+04	n	2.0E+03	n		4.5E-01	
Methyl Isocyanate	624-83-9							1.0E-03	C						1.4E+06	nm	6.0E+06	nm	1.0E+00	n	4.4E+00	n					
Methyl Methacrylate	80-62-6					1.4E+00	I	7.0E-01	I	V		1		2.4E+03	4.8E+03	ns	2.1E+04	ns	7.3E+02	n	3.1E+03	n	1.4E+03	n		3.1E-01	
Methyl Parathion	298-00-0					2.5E-04	I					1	0.1		1.5E+01	n	1.5E+02	n					9.1E+00	n		1.5E-02	
Methyl Phosphonic Acid	993-13-5					6.0E-02	X					1	0.1		3.7E+03	n	3.7E+04	n					2.2E+03	n		4.4E-01	
Methyl Styrene (Mixed Isomers)	25013-15-4					6.0E-03	H	4.0E-02	H	V		1		3.8E+02	2.5E+02	n	1.6E+03	ns	4.2E+01	n	1.8E+02	n	6.0E+01	n		9.7E-02	
Methyl methanesulfonate	66-27-3	9.9E-02	C	2.8E-05	C							1	0.1		4.9E+00	c	1.7E+01	c	8.7E-02	c	4.4E-01	c	6.8E-01	c		1.4E-04	
Methyl tert-Butyl Ether (MTBE)	1634-04-4	1.8E-03	C	2.6E-07	C			3.0E+00	I	V		1		8.9E+03	4.3E+01	c	2.2E+02	c	9.4E+00	c	4.7E+01	c	1.2E+01	c		2.8E-03	
Methyl-5-Nitroaniline, 2-	99-55-8	3.3E-02	H									1	0.1		1.5E+01	c	5.2E+01	c					2.0E+00	c		1.1E-03	
Methyl-N-nitro-N-nitrosoguanidine, N-	70-25-7	8.3E+00	C	2.4E-03	C										7.7E-02	c	3.4E-01	c	1.0E-03	c	5.1E-03	c	8.1E-03	c		2.8E-06	
Methylaniline Hydrochloride, 2-	636-21-5	1.3E-01	C	3.7E-05	C							1	0.1		3.7E+00	c	1.3E+01	c	6.6E-02	c	3.3E-01	c	5.2E-01	c		2.2E-04	
Methylarsonic acid	124-58-3					1.0E-02	A					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n			
Methylcholanthrene, 3-	56-49-5	2.2E+01	C	6.3E-03	C							1	0.1		2.2E-02	c	7.8E-02	c	3.9E-04	c	1.9E-03	c	3.1E-03	c		5.9E-03	
Methylene Chloride	75-09-2	7.5E-03	I	4.7E-07	I	6.0E-02	I	1.0E+00	A	V		1		3.3E+03	1.1E+01	c	5.3E+01	c	5.2E+00	c	2.6E+01	c	4.8E+00	c	5.0E+00	1.2E-03	1.3E-03
Methylene-bis(2-chloroaniline), 4,4'-	101-14-4	1.0E-01	P	4.3E-04	C	2.0E-03	P				M	1	0.1		1.2E+00	c	1.7E+01	c*	2.2E-03	c	2.9E-02	c	2.2E-01	c		2.5E-03	
Methylene-bis(N,N-dimethyl) Aniline, 4,4'-	101-61-1	4.6E-02	I	1.3E-05	C							1	0.1		1.1E+01	c	3.7E+01	c	1.9E-01	c	9.4E-01	c	1.5E+00	c		8.1E-03	
Methylenebisbenzenamine, 4,4'-	101-77-9	1.6E+00	C	4.6E-04	C			2.0E-02	C			1	0.1		3.0E-01	c	1.1E+00	c	5.3E-03	c	2.7E-02	c	4.2E-02	c		1.9E-04	
Methylenediphenyl Diisocyanate	101-68-8							6.0E-04	I			1	0.1		8.5E+05	nm	3.6E+06	nm	6.3E-01	n	2.6E+00	n					
Methylstyrene, Alpha-	98-83-9					7.0E-02	H			V		1		5.0E+02	5.5E+03	ns	7.2E+04	ns					2.6E+03	n		4.1E+00	
Metolachlor	51218-45-2					1.5E-01	I					1	0.1		9.2E+03	n	9.2E+04	n					5.5E+03	n		6.4E+00	
Metribuzin	21087-64-9					2.5E-02	I					1	0.1		1.5E+03	n	1.5E+04	n					9.1E+02	n		2.8E-01	
Mineral oils	8012-95-1					3.0E+00	P								2.3E+05	nm	3.1E+06	nm					1.1E+05	n		4.3E+03	
Mirex	2385-85-5	1.8E+01	C	5.1E-03	C	2.0E-04	I					1	0.1		2.7E-02	c	9.6E-02	c	4.8E-04	c	2.4E-03	c	3.7E-03	c		2.7E-03	
Molinate	2212-67-1					2.0E-03	I					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		4.1E-02	
Molybdenum	7439-98-7					5.0E-03	I					1			3.9E+02	n	5.1E+03	n					1.8E+02	n		3.7E+00	
Monochloramine	10599-90-3					1.0E-01	I					1			7.8E+03	n	1.0E+05	nm					3.7E+03	n			
Monomethylaniline	100-61-8					2.0E-03	P					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		2.7E-02	
N,N'-Diphenyl-1,4-benzenediamine	74-31-7					3.0E-04	X					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n		1.1E+00	
Naled	300-76-5					2.0E-03	I					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		3.3E-02	
Naphtha, High Flash Aromatic (HFAN)	64724-95-6					3.0E-02	X	1.0E-01	P	V					2.3E+03	n	3.1E+04	n	1.0E+02	n	4.4E+02	n	1.8E+02	n			
Naphthylamine, 2-	91-59-8	1.8E+00	C	0.0E+00	C							1	0.1		2.7E-01	c	9.6E-01	c					3.7E-02	c		1.9E-04	
Napropamide	15299-99-7					1.0E-01	I					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n		2.4E+01	
Nickel Carbonyl	13463-39-3					5.0E-02	C	5.0E-05	C			0.04			3.7E+03	n	4.4E+04	n	5.2E-02	n	2.2E-01	n	1.8E+03	n			
Nickel Oxide	1313-99-1					5.0E-02	C	1.0E-04	C						3.8E+03	n	4.7E+04	n	1.0E-01	n	4.4E-01	n	1.8E+03	n			
Nickel Refinery Dust	NA			2.4E-04	I	5.0E-02	C	5.0E-05	C			0.04			3.7E+03	n	4.4E+04	n	1.0E-02	c**	5.1E-02	c**	1.8E+03	n			
Nickel Soluble Salts	7440-02-0			2.6E-04	C	2.0E-02	I	9.0E-05	A			0.04			1.5E+03	n	2.0E+04	n	9.4E-03	c*	4.7E-02	c**	7.3E+02	n		4.8E+01	
Nickel Subsulfide	12035-72-2	1.7E+00	C	4.8E-04	I	5.0E-02	C	5.0E-05	C			0.04			3.8E-01	c	1.7E+00	c	5.1E-03	c*	2.6E-02	c**	4.0E-02	c			
Nitrate	14797-55-8					1.6E+00	I					1			1.3E+05	nm	1.6E+06	nm					5.8E+04	n	1.0E+04		
Nitrite	14797-65-0					1.0E-01	I					1			7.8E+03	n	1.0E+05	nm					3.7E+03	n	1.0E+03		
Nitroaniline, 2-	88-74-4					1.0E-02	X	5.0E-05	X			1	0.1		6.1E+02	n	6.0E+03	n	5.2E-02	n	2.2E-01	n	3.7E+02	n		1.5E-01	
Nitroaniline, 4-	100-01-6	2.0E-02	P			4.0E-03	P	6.0E-03	P			1	0.1		2.4E+01	c*	8.6E+01	c*	6.3E+00	n	2.6E+01	n	3.4E+00	c*		1.4E-03	
Nitrobenzene	98-95-3			4.0E-05	I	2.0E-03	I	9.0E-03	I	V		1		3.1E+03	4.8E+00	c*	2.4E+01	c*	6.1E-02	c	3.1E-01	c	1.2E-01	c		7.9E-05	
Nitrocellulose	9004-70-0					3.0E+03	P								2.3E+08	nm	3.1E+09	nm					1.1E+08	n		2.4E+04	
Nitrofurantoin	67-20-9					7.0E-02	H					1	0.1		4.3E+03	n	4.3E+04	n					2.6E+03	n		1.1E+00	
Nitrofurazone	59-87-0	1.3E+00	C	3.7E-04	C							1	0.1		3.7E-01	c	1.3E+00	c	6.6E-03	c	3.3E-02	c	5.2E-02	c		4.7E-05	
Nitroglycerin	55-63-0	1.7E-02	P			1.0E-04	P					1	0.1		6.1E+00	n	6.2E+01	n					3.7E+00	n		1.6E-03	
Nitroguanidine	556-88-7					1.0E-01	I					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n		8.8E-01	
Nitromethane	75-52-5			9.0E-06	P			2.0E-02	P	V		1		1.8E+04	4.9E+00	c*	2.5E+01	c*	2.7E-01	c*	1.4E+00	c*	5.4E-01	c*		1.2E-04	
Nitropropane, 2-	79-46-9			2.7E-03	H			2.0E-02	I	V		1		4.9E+03	1.3E-02	c	6.4E-02	c	9.0E-04	c	4.5E-03	c	1.8E-03	c		4.7E-07	
Nitroso-N-ethylurea, N-	759-73-9	2.7E+01	C	7.7E-03	C							1	0.1		1.8E-02	c	6.4E-02	c	3.2E-04	c	1.6E-03	c	2.5E-03	c		6.0E-07	
Nitroso-N-methylurea, N-	684-93-5	1.2E+02	C	3.4E-02	C							1	0.1		4.0E-03	c	1.4E-02	c	7.2E-05	c	3.6E-04	c	5.6E-04	c		1.2E-07	
Nitroso-di-N-butylamine, N-	924-16-3	5.4E+00	I	1.6E-03	I					V		1		7.1E+03	8.7E-02	c	4.0E-01	c	1.5E-03	c	7.7E-03	c	2.4E-03	c		5.0E-06	
Nitroso-di-N-propylamine, N-	621-64-7	7.0E+00	I	2.0E-03	C							1	0.1		6.9E-02	c	2.5E-01	c	1.2E-03	c	6.1E-03	c	9.6E-03	c		7.2E-06	
Nitrosodiethanolamine, N-	1116-54-7	2.8E+00	I	8.0E-04	C							1	0.1		1.7E-01	c	6.2E-01	c	3.0E-03	c	1.5E-02	c	2.4E-02	c		4.9E-06	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ #29; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10 c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User's Guide); s = Concentration may exceed Csat (See User's Guide); SSL values are based on DAF=1

Contaminant		Toxicity and Chemical-specific Information													Screening Levels											Protection of Groundwater Soil	
		SFO	key	IUR	key	RfDo	key	RfCi	key	voc	muta-gen	GIABS	ABS	Csat	Residential Soil	key	Industrial Soil	key	Residential Air	key	Industrial Air	key	Tapwater	key	MCL	Risk-based SSL	MCL-based SSL
Analyte	CAS No.	(mg/kg-day)$^{-1}$		(ug/m^3)$^{-1}$		(mg/kg-day)		(mg/m^3)						mg/kg	mg/kg		mg/kg		ug/m^3		ug/m^3		ug/L		ug/L	mg/kg	mg/kg
Nitrosodiethylamine, N-	55-18-5	1.5E+02	I	4.3E-02	I					M		1	0.1		7.7E-04	c	1.1E-02	c	2.2E-05	c	2.9E-04	c	1.4E-04	c		5.3E-08	
Nitrosodimethylamine, N-	62-75-9	5.1E+01	I	1.4E-02	I	8.0E-06	P	4.0E-05	X	M		1	0.1		2.3E-03	c	3.4E-02	c	6.9E-05	c	8.8E-04	c	4.2E-04	c		1.0E-07	
Nitrosodiphenylamine, N-	86-30-6	4.9E-03	I	2.6E-06	C							1	0.1		9.9E+01	c	3.5E+02	c	9.4E-01	c	4.7E+00	c	1.4E+01	c		7.5E-02	
Nitrosomethylethylamine, N-	10595-95-6	2.2E+01	I	6.3E-03	C							1	0.1		2.2E-02	c	7.8E-02	c	3.9E-04	c	1.9E-03	c	3.1E-03	c		8.8E-07	
Nitrosomorpholine [N-]	59-89-2	6.7E+00	C	1.9E-03	C							1	0.1		7.2E-02	c	2.6E-01	c	1.3E-03	c	6.5E-03	c	1.0E-02	c		2.5E-06	
Nitrosopiperidine [N-]	100-75-4	9.4E+00	C	2.7E-03	C							1	0.1		5.2E-02	c	1.8E-01	c	9.0E-04	c	4.5E-03	c	7.2E-03	c		3.8E-06	
Nitrosopyrrolidine, N-	930-55-2	2.1E+00	I	6.1E-04	I							1	0.1		2.3E-01	c	8.2E-01	c	4.0E-03	c	2.0E-02	c	3.2E-02	c		1.2E-05	
Nitrotoluene, m-	99-08-1					1.0E-04	X					1	0.1		6.1E+00	n	6.2E+01	n					3.7E+00	n		3.4E-03	
Nitrotoluene, o-	88-72-2	2.2E-01	P			9.0E-04	P			V		1		1.5E+03	2.9E+00	c*	1.3E+01	c*					3.1E-01	c		2.9E-04	
Nitrotoluene, p-	99-99-0	1.6E-02	P			4.0E-03	P					1	0.1		3.0E+01	c**	1.1E+02	c*					4.2E+00	c*		3.9E-03	
Nonane, n-	111-84-2					3.0E-04	X	2.0E-01	P	V				6.9E+00	2.1E+01	ns	2.3E+02	ns	2.1E+02	n	8.8E+02	n	1.1E+01	n		1.5E-01	
Norflurazon	27314-13-2					4.0E-02	I					1	0.1		2.4E+03	n	2.5E+04	n					1.5E+03	n		9.4E+00	
Nustar	85509-19-9					7.0E-04	I					1	0.1		4.3E+01	n	4.3E+02	n					2.6E+01	n		4.1E+00	
Octabromodiphenyl Ether	32536-52-0					3.0E-03	I					1	0.1		1.8E+02	n	1.8E+03	n					1.1E+02	n		2.2E+01	
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetra (HMX)	2691-41-0					5.0E-02	I					1	0.006		3.8E+03	n	4.9E+04	n					1.8E+03	n		2.3E+00	
Octamethylpyrophosphoramide	152-16-9					2.0E-03	H					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		1.8E-02	
Oryzalin	19044-88-3					5.0E-02	I					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		3.4E+00	
Oxadiazon	19666-30-9					5.0E-03	I					1	0.1		3.1E+02	n	3.1E+03	n					1.8E+02	n		1.9E+00	
Oxamyl	23135-22-0					2.5E-02	I					1	0.1		1.5E+03	n	1.5E+04	n					9.1E+02	n	2.0E+02	2.0E-01	4.4E-02
Paclobutrazol	76738-62-0					1.3E-02	I					1	0.1		7.9E+02	n	8.0E+03	n					4.7E+02	n		9.7E-01	
Paraquat Dichloride	1910-42-5					4.5E-03	I					1	0.1		2.7E+02	n	2.8E+03	n					1.6E+02	n		2.3E+00	
Parathion	56-38-2					6.0E-03	H					1	0.1		3.7E+02	n	3.7E+03	n					2.2E+02	n		1.1E+00	
Pebulate	1114-71-2					5.0E-02	H					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		1.5E+00	
Pendimethalin	40487-42-1					4.0E-02	I					1	0.1		2.4E+03	n	2.5E+04	n					1.5E+03	n		1.7E+01	
Pentabromodiphenyl Ether	32534-81-9					2.0E-03	I					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		3.2E+00	
Pentabromodiphenyl ether, 2,2',4,4',5- (BDE-99)	60348-60-9					1.0E-04	I								7.8E+00	n	1.0E+02	n					3.7E+00	n		1.6E-01	
Pentachlorobenzene	608-93-5					8.0E-04	I					1	0.1		4.9E+01	n	4.9E+02	n					2.9E+01	n		2.2E-01	
Pentachloroethane	76-01-7	9.0E-02	P									1	0.1		5.4E+00	c	1.9E+01	c					7.5E-01	c		3.6E-04	
Pentachloronitrobenzene	82-68-8	2.6E-01	H			3.0E-03	I					1	0.1		1.9E+00	c*	6.6E+00	c					2.6E-01	c		3.2E-03	
Pentachlorophenol	87-86-5	1.2E-01	I	5.1E-06	C	3.0E-02	I					1	0.25		3.0E+00	c	9.0E+00	c	4.8E-01	c	2.4E+00	c	5.6E-01	c	1.0E+00	5.7E-03	1.0E-02
Pentane, n-	109-66-0							1.0E+00	P	V				3.9E+02	8.7E+02	ns	3.7E+03	ns	1.0E+03	n	4.4E+03	n	2.1E+03	n		1.0E+01	
Perchlorate and Perchlorate Salts	14797-73-0					7.0E-04	I					1			5.5E+01	n	7.2E+02	n					2.6E+01	n	15 (F)		
Permethrin	52645-53-1					5.0E-02	I					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		4.3E+02	
Phenacetin	62-44-2	2.2E-03	C	6.3E-07	C							1	0.1		2.2E+02	c	7.8E+02	c	3.9E+00	c	1.9E+01	c	3.1E+01	c		8.6E-03	
Phenmedipham	13684-63-4					2.5E-01	I					1	0.1		1.5E+04	n	1.5E+05	nm					9.1E+03	n		4.9E+01	
Phenol	108-95-2					3.0E-01	I	2.0E-01	C			1	0.1		1.8E+04	n	1.8E+05	nm	2.1E+02	n	8.8E+02	n	1.1E+04	n		6.3E+00	
Phenylenediamine, m-	108-45-2					6.0E-03	I					1	0.1		3.7E+02	n	3.7E+03	n					2.2E+02	n		5.9E-02	
Phenylenediamine, o-	95-54-5	4.7E-02	H									1	0.1		1.0E+01	c	3.7E+01	c					1.4E+00	c		3.8E-04	
Phenylenediamine, p-	106-50-3					1.9E-01	H					1	0.1		1.2E+04	n	1.2E+05	nm					6.9E+03	n		1.9E+00	
Phenylphenol, 2-	90-43-7	1.9E-03	H									1	0.1		2.5E+02	c	8.9E+02	c					3.5E+01	c		4.7E-01	
Phorate	298-02-2					2.0E-04	H					1	0.1		1.2E+01	n	1.2E+02	n					7.3E+00	n		8.2E-03	
Phosgene	75-44-5							3.0E-04	I	V		1		1.6E+03	3.3E-01	n	1.4E+00	n	3.1E-01	n	1.3E+00	n					
Phosmet	732-11-6					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		1.6E-01	
Phosphine	7803-51-2					3.0E-04	I	3.0E-04	I			1			2.3E+01	n	3.1E+02	n	3.1E-01	n	1.3E+00	n	1.1E+01	n			
Phosphoric Acid	7664-38-2							1.0E-02	I			1			1.4E+07	nm	6.0E+07	nm	1.0E+01	n	4.4E+01	n					
Phosphorus, White	7723-14-0					2.0E-05	I					1			1.6E+00	n	2.0E+01	n					7.3E-01	n		2.7E-03	
Phthalic Acid, P-	100-21-0					1.0E+00	H					1	0.1		6.1E+04	n	6.2E+05	nm					3.7E+04	n		1.3E+01	
Phthalic Anhydride	85-44-9					2.0E+00	I	2.0E-02	C			1	0.1		1.2E+05	nm	1.2E+06	nm	2.1E+01	n	8.8E+01	n	7.3E+04	n		1.6E+01	
Picloram	1918-02-1					7.0E-02	I					1	0.1		4.3E+03	n	4.3E+04	n					2.6E+03	n	5.0E+02	7.1E-01	1.4E-01
Picramic Acid (2-Amino-4,6-dinitrophenol)	96-91-3					1.0E-04	X					1	0.1		6.1E+00	n	6.2E+01	n					3.7E+00	n		2.4E-03	
Pirimiphos, Methyl	29232-93-7					1.0E-02	I					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		3.5E-01	
Polybrominated Biphenyls	59536-65-1	3.0E+01	C	8.6E-03	C	7.0E-06	H					1	0.1		1.6E-02	c*	5.7E-02	c*	2.8E-04	c	1.4E-03	c	2.2E-03	c			
Polychlorinated Biphenyls (PCBs)																											
~Aroclor 1016	12674-11-2	7.0E-02	I	2.0E-05	I	7.0E-05	I					1	0.14		3.9E+00	n	2.1E+01	c**	1.2E-01	c	6.1E-01	c	9.6E-01	c**		9.2E-02	
~Aroclor 1221	11104-28-2	2.0E+00	I	5.7E-04	I					V		1	0.14	7.6E+02	1.4E-01	c	5.4E-01	c	4.3E-03	c	2.1E-02	c	6.8E-03	c		1.2E-04	
~Aroclor 1232	11141-16-5	2.0E+00	I	5.7E-04	I					V		1	0.14	7.3E+01	1.4E-01	c	5.4E-01	c	4.3E-03	c	2.1E-02	c	6.8E-03	c		1.2E-04	
~Aroclor 1242	53469-21-9	2.0E+00	I	5.7E-04	I							1	0.14		2.2E-01	c	7.4E-01	c	4.3E-03	c	2.1E-02	c	3.4E-02	c		5.3E-03	
~Aroclor 1248	12672-29-6	2.0E+00	I	5.7E-04	I							1	0.14		2.2E-01	c	7.4E-01	c	4.3E-03	c	2.1E-02	c	3.4E-02	c		5.2E-03	
~Aroclor 1254	11097-69-1	2.0E+00	I	5.7E-04	I	2.0E-05	I					1	0.14		2.2E-01	c**	7.4E-01	c*	4.3E-03	c	2.1E-02	c	3.4E-02	c*		8.8E-03	
~Aroclor 1260	11096-82-5	2.0E+00	I	5.7E-04	I							1	0.14		2.2E-01	c	7.4E-01	c	4.3E-03	c	2.1E-02	c	3.4E-02	c		2.4E-02	
~Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189)	39635-31-9	1.3E+01	C	3.8E-03	C							1	0.14		3.4E-02	c	1.1E-01	c	6.4E-04	c	3.2E-03	c	5.2E-03	c		3.6E-03	
~Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167)	52663-72-6	1.3E+00	C	3.8E-04	C							1	0.14		3.4E-01	c	1.1E+00	c	6.4E-03	c	3.2E-02	c	5.2E-02	c		2.2E-02	
~Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157)	69782-90-7	6.5E+01	C	1.9E-02	C							1	0.14		6.8E-03	c	2.3E-02	c	1.3E-04	c	6.5E-04	c	1.0E-03	c		4.4E-04	
~Hexachlorobiphenyl, 2,3,3',4,4',5- (PCB 156)	38380-08-4	6.5E+01	C	1.9E-02	C							1	0.14		6.8E-03	c	2.3E-02	c	1.3E-04	c	6.5E-04	c	1.0E-03	c		4.4E-04	
~Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169)	32774-16-6	1.3E+03	C	3.8E-01	C							1	0.14		3.4E-04	c	1.1E-03	c	6.4E-06	c	3.2E-05	c	5.2E-05	c		2.2E-05	
~Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123)	65510-44-3	1.3E+01	C	3.8E-03	C							1	0.14		3.4E-02	c	1.1E-01	c	6.4E-04	c	3.2E-03	c	5.2E-03	c		1.4E-03	
~Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118)	31508-00-6	1.3E+01	C	3.8E-03	C							1	0.14		3.4E-02	c	1.1E-01	c	6.4E-04	c	3.2E-03	c	5.2E-03	c		1.3E-03	
~Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105)	32598-14-4	1.3E+01	C	3.8E-03	C							1	0.14		3.4E-02	c	1.1E-01	c	6.4E-04	c	3.2E-03	c	5.2E-03	c		1.4E-03	
~Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114)	74472-37-0	6.5E+02	C	1.9E-02	C							1	0.14		6.8E-04	c	2.3E-03	c	1.3E-04	c	6.5E-04	c	1.0E-04	c		2.7E-05	
~Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126)	57465-28-8	1.3E+04	C	3.8E+00	C							1	0.14		3.4E-05	c	1.1E-04	c	6.4E-07	c	3.2E-06	c	5.2E-06	c		1.3E-06	
~Polychlorinated Biphenyls (high risk)	1336-36-3	2.0E+00	I	5.7E-04	C							1	0.14		2.2E-01	c	7.4E-01	c	4.3E-03	c	2.2E-02	c					
~Polychlorinated Biphenyls (low risk)	1336-36-3	4.0E-01	I	1.0E-04	I							1	0.14						2.4E-02	c	1.2E-01	c	1.7E-01	c	5.0E-01	2.6E-02	7.8E-02
~Polychlorinated Biphenyls (lowest risk)	1336-36-3	7.0E-02	I	2.0E-05	C							1	0.14						1.2E-01	c	6.1E-01	c					
~Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77)	32598-13-3	1.3E+01	C	3.8E-03	C							1	0.14		3.4E-02	c	1.1E-01	c	6.4E-04	c	3.2E-03	c	5.2E-03	c		8.1E-04	
~Tetrachlorobiphenyl, 3,4,4',5- (PCB 81)	70362-50-4	1.3E+01	C	3.8E-03	C							1	0.14		3.4E-02	c	1.1E-01	c	6.4E-04	c	3.2E-03	c	5.2E-03	c		8.1E-04	
Polymeric Methylene Diphenyl Diisocyanate (PMDI)	9016-87-9							6.0E-04	I			1	0.1		8.5E+05	nm	3.6E+06	nm	6.3E-01	n	2.6E+00	n					
Polynuclear Aromatic Hydrocarbons (PAHs)																											
~Acenaphthene	83-32-9					6.0E-02	I			V		1	0.13		3.4E+03	n	3.3E+04	n					2.2E+03	n		2.2E+01	
~Anthracene	120-12-7					3.0E-01	I			V		1	0.13		1.7E+04	n	1.7E+05	nm					1.1E+04	n		3.6E+02	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ #29; c = cancer, * = where: n SL < 100X c SL; ** = where n SL < 10 c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User's Guide); s = Concentration may exceed Csat (See User's Guide); SSL values are based on DAF=1

Contaminant		Toxicity and Chemical-specific Information												Screening Levels												Protection of Groundwater Soil	
		SFO	key	IUR	key	RfDo	key	RfCi	key	voc	muta-gen	GIABS	ABS	Csat	Residential Soil	key	Industrial Soil	key	Residential Air	key	Industrial Air	key	Tapwater	key	MCL	Risk-based SSL	MCL-based SSL
Analyte	CAS No.	(mg/kg-day)$^{-1}$		(ug/m^3)$^{-1}$		(mg/kg-day)		(mg/m^3)						mg/kg	mg/kg		mg/kg		ug/m^3		ug/m^3		ug/L		ug/L	mg/kg	mg/kg
~Benz[a]anthracene	56-55-3	7.3E-01	E	1.1E-04	C						M	1	0.13		1.5E-01	c	2.1E+00	c	8.7E-03	c	1.1E-01	c	2.9E-02	c		1.0E-02	
~Benzo(j)fluoranthene	205-82-3	1.2E+00	C	1.1E-04	C										5.3E-01	c	2.4E+00	c	2.2E-02	c	1.1E-01	c	5.6E-02	c		6.7E-02	
~Benzo[a]pyrene	50-32-8	7.3E+00	I	1.1E-03	C						M	1	0.13		1.5E-02	c	2.1E-01	c	8.7E-04	c	1.1E-02	c	2.9E-03	c	2.0E-01	3.5E-03	2.4E-01
~Benzo[b]fluoranthene	205-99-2	7.3E-01	E	1.1E-04	C						M	1	0.13		1.5E-01	c	2.1E+00	c	8.7E-03	c	1.1E-01	c	2.9E-02	c		3.5E-02	
~Benzo[k]fluoranthene	207-08-9	7.3E-02	E	1.1E-04	C						M	1	0.13		1.5E+00	c	2.1E+01	c	8.7E-03	c	1.1E-01	c	2.9E-01	c		3.5E-01	
~Chrysene	218-01-9	7.3E-03	E	1.1E-05	C						M	1	0.13		1.5E+01	c	2.1E+02	c	8.7E-02	c	1.1E+00	c	2.9E+00	c		1.1E+00	
~Dibenz[a,h]anthracene	53-70-3	7.3E+00	E	1.2E-03	C						M	1	0.13		1.5E-02	c	2.1E-01	c	8.0E-04	c	1.0E-02	c	2.9E-03	c		1.1E-02	
~Dibenzo(a,e)pyrene	192-65-4	1.2E+01	C	1.1E-03	C										5.3E-02	c	2.4E-01	c	2.2E-03	c	1.1E-02	c	5.6E-03	c		7.3E-02	
~Dimethylbenz(a)anthracene, 7,12-	57-97-6	2.5E+02	C	7.1E-02	C							1	0.13		1.8E-03	c	6.2E-03	c	3.4E-05	c	1.7E-04	c	2.7E-04	c		2.7E-04	
~Fluoranthene	206-44-0					4.0E-02	I					1	0.13		2.3E+03	n	2.2E+04	n					1.5E+03	n		1.6E+02	
~Fluorene	86-73-7					4.0E-02	I			V		1	0.13		2.3E+03	n	2.2E+04	n					1.5E+03	n		2.7E+01	
~Indeno[1,2,3-cd]pyrene	193-39-5	7.3E-01	E	1.1E-04	C						M	1	0.13		1.5E-01	c	2.1E+00	c	8.7E-03	c	1.1E-01	c	2.9E-02	c		1.2E-01	
~Methylnaphthalene, 1-	90-12-0	2.9E-02	P			7.0E-02	A			V		1		3.9E+02	2.2E+01	c	9.9E+01	c					2.3E+00	c		1.2E-02	
~Methylnaphthalene, 2-	91-57-6					4.0E-03	I			V		1		3.7E+02	3.1E+02	n	4.1E+03	ns					1.5E+02	n		7.5E-01	
~Naphthalene	91-20-3			3.4E-05	C	2.0E-02	I	3.0E-03	I	V		1	0.13		3.6E+00	c*	1.8E+01	c*	7.2E-02	c*	3.6E-01	c*	1.4E-01	c*		4.7E-04	
~Nitropyrene, 4-	57835-92-4	1.2E+00	C	1.1E-04	C										5.3E-01	c	2.4E+00	c	2.2E-02	c	1.1E-01	c	5.6E-02	c		9.7E-03	
~Pyrene	129-00-0					3.0E-02	I			V		1	0.13		1.7E+03	n	1.7E+04	n					1.1E+03	n		1.2E+02	
Potassium Perchlorate	7778-74-7					7.0E-04	I					1			5.5E+01	n	7.2E+02	n					2.6E+01	n			
Prochloraz	67747-09-5	1.5E-01	I			9.0E-03	I					1	0.1		3.2E+00	c	1.1E+01	c					4.5E-01	c		2.3E-03	
Profluralin	26399-36-0					6.0E-03	H					1	0.1		3.7E+02	n	3.7E+03	n					2.2E+02	n		1.3E+01	
Prometon	1610-18-0					1.5E-02	I					1	0.1		9.2E+02	n	9.2E+03	n					5.5E+02	n		2.6E-01	
Prometryn	7287-19-6					4.0E-03	I					1	0.1		2.4E+02	n	2.5E+03	n					1.5E+02	n		2.2E-01	
Propachlor	1918-16-7					1.3E-02	I					1	0.1		7.9E+02	n	8.0E+03	n					4.7E+02	n		2.9E-01	
Propanil	709-98-8					5.0E-03	I					1	0.1		3.1E+02	n	3.1E+03	n					1.8E+02	n		1.0E-01	
Propargite	2312-35-8					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		5.4E+01	
Propargyl Alcohol	107-19-7					2.0E-03	I					1	0.1		1.2E+02	n	1.2E+03	n					7.3E+01	n		1.5E-02	
Propazine	139-40-2					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		6.5E-01	
Propham	122-42-9					2.0E-02	I					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		4.7E-01	
Propiconazole	60207-90-1					1.3E-02	I					1	0.1		7.9E+02	n	8.0E+03	n					4.7E+02	n		1.6E+00	
Propionaldehyde	123-38-6							8.0E-03	I	V				3.3E+04	8.0E+01	n	3.4E+02	n	8.3E+00	n	3.5E+01	n	1.7E+01	n		3.4E-03	
Propyl benzene	103-65-1					1.0E-01	X	1.0E+00	X	V		1	0.1	2.6E+02	3.4E+03	ns	2.1E+04	ns	1.0E+03	n	4.4E+03	n	1.3E+03	n		2.5E+00	
Propylene	115-07-1							3.0E+00	C						4.3E+09	nm	1.8E+10	nm	3.1E+03	n	1.3E+04	n					
Propylene Glycol	57-55-6					2.0E+01	P					1	0.1		1.2E+06	nm	1.2E+07	nm					7.3E+05	n		1.5E+02	
Propylene Glycol Dinitrate	6423-43-4							2.7E-04	A	V		1		1.5E+03	5.7E+01	n	2.4E+02	n	2.8E-01	n	1.2E+00	n	5.7E-01	n		1.8E-04	
Propylene Glycol Monoethyl Ether	1569-02-4					7.0E-01	H					1	0.1		4.3E+04	n	4.3E+05	nm					2.6E+04	n		5.2E+00	
Propylene Glycol Monomethyl Ether	107-98-2					7.0E-01	H	2.0E+00	I			1	0.1		4.3E+04	n	4.3E+05	nm	2.1E+03	n	8.8E+03	n	2.6E+04	n		5.2E+00	
Propylene Oxide	75-56-9	2.4E-01	I	3.7E-06	I			3.0E-02	I	V		1		7.8E+04	1.9E+00	c	8.8E+00	c	6.6E-01	c*	3.3E+00	c*	2.3E-01	c		4.9E-05	
Pursuit	81335-77-5					2.5E-01	I					1	0.1		1.5E+04	n	1.5E+05	nm					9.1E+03	n		8.0E+00	
Pydrin	51630-58-1					2.5E-02	I					1	0.1		1.5E+03	n	1.5E+04	n					9.1E+02	n		5.8E+02	
Pyridine	110-86-1					1.0E-03	I			V		1		5.3E+05	7.8E+01	n	1.0E+03	n					3.7E+01	n		1.3E-02	
Quinalphos	13593-03-8					5.0E-04	I					1	0.1		3.1E+01	n	3.1E+02	n					1.8E+01	n		1.6E-01	
Quinoline	91-22-5	3.0E+00	I									1	0.1		1.6E-01	c	5.7E-01	c					2.2E-02	c		7.4E-05	
Refractory Ceramic Fibers	NA							3.0E-02	A			1			4.3E+07	nm	1.8E+08	nm	3.1E+01	n	1.3E+02	n					
Resmethrin	10453-86-8					3.0E-02	I					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n		6.8E+02	
Ronnel	299-84-3					5.0E-02	H					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		1.7E+01	
Rotenone	83-79-4					4.0E-03	I					1	0.1		2.4E+02	n	2.5E+03	n					1.5E+02	n		7.6E+01	
Safrole	94-59-7	2.2E-01	C	6.3E-05	C							1	0.1		2.2E+00	c	7.8E+00	c	3.9E-02	c	1.9E-01	c	3.1E-01	c		1.9E-04	
Savey	78587-05-0					2.5E-02	I					1	0.1		1.5E+03	n	1.5E+04	n					9.1E+02	n		4.1E+00	
Selenious Acid	7783-00-8					5.0E-03	I					1			3.9E+02	n	5.1E+03	n					1.8E+02	n			
Selenium	7782-49-2					5.0E-03	I	2.0E-02	C			1			3.9E+02	n	5.1E+03	n	2.1E+01	n	8.8E+01	n	1.8E+02	n	5.0E+01	9.5E-01	2.6E-01
Selenium Sulfide	7446-34-6					5.0E-03	C	2.0E-02	C			1			3.9E+02	n	5.1E+03	n	2.1E+01	n	8.8E+01	n	1.8E+02	n			
Sethoxydim	74051-80-2					9.0E-02	I					1	0.1		5.5E+03	n	5.5E+04	n					3.3E+03	n		2.9E+01	
Silica (crystalline, respirable)	7631-86-9							3.0E-03	C						4.3E+06	nm	1.8E+07	nm	3.1E+00	n	1.3E+01	n					
Silver	7440-22-4					5.0E-03	I					0.04			3.9E+02	n	5.1E+03	n					1.8E+02	n		1.6E+00	
Simazine	122-34-9	1.2E-01	H			5.0E-03	I					1	0.1		4.0E+00	c*	1.4E+01	c					5.6E-01	c	4.0E+00	2.8E-04	2.0E-03
Sodium Acifluorfen	62476-59-9					1.3E-02	I					1	0.1		7.9E+02	n	8.0E+03	n					4.7E+02	n		3.8E+00	
Sodium Azide	26628-22-8					4.0E-03	I					1			3.1E+02	n	4.1E+03	n					1.5E+02	n			
Sodium Diethyldithiocarbamate	148-18-5	2.7E-01	H			3.0E-02	I					1	0.1		1.8E+00	c	6.4E+00	c					2.5E-01	c			
Sodium Fluoride	7681-49-4					5.0E-02	A	1.3E-02	C			1			3.9E+03	n	5.1E+04	n	1.4E+01	n	5.7E+01	n	1.8E+03	n			
Sodium Fluoroacetate	62-74-8					2.0E-05	I					1	0.1		1.2E+00	n	1.2E+01	n					7.3E-01	n		1.5E-04	
Sodium Metavanadate	13718-26-8					1.0E-03	H					1			7.8E+01	n	1.0E+03	n					3.7E+01	n			
Sodium Perchlorate	7601-89-0					7.0E-04	I					1			5.5E+01	n	7.2E+02	n					2.6E+01	n			
Stirofos (Tetrachlorovinphos)	961-11-5	2.4E-02	H			3.0E-02	I					1	0.1		2.0E+01	c*	7.2E+01	c					2.8E+00	c		8.3E-03	
Strontium, Stable	7440-24-6					6.0E-01	I					1			4.7E+04	n	6.1E+05	nm					2.2E+04	n		7.7E+02	
Strychnine	57-24-9					3.0E-04	I					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n		1.2E-01	
Styrene	100-42-5					2.0E-01	I	1.0E+00	I	V		1		8.7E+02	6.3E+03	ns	3.6E+04	ns	1.0E+03	n	4.4E+03	n	1.6E+03	n	1.0E+02	1.8E+00	1.1E-01
Sulfonylbis(4-chlorobenzene), 1,1'-	80-07-9					8.0E-04	P					1	0.1		4.9E+01	n	4.9E+02	n					2.9E+01	n		1.7E-01	
Sulfuric Acid	7664-93-9							1.0E-03	C						1.4E+06	nm	6.0E+06	nm	1.0E+00	n	4.4E+00	n					
Systhane	88671-89-0					2.5E-02	I					1	0.1		1.5E+03	n	1.5E+04	n					9.1E+02	n		1.1E+01	
TCMTB	21564-17-0					3.0E-02	H					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n		7.6E+00	
Tebuthiuron	34014-18-1					7.0E-02	I					1	0.1		4.3E+03	n	4.3E+04	n					2.6E+03	n		7.3E-01	
Temephos	3383-96-8					2.0E-02	H					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		1.4E+02	
Terbacil	5902-51-2					1.3E-02	I					1	0.1		7.9E+02	n	8.0E+03	n					4.7E+02	n		1.4E-01	
Terbufos	13071-79-9					2.5E-05	H					1	0.1		1.5E+00	n	1.5E+01	n					9.1E-01	n		2.0E-03	
Terbutryn	886-50-0					1.0E-03	I					1	0.1		6.1E+01	n	6.2E+02	n					3.7E+01	n		5.2E-02	
Tetrabromodiphenyl ether, 2,2',4,4'- (BDE-47)	5436-43-1					1.0E-04	I								7.8E+00	n	1.0E+02	n					3.7E+00	n		9.7E-02	
Tetrachlorobenzene, 1,2,4,5-	95-94-3					3.0E-04	I					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n		5.1E-02	
Tetrachloroethane, 1,1,1,2-	630-20-6	2.6E-02	I	7.4E-06	I	3.0E-02	I			V		1		6.8E+02	1.9E+00	c	9.3E+00	c	3.3E-01	c	1.7E+00	c	5.2E-01	c		2.0E-04	
Tetrachloroethane, 1,1,2,2-	79-34-5	2.0E-01	I	5.8E-05	I	4.0E-03	P			V		1		1.9E+03	5.6E-01	c	2.8E+00	c	4.2E-02	c	2.1E-01	c	6.7E-02	c		2.6E-05	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = PPRTV Appendix; H = HEAST; J = New Jersey; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; F = See FAQ #29; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10 c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User's Guide); s = Concentration may exceed Csat (See User's Guide); SSL values are based on DAF=1

Contaminant		Toxicity and Chemical-specific Information												Screening Levels												Protection of Groundwater Soil	
		SFO	key	IUR	key	RfDo	key	RfCi	key	voc	muta-gen	GIABS	ABS	Csat	Residential Soil	key	Industrial Soil	key	Residential Air	key	Industrial Air	key	Tapwater	key	MCL	Risk-based SSL	MCL-based SSL
Analyte	CAS No.	(mg/kg-day)$^{-1}$		(ug/m^3)$^{-1}$		(mg/kg-day)		(mg/m^3)						mg/kg	mg/kg		mg/kg		ug/m^3		ug/m^3		ug/L		ug/L	mg/kg	mg/kg
Tetrachloroethylene	127-18-4	5.4E-01	C	5.9E-06	C	1.0E-02	I	2.7E-01	A	V		1		1.7E+02	5.5E-01	c	2.6E+00	c	4.1E-01	c	2.1E+00	c	1.1E-01	c	5.0E+00	4.9E-05	2.3E-03
Tetrachlorophenol, 2,3,4,6-	58-90-2					3.0E-02	I					1	0.1		1.8E+03	n	1.8E+04	n					1.1E+03	n		6.7E+00	
Tetrachlorotoluene, p- alpha, alpha, alpha-	5216-25-1	2.0E+01	H									1	0.1		2.4E-02	c	8.6E-02	c					3.4E-03	c		1.1E-05	
Tetraethyl Dithiopyrophosphate	3689-24-5					5.0E-04	I					1	0.1		3.1E+01	n	3.1E+02	n					1.8E+01	n		1.3E-02	
Tetrafluoroethane, 1,1,1,2-	811-97-2							8.0E+01	I	V		1		1.1E+03	1.1E+05	nms	4.6E+05	nms	8.3E+04	n	3.5E+05	n	1.7E+05	n		9.3E+01	
Tetryl (Trinitrophenylmethylnitramine)	479-45-8					4.0E-03	P					1	0.1		2.4E+02	n	2.5E+03	n					1.5E+02	n		1.4E+00	
Thallium (Soluble Salts)	7440-28-0											1													2.0E+00		1.4E-01
Thiobencarb	28249-77-6					1.0E-02	I					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		1.3E+00	
Thiodiglycol	111-48-8					7.0E-02	X					1	0.008		5.4E+03	n	6.8E+04	n					2.6E+03	n		5.2E-01	
Thiofanox	39196-18-4					3.0E-04	H					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n		3.8E-03	
Thiophanate, Methyl	23564-05-8					8.0E-02	I					1	0.1		4.9E+03	n	4.9E+04	n					2.9E+03	n		2.5E+00	
Thiram	137-26-8					5.0E-03	I					1	0.1		3.1E+02	n	3.1E+03	n					1.8E+02	n		2.6E-01	
Tin	7440-31-5					6.0E-01	H					1			4.7E+04	n	6.1E+05	nm					2.2E+04	n		5.5E+03	
Titanium Tetrachloride	7550-45-0							1.0E-04	A			1			1.4E+05	nm	6.0E+05	nm	1.0E-01	n	4.4E-01	n					
Toluene	108-88-3					8.0E-02	I	5.0E+00	I	V		1		8.2E+02	5.0E+03	ns	4.5E+04	ns	5.2E+03	n	2.2E+04	n	2.3E+03	n	1.0E+03	1.6E+00	6.9E-01
Toluidine, p-	106-49-0	1.9E-01	H									1	0.1		2.6E+00	c	9.1E+00	c					3.5E-01	c		1.5E-04	
Toxaphene	8001-35-2	1.1E+00	I	3.2E-04	I							1	0.1		4.4E-01	c	1.6E+00	c	7.6E-03	c	3.8E-02	c	6.1E-02	c	3.0E+00	9.4E-03	4.6E-01
Tralomethrin	66841-25-6					7.5E-03	I					1	0.1		4.6E+02	n	4.6E+03	n					2.7E+02	n		1.0E+02	
Tri-n-butyltin	688-73-3					3.0E-04	A					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n		2.4E-01	
Trialllate	2303-17-5					1.3E-02	I					1	0.1		7.9E+02	n	8.0E+03	n					4.7E+02	n		1.1E+00	
Triasulfuron	82097-50-5					1.0E-02	I					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		3.8E-01	
Tribromobenzene, 1,2,4-	615-54-3					5.0E-03	I					1	0.1		3.1E+02	n	3.1E+03	n					1.8E+02	n		2.6E-01	
Tributyl Phosphate	126-73-8	9.2E-03	P			2.0E-01	P					1	0.1		5.3E+01	c	1.9E+02	c					7.3E+00	c		3.6E-02	
Tributyltin Compounds	NA					3.0E-04	P					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n			
Tributyltin Oxide	56-35-9					3.0E-04	I					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n		5.7E+02	
Trichloro-1,2,2-trifluoroethane, 1,1,2-	76-13-1					3.0E+01	I	3.0E+01	H	V		1		9.1E+02	4.3E+04	ns	1.8E+05	nms	3.1E+04	n	1.3E+05	n	5.9E+04	n		1.5E+02	
Trichloroaniline HCl, 2,4,6-	33663-50-2	2.9E-02	H									1	0.1		1.7E+01	c	5.9E+01	c					2.3E+00	c		6.4E-03	
Trichloroaniline, 2,4,6-	634-93-5	3.4E-02	H									1	0.1		1.4E+01	c	5.1E+01	c					2.0E+00	c		1.8E-02	
Trichlorobenzene, 1,2,3-	87-61-6					8.0E-04	X			V		1	0.1	1.5E+02	4.9E+01	n	4.9E+02	ns					2.9E+01	n		8.7E-02	
Trichlorobenzene, 1,2,4-	120-82-1	2.9E-02	P			1.0E-02	I	2.0E-03	P	V		1		4.0E+02	2.2E+01	c**	9.9E+01	c**	2.1E+00	n	8.8E+00	n	2.3E+00	c**	7.0E+01	6.8E-03	2.0E-01
Trichloroethane, 1,1,1-	71-55-6					2.0E+00	I	5.0E+00	I	V		1		6.4E+02	8.7E+03	ns	3.8E+04	ns	5.2E+03	n	2.2E+04	n	9.1E+03	n	2.0E+02	3.2E+00	7.0E-02
Trichloroethane, 1,1,2-	79-00-5	5.7E-02	I	1.6E-05	I	4.0E-03	I			V		1		2.2E+03	1.1E+00	c	5.3E+00	c	1.5E-01	c	7.7E-01	c	2.4E-01	c	5.0E+00	7.8E-05	1.6E-03
Trichloroethylene	79-01-6	5.9E-03	C	2.0E-06	C					V		1		6.9E+02	2.8E+00	c	1.4E+01	c	1.2E+00	c	6.1E+00	c	2.0E+00	c	5.0E+00	7.2E-04	1.8E-03
Trichlorofluoromethane	75-69-4					3.0E-01	I	7.0E-01	H	V		1		1.2E+03	7.9E+02	n	3.4E+03	ns	7.3E+02	n	3.1E+03	n	1.3E+03	n		8.3E-01	
Trichlorophenol, 2,4,5-	95-95-4					1.0E-01	I					1	0.1		6.1E+03	n	6.2E+04	n					3.7E+03	n		1.4E+01	
Trichlorophenol, 2,4,6-	88-06-2	1.1E-02	I	3.1E-06	I	1.0E-03	P					1	0.1		4.4E+01	c**	1.6E+02	c**	7.8E-01	c	4.0E+00	c	6.1E+00	c**		2.3E-02	
Trichlorophenoxyacetic Acid, 2,4,5-	93-76-5					1.0E-02	I					1	0.1		6.1E+02	n	6.2E+03	n					3.7E+02	n		1.5E-01	
Trichlorophenoxypropionic acid, -2,4,5	93-72-1					8.0E-03	I					1	0.1		4.9E+02	n	4.9E+03	n					2.9E+02	n	5.0E+01	1.6E-01	2.8E-02
Trichloropropane, 1,1,2-	598-77-6					5.0E-03	I			V		1		1.3E+03	3.9E+02	n	5.1E+03	ns					1.8E+02	n		7.1E-02	
Trichloropropane, 1,2,3-	96-18-4	3.0E+01	I			4.0E-03	I	3.0E-04	I	V	M	1		1.4E+03	5.0E-03	c	9.5E-02	c	3.1E-01	n	1.3E+00	n	7.2E-04	c		3.1E-07	
Trichloropropene, 1,2,3-	96-19-5					3.0E-03	X	3.0E-04	P	V		1		4.5E+02	7.8E-01	n	3.3E+00	n	3.1E-01	n	1.3E+00	n	6.2E-01	n		3.1E-04	
Tridiphane	58138-08-2					3.0E-03	I					1	0.1		1.8E+02	n	1.8E+03	n					1.1E+02	n		7.8E-01	
Triethylamine	121-44-8							7.0E-03	I	V		1		2.8E+04	1.2E+02	n	5.2E+02	n	7.3E+00	n	3.1E+01	n	1.5E+01	n		4.4E-03	
Trifluralin	1582-09-8	7.7E-03	I			7.5E-03	I					1	0.1		6.3E+01	c**	2.2E+02	c*					8.7E+00	c*		2.9E-01	
Trimethyl Phosphate	512-56-1	3.7E-02	H									1	0.1		1.3E+01	c	4.7E+01	c					1.8E+00	c		4.0E-04	
Trimethylbenzene, 1,2,4-	95-63-6							7.0E-03	P	V		1		2.2E+02	6.2E+01	n	2.6E+02	ns	7.3E+00	n	3.1E+01	n	1.5E+01	n		2.1E-02	
Trimethylbenzene, 1,3,5-	108-67-8					1.0E-02	X			V		1		1.8E+02	7.8E+02	ns	1.0E+04	ns					3.7E+02	n		5.2E-01	
Trinitrobenzene, 1,3,5-	99-35-4					3.0E-02	I					1	0.019		2.2E+03	n	2.7E+04	n					1.1E+03	n		3.9E+00	
Trinitrotoluene, 2,4,6-	118-96-7	3.0E-02	I			5.0E-04	I					1	0.032		1.9E+01	c**	7.9E+01	c**					2.2E+00	c**		1.3E-02	
Triphenylphosphine Oxide	791-28-6					2.0E-02	P					1	0.1		1.2E+03	n	1.2E+04	n					7.3E+02	n		3.0E+00	
Tris(2-chloroethyl)phosphate	115-96-8	2.0E-02	P			7.0E-03	P					1	0.1		2.4E+01	c*	8.6E+01	c*					3.4E+00	c*		3.3E-03	
Tris(2-ethylhexyl)phosphate	78-42-2	3.2E-03	P			1.0E-01	P					1	0.1		1.5E+02	c*	5.4E+02	c					2.1E+01	c		1.0E+02	
Uranium (Soluble Salts)	NA					3.0E-03	I	3.0E-04	A			1			2.3E+02	n	3.1E+03	n	3.1E-01	n	1.3E+00	n	1.1E+02	n		4.9E+01	
Urethane	51-79-6	1.0E+00	C	2.9E-04	C										6.4E-01	c	2.9E+00	c	8.4E-03	c	4.2E-02	c	6.7E-02	c		1.5E-05	
Vanadium Pentoxide	1314-62-1			8.3E-03	P	9.0E-03	I	7.0E-06	P			0.026			4.0E+02	c**	2.0E+03	c**	2.9E-04	c*	1.5E-03	c*	3.3E+02	n			
Vanadium Sulfate	36907-42-3					2.0E-02	H					0.026			1.6E+03	n	2.0E+04	n					7.3E+02	n			
Vanadium and Compounds	NA					5.0E-03	S					1			3.9E+02	n	5.2E+03	n					1.8E+02	n		1.8E+02	
Vanadium, Metallic	7440-62-2					7.0E-05	P					0.026			5.5E+00	n	7.2E+01	n					2.6E+00	n		2.6E+00	
Vernolate	1929-77-7					1.0E-03	I					1	0.1		6.1E+01	n	6.2E+02	n					3.7E+01	n		2.9E-02	
Vinclozolin	50471-44-8					2.5E-02	I					1	0.1		1.5E+03	n	1.5E+04	n					9.1E+02	n		7.0E-01	
Vinyl Acetate	108-05-4					1.0E+00	H	2.0E-01	I	V		1		2.8E+03	9.7E+02	n	4.1E+03	ns	2.1E+02	n	8.8E+02	n	4.1E+02	n		8.8E-02	
Vinyl Bromide	593-60-2			3.2E-05	H			3.0E-03	I	V		1		3.4E+03	1.1E-01	c*	5.6E-01	c*	7.6E-02	c*	3.8E-01	c*	1.5E-01	c*		4.4E-05	
Vinyl Chloride	75-01-4	7.2E-01	I	4.4E-06	I	3.0E-03	I	1.0E-01	I	V	M	1		3.9E+03	6.0E-02	c	1.7E+00	c	1.6E-01	c	2.8E+00	c	1.6E-02	c	2.0E+00	5.6E-06	6.9E-04
Warfarin	81-81-2					3.0E-04	I					1	0.1		1.8E+01	n	1.8E+02	n					1.1E+01	n		1.2E-02	
Xylene, Mixture	1330-20-7					2.0E-01	I	1.0E-01	I	V		1		2.6E+02	6.3E+02	ns	2.7E+03	ns	1.0E+02	n	4.4E+02	n	2.0E+02	n	1.0E+04	2.0E-01	9.8E+00
Xylene, P-	106-42-3					2.0E-01	I	7.0E-01	C	V		1		3.9E+02	3.4E+03	ns	1.7E+04	ns	7.3E+02	n	3.1E+03	n	1.2E+03	n		1.2E+00	
Xylene, m-	108-38-3					2.0E-01	I	7.0E-01	C	V		1		3.9E+02	3.4E+03	ns	1.7E+04	ns	7.3E+02	n	3.1E+03	n	1.2E+03	n		1.2E+00	
Xylene, o-	95-47-6					2.0E-01	I	7.0E-01	C	V		1		4.3E+02	3.8E+03	ns	1.9E+04	ns	7.3E+02	n	3.1E+03	n	1.2E+03	n		1.2E+00	
Zinc (Metallic)	7440-66-6					3.0E-01	I					1			2.3E+04	n	3.1E+05	nm					1.1E+04	n		6.8E+02	
Zinc Phosphide	1314-84-7					3.0E-04	I					1			2.3E+01	n	3.1E+02	n					1.1E+01	n			
Zineb	12122-67-7					5.0E-02	I					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		5.3E+00	
Xylene, Mixture	1330-20-7					2.0E-01	I	1.0E-01	I	V		1		2.6E+02	6.3E+02	ns	2.7E+03	ns	1.0E+02	n	4.4E+02	n	2.0E+02	n	1.0E+04	2.0E-01	9.8E+00
Xylene, P-	106-42-3					2.0E-01	I	7.0E-01	C	V		1		3.9E+02	3.4E+03	ns	1.7E+04	ns	7.3E+02	n	3.1E+03	n	1.2E+03	n		1.2E+00	
Xylene, m-	108-38-3					2.0E-01	I	7.0E-01	C	V		1		3.9E+02	3.4E+03	ns	1.7E+04	ns	7.3E+02	n	3.1E+03	n	1.2E+03	n		1.2E+00	
Xylene, o-	95-47-6					2.0E-01	I	7.0E-01	C	V		1		4.3E+02	3.8E+03	ns	1.9E+04	ns	7.3E+02	n	3.1E+03	n	1.2E+03	n		1.2E+00	
Zinc (Metallic)	7440-66-6					3.0E-01	I					1			2.3E+04	n	3.1E+05	nm					1.1E+04	n		6.8E+02	
Zinc Phosphide	1314-84-7					3.0E-04	I					1			2.3E+01	n	3.1E+02	n					1.1E+01	n			
Zineb	12122-67-7					5.0E-02	I					1	0.1		3.1E+03	n	3.1E+04	n					1.8E+03	n		5.3E+00	

Section J.0

J.0 SOLID WASTE MANAGEMENT UNITS

The information provided in this section is submitted in accordance with the applicable requirements of 20 NMAC 4.1 subpart IX, §270.14(d). The solid waste management units (SWMUs) identified at the Gallup Refinery (Ciniza) are listed in the *Ciniza Hazardous Waste Permit NMD000333211-2 (EPA 1988).*

The Gallup Refinery uses the definition of a SWMU presented in 50 Federal Register (FR) 278702. This definition states that a SWMU is "any unit at the facility from which hazardous constituents might migrate, irrespective of whether the unit was intended for the management of solid and/or hazardous wastes. "Applying the definition to units at Gallup Refinery, the following have the potential to be considered SWMUs:

- Container storage units
- Tanks
- Surface impoundments
- Waste piles
- Land treatment units
- Landfills
- Incinerators
- Underground injection wells
- Physical, chemical and biological treatment units
- Recycling units
- Areas contaminated by routine and systematic discharges from process areas.

In August 1987, a RCRA Facility Assessment (RFA) was conducted at Ciniza that identified 17 SWMUs and 10 units of concern requiring investigation as sources of suspected releases of hazardous material to the environment. From the original 27 SWMUs identified in the Resource Conservation Recovery Act Facility Assessment (RFA), EPA identified and designated 13 SWMUs in the HSWA permit. The Aeration Basin, not previously classified as either a SWMU or unit of concern, was added to the list in the HSWA permit as (i) Aeration Basin resulting in 14 SWMUs. In 1990, in response to permit requirements, Gallup Refinery conducted a release

verification and source characterization study and developed a site specific Resource Conservation Act Facility Investigation (RFI) Work Plan. In the RFI Work Plan, the 14 SWMUs were reduced to 13 because the Inactive Land Treatment Area and the Drainage Ditch were combined to become SWMU No. 9, the Drainage Ditch near the Inactive Land Treatment Area.

The Gallup Refinery (Ciniza) SWMU numbering system differs in the various Ciniza and EPA reference documents related to SWMUs. The 1998 HSWA permit lists each SWMU preceded by a lowercase roman numeral reflects the document numbering format, not SWMU identification number. The 1990 RFI Work Plan provides the first SWMU numbering system for the 14 SWMUs. EPA letters, 1994, refer to both the RFI Work Plan numbering system and to Arabic numbers assigned to the roman numerals used in the HSWA permit as a format numbering system. On August 17, 2000, the NMED issued a Post-Closure Care Permit ("Permit") to the former owner, Giant Refining Company. The Permit authorized the post-closure care at the hazardous waste land treatment unit and also includes corrective action provisions. The API Separator was not originally included as a SWMU in the 1988 Hazardous and Solid Waste Act (HSWA) permit or the subsequent 1990 RFI Work Plan. The "API Separator" was first added as SWMU-14 in the August 2000 Post-Closure Care Permit. Table J-2 provides a crosswalk between the SWMU numbers designated in the various reference documents. This Part B closure permit application uses the SWMU numbering system from the RFI 2000 Post-closure Care Permit.

Between November 1990, and October 1992, Ciniza prepared three RFI reports covering the original 14 SWMUs (i.e. before SWMU-9 and SWMU-14 were combined, and a new SWMU-14 added) and submitted them to the EPA for review and comment. Based on the nature and extent of contamination detected during the RFI, 10 of the SWMUs were recommended for no further action. The four remaining SWMUs were recommended for corrective action. Voluntary Corrective Action Plans (VCAPs) were prepared for these four SWMUs and submitted to EPA for review. The following sections describe the activities conducted during the RFIs and corrective actions conducted, as required. Table J-1 provides the SWMU number, SWMU title, and current status of the Gallup Refinery SWMUs; Figure J-14 depicts the 14 current SWMUs on the survey plat; and Volume III of this Part B post closure application provides SWMU Summary Reports as Appendices I-1 thru I-14.

J.1 SWMU No. 1 Aeration Basin

SWMU No. 1 (Figure J-1) consists of three cells located west of the tank farm. The three cells include two aeration lagoons and evaporation pond 1. The aeration basins site was identified as a SWMU, and designated as SWMU No. 1 during a RFI conducted at the refinery in the early 1990's. Soil samples were collected on the perimeter of the site and analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals. Based on soil sample results, Ciniza recommended NFA for SWMU No.1 EPA formerly agreed with this finding (Attachment J-1); however, EPA required periodic soil sample collection around the aeration basin every five years. Ciniza submitted a survey plat of the site to EPA in 1995. Ciniza conducted the first sampling even in October 1996, and submitted results the New Mexico Oil Conservation Division (NMOCD) in their Quarterly Progress Report for fourth quarter 1996. *The Aeration Basin – SWMU No. 1 Summary* is included in Appendix I-1.

Two wells (GMW-1 and GWM-2) located along the down-gradient side of the aeration lagoons have been installed. Analyses of ground water samples collected at GWM-1 and GWM-2 have indicated low concentrations of constituents such as benzene that would indicate a potential for historical releases in the area.

A Corrective Measures Implementation Work Plan was recently submitted to the NMED for SWMU No. 1 Wastewater Aeration Lagoons, which includes a Scope of Work to conduct an investigation of environmental media around the aeration lagoons and the benzene strippers.

J.2 SWMU No. 2, Evaporation Ponds

SWMU No. 2 (Figure J-2) consists of a series of evaporation ponds located west and northwest of the tank farm. The evaporation pond area was identified as a SWMU, and designated as SWMU No. 2 during a RFI conducted at the refinery in the early 1990's. This investigation included both soil and groundwater sampling and analysis. Samples were collected around the perimeter of the ponds and were sampled for VOCs, SVOCs, and metals. Ciniza recommended NFA for this SWMU and EPA formally approved the finding of NFA on January 7, 1994 (Attachment O-1); however, EPA requested follow up groundwater sampling from the seven groundwater wells surrounding the evaporation ponds every five years, with analysis identical to

that required in the RFI. Ciniza initiated the five-year sampling schedule in 1996. The survey plat, as required, was submitted to EPA in 1995. *The Evaporation Ponds – SWMU No. 2 Summary* is included as Appendix I-2.

J.3 SWMU No. 3, Empty Container Storage Area

SWMU No. 3 (Figure J-3) consists of the empty container storage area, which was located behind the maintenance buildings. The area was used for storing empty drums awaiting recycling. The empty container storage area was identified as a SWMU, and designated as SWMU No. 3, during the RFI conducted at the refinery in the early 1990's. The investigation focused on soil sampling and analysis. Soil borings were drilled to a depth of 4.5 feet, within the perimeter of the empty container storage area. Samples were collected from each boring in accordance with procedures specified in the Ciniza Sampling and Analysis Plan. Samples were analyzed for priority VOCs using the EPA-approved methods.

Ciniza recommended NFA for this SWMU and EPA formally approved the finding of the NFA on January 7, 1994 (Attachment J-1). The survey plat as required was submitted to EPA in 1995. *The Empty Container Storage – SWMU No. 3 Summary* is included as Appendix I-3.

J.4 SWMU No. 4, Old Burn Pit

SWMU No. 4 (Figure J-4) consists of the old burn pit located just north of the tank farm. The old burn pit was used to burn acid-soluble oils (ASOs). ASOs are heavy molecular weight, asphalt type, cross polymerized hydrocarbons. The old burn pit was identified as a SWMU, and designed as SWMU No. 4, during a RFI conducted at the refinery during the early 1990's. The RFI investigation included soil sampling and analysis. Soil borings were drilled to a depth of 4.5 feet, within the perimeter of the old burn pit. Soil samples were collected from each boring and analyzed for VOCs, SVOCs, total metals, and pH using EPA approved methods. Trace organics and metals were detected. Ciniza recommended NFA for this SWMU, which was rejected by EPA (Attachment J-1). The EPA required additional borings with samples collected at 6 and 10 feet. As an interim measure, an engineered earthen cap composed of low hydraulic conductivity, native soil has been installed over the site. *The Old Burn Pit – SWMU No. 4 Summary* details these activities and is included as Appendix I-4.

J.5 SWMU No. 5, Landfill Areas

In 1987 five inactive solid waste landfill areas were identified a SWMU during a RFA. No further action was recommended at one site, but further evaluation was required at the other four landfill areas. A subsequent RFI designated these four inactive solid waste landfill areas collectively as SWMU No. 5. SWMU No. 5 (Figure J-5) is located midway between the Ciniza tank farm and the air strip. Three of the landfill areas are contiguous, and the fourth is located approximately 50 feet north of the main landfill area. The landfills were used to dispose of non-regulated materials from refinery construction, maintenance, and operational activities. The landfills have been inactive since the early 1980s.

Landfill Area SWMU No. 5, was recommended for corrective action in the Phase III RFI. A VCAP was submitted in March 1993; the recommendation was regarding of the landfills, compaction and placement of a 6 inch vegetated cover layer. EPA approved the VCAP on January 5, 1994 (Attachment J-1). Ciniza proceeded with capping the landfills in accordance with the approved VCAP. This activity has been documented in the Landfill Area – SWMU No. 5 Closure Certification. The closure certification report is included in Appendix I-5 and provides certification of closure by a registered Professional Engineer.

J.6 SWMU No. 6 Tank Farm – Leaded Gasoline Tanks

SWMU NO. 6 (Figure J-6) consists of 10 tanks in the refinery storage area that were used for the storage of leaded gasoline. The tank farm area was identified as a SWMU, and designated as SWMU No. 6, during a RFI conducted at the refinery in the early 1990's. Trace organics and metals were detected. In 1994, EPA requested additional sampling at greater depth (Attachment J-1). Vertical borings were made near the manway of each tank and an angle boring was made a pre-approved location around each tank. Soil samples were collected and analyzed for benzene, toluene, ethylbenzene3, and xylene (BTEX); lead; and nickel. Laboratory analysis of the free product indicated that it was gasoline.

Ciniza submitted a VCAP in April 1996 (Giant 1996). The VCAPO proposed product recovery from the two investigation wells, with down gradient well monitoring thereafter. The NMOCD approved the VCAP with modifications, which included drilling six borings to identify the vertical and horizontal extent of the gasoline plume. Corrective action is proceeding in

accordance with the VCAP. *The Tank Farm – Leaded Gasoline Tanks – SWMU NO. 6 Summary* is included in Appendix I-6.

J.7 SWMU No. 7, Fire Training Area

SWMU No.7 (Figure J-7) consists of the fire training area located adjacent to the idle process equipment storage area. It consists of a fire water header, a 4 feet high by 16 feet Diameter tank, and an industrial pump on a cement pedestal. The fire training area was used two to three times a year to train Ciniza Refinery fire crews. The fire training area was identified as a SWMU, and designated as SWMU No.7 during a RFI conducted at the refinery in the early 1990's. The investigation included soil sampling and analysis. Soil borings were drilled to a depth of 4.5 feet around the perimeter of the fire training area. Soil samples were collected at each boring and sampled for oil and grease and total petroleum hydrocarbons (TPH) using EPA approved methods.

The Fire Training Area SWMU No. 7 was recommended for corrective action in the Phase III RFI and a VCAP was submitted in March 1993 (Giant 1993a). The VCAP recommends removing the existing steel tank, aeration of soils beneath the tank to a depth of 5 feet, amending soils with fertilizer and water to increase biological degradation, and quarterly monitoring. When oil and grease are at, or below cleanup levels, closure will be initiated. The EPA approved the VCAP January 5, 1994. Corrective action is proceeding in accordance with the VCAP. *The Fire Training Area – SWMU No. 7 Summary* is included in Appendix I-7.

J.8 SWMU No. 8, Railroad Lagoon

SWMU No. 8 (Figure J-8) consists of the railroad rack lagoon, and its overflow ditch and fan-out. This area is located to the north of the refinery tank farm area near the railway spur. The railroad rack lagoon was identified as a SWMU, and designated as SWMU No. 8, during a RFI conducted at the refiner in the early 1990's. Soil samples from adjacent and under the railroad rack lagoon and within the overflow ditch and fan-out area were collected and analyzed during this initial investigation. A Final Remedy Plan was proposed in the Phase I RFI supplemental report, which included diverting drainage water around the railroad rack from the existing lagoon to the refinery wastewater system; plugging the old system; transferring the lagoon liquids to the refinery wastewater system, and treating contaminated soils. This procedure was formalized

through a VCAP for the Railroad Rack Lagoon. The VCAP was submitted to the EPA in December 1992 and approved in November 1993 (Attachment J-1); however, additional site monitoring during soil remediation is required. Ciniza completed the piping modifications and evacuation of lagoon liquids by June 1994. Corrective action is ongoing in accordance with the approved VCAP criteria. *The Railroad Rack Lagoon – SWMU No. 8 Summary* is included as Appendix I-8. An updated summary of the corrective actions is included in Appendix I-8A.

J.9 SWMU NO. 9 and No. 14, Drainage Ditch Near the Inactive Land Farm

SWMU No. 9 (Figure J.9) consists of an inactive treatment area and associated drainage ditch. This SWMU is located north of the tank farm. In 1990, the Inactive Land Treatment Unit and Drainage Ditch were identified as SWMU No. 9 and SWMU No. 14, respectively. They were combined to become SWMU No. 9, the Drainage Ditch Near the Inactive Land Treatment Area. Specific sample activities at SWMU No. 9 included vertical soil borings at the inactive treatment area. The soil samples were analyzed for VOCs, SVOC, and total metals. Ciniza recommended NFA for the Drainage Ditch Near the Inactive Land Treatment Area; a survey plat was submitted to EPA in July 1995 (Attachment J-1). *The Drainage Ditch Near the Inactive Land Farm SWMU NO. 9 and 14 Summary* is included as Appendix I-9).

J.10 SWMU No. 10, Sludge Pits

SWMU No. 10 (Figure J-10) consists of two former American Petroleum Institute (API) separator sludge pits located to the west of the existing API separator. The pits were backfilled in 1980. The sludge pit area was identified as a SWMU, and designated as SWMU No. 10, during a RFI conducted at the refinery in the early 1990's. Soil borings were advanced at this site, and samples were collected and analyzed for VOCs, SVOCs, and metals. Soil sampling results detected organic contaminants. A Final Remedy Plan was proposed in the Phase I, RFI supplemental report, which included remediation of the soils. In Place remediation of the soils was formalized in the VCAP for the Sludge Pits submitted to the EPA in December 1992. The EPA approved the VCAP in November 1993, requiring additional site monitoring. The additional monitoring was completed in 1994. Ciniza is proceeding with corrective action in accordance with approved VCAP criteria. *The Sludge Pits – SWMU No. 10 Summary* is submitted in Appendix I-10.

J.11 SWMU No. 11, Secondary Oil Skimmer

SWMU No. 11 (Figure J-11) consists of the secondary oil skimmer located south of the main evaporation ponds. Prior to removal, it was used as a backup oil skimmer during maintenance activities on the primary oil skimmer. During a 1987 RFA the secondary oil skimmer was identified as a unit of concern. Subsequent investigation determined this area to be a SWMU, designated as SWMU No. 11. Soil samples were collected from the oil skimmer area in accordance with the Ciniza Sampling and Analysis Plan. Each of the borings was analyzed for VOCs and SVOCs using EPA approved methods. Based on the sample results, Ciniza recommended NFA. The EPA rejected the recommendation and required two additional borings with samples collected at 10 feet. Additional monitoring was completed. Ciniza is proceeding with corrective actions in accordance with the approved VCAP criteria. *The Secondary Oil Skimmer – SWMU No. 11 Summary* is submitted in Appendix I-11.

J.12 SWMU No. 12, Contact Wastewater Collection System

SWMU No. 12 (Figure J-12) consists of the piping runs and catch basins of the Contact Wastewater Collection System (CWWCS). A Vactor system was used to clean the sewer boxes and underground lines. Once cleaned, the lines were inspected by inserting TV cameras inside the pipe and video taping the inside of the lines. The inspection showed evidence of pitting and corrosion throughout the CWWCS; however, it did not show any evidence of leaks or exfiltration of hydrocarbons into the surrounding soil. NFA was recommended for the CWWCS in the Phase I RFI report. EPA rejected the NFA recommendation and required inspection of the CWWCS every five years, beginning in calendar year 1996. The inspection was to be identical to the one performed in the RFI unless better technologies are proposed by Ciniza and approved by EPA. The Gallup Refinery is currently inspecting the system and will notify the NMOCD upon completion. CWWCS is also regulated by the NMOCD pursuant to the Clean Water Act (G10-32-Part A). Because the CWWCS is a closed loop system connected to a permitted unit, it is exempt from HSWA based on Criterion 2 (Attachment J-1). *The Contact Wastewater Collection System – SWMU No. 12 Summary* is submitted in Appendix I-12.

J.13 SWMU No. 13, Drainage Ditch Between API Evaporation Ponds and Neutralization Tank Evaporation Ponds (a.k.a. Drainage Ditch Between API Evaporation Ponds and the North Series and South Series of Ponds)

SWMU No. 13 (Figure J-13) consists of the small overflow lagoon known as Pond No. 10 and its associated drainage ditch. The drainage ditch site was identified as a SWMU, and designated as SWMU No. 13 during a RFI conducted at the refinery in the early 1990's. Based on the results of soil collected on the perimeter of the pond and beside the ditch, Ciniza recommended NFA for this SWMU. The EPA concurred with this finding of NFA and approved cessation of the investigative process; however, they required soil sample collection around the drainage ditch every five years, with analysis identical to that required in the RFI. The EPA reviewed Ciniza's proposal and in August 1994, agreed to the five-year sampling schedule to begin in 1995. Ciniza also submitted a survey plat of the site in July 1995. Ciniza conducted the first sampling event in October 1996, and submitted results to the NMOCD in their Quarterly Progress Report for the fourth-quarter 1996. *The Drainage Ditch Between API Evaporation Ponds and Neutralization Tank Evaporation Ponds – SWMU No. 13 Summary* is submitted as Appendix I-13.

J.14 SWMU No. 14, API Separator

The API Separator was not originally included as a SWMU in the 1988 Hazardous and Solid Waste Act (HSWA) permit or the subsequent 1990 RFI Work Plan. The "API Separator" was first added as a SWMU in the August 2000 Post-Closure Care Permit. There are two API Separators at the refinery as shown in Figure J-14. The original separator, now referred to as the Old API Separator was put into service in 1957. The OAPIS initially only received process wastewater and in 1996 a stormwater sewer system was installed that also flowed to the OAPIS. A new API Separator was put into service in October 2004 and the process wastewater was redirected to the New API Separator. The intention was that only the stormwater sewer system would continue to be directed to the OAPIS.

After the wastewater flows were diverted to the New API Separator, all residual materials were removed from the OAPIS in October 2004. The material was removed using vacuum trucks and sent off-site for recycling at the NORCO refinery. The OAPIS was steam cleaned and sand blasted in preparation for inspection and repairs. The concrete was patched in numerous locations in both bays and the weir wall down-stream of the pipe skimmer was rebuilt on both bays. Stained soil (approx. 4,500 lbs) identified around the perimeter of the separator was removed and sent off-site for disposal as hazardous waste (K051).

In 2006, Western identified potential "dry weather" flows into the OAPIS and undertook an investigation of the sewer systems to determine if process wastewater was continuing to flow to the OAPIS. Flows from the OAPIS were directed to the New API Separator to ensure any potential process wastewaters entering the OAPIS were appropriately managed. A dye tracer study did not identify any cross-connections between the process wastewater and stormwater sewers. To help reduce the potential for process wastewater to flow to the OAPIS, numerous changes were made to both the stormwater drains and the process sewer drains in the summer of 2006.

The OAPIS is currently in service to handle stormwater flows but in spite of extensive efforts to eliminate dry weather flows, it appears that some dry weather flow still enters the unit. The discharge from the OAPIS is directed to the New API Separator to ensure appropriate treatment of any dry weather flow that may enter the OAPIS. A new wastewater treatment plant is planned for the Gallup Refinery and the OAPIS will no longer be required when the new treatment plant is put into operation.

The material handled in the OAPIS has primarily been petroleum hydrocarbons, with a lesser potential for refinery catalyst and gasoline additives to enter the sewer systems. As the solids that accumulate in the bottom of the separator are routinely removed, the greatest potential for a release from the unit would be the liquid phase containing dissolved petroleum hydrocarbons. Liquids could leak from the unit along cracks in the below ground concrete structure or from piping that transfers liquids into and from the unit.

There has not been an investigation of soils or ground water in the immediate vicinity of the OAPIS. There are existing monitoring wells in the general area, with two wells (GMW-1 and GWM-2) located along the down-gradient side of the aeration lagoons and also possibly down-gradient of the OAPIS and four monitoring wells near the New API Separator (NAPIS 1, NAPIS 2, NAPIS 3, and KA-3), which are cross-gradient to the OAPIS. Analyses of ground water samples collected at GWM-1 and NAPIS 2 have indicated only very low concentrations of constituents such as BTEX and methyl tertiary butyl ether (MTBE) that would indicate a potential for historical releases in the area. The fact that the well GMW-1 is located immediately adjacent to the aeration lagoons makes it impossible to determine if the impacts are from the lagoons or other possible up-gradient sources (e.g., the OAPIS) without additional ground water information.

On August 17, 2000, the NMED issued a Post-Closure Care Permit ("Permit") to the former owner, Giant Refining Company. The Permit authorized the post-closure care at a hazardous waste land treatment unit and also includes corrective action provisions. Section IV.B.5.a requires the Permitee to prepare and submit a RCRA Facility Investigation Work Plan after notice from the NMED that an RFI is required under Sections IV.B.4 or IV.b.2.d. On April 15, 2009, the NMED provided such notice to Western and

requested a schedule for submittal of an investigation work plan to address releases from the Old API Separator.

An Investigation Work Plan has been prepared for the SWMU No. 14 Old API Separator (OAPIS). The purpose of the site investigation is to determine and evaluate the presence, nature, and extent of releases of contaminants in accordance with 20.4.1.500 New Mexico Administrative Code (NMAC) incorporating 40 Code of Federal Regulations (CFR) Section 264.101. The investigation activities will be conducted in accordance with Section IV.B.5 of the Post-Closure Care Permit. *The Old API Separator – SWMU No. 14 Summary* is submitted as Appendix I-14.

Table J-1. Solid Waste Management Units

SWMU No.	SWMU Title	STATUS	REPORT
1	The Aeration Basin(i)	EPA approval of NFA given in January 1994. Survey Plat submitted to EPA. Investigative process complete. Five-year sampling of soil around basin required again in 2001	Appendix I-1: Aeration Basin – SWMU No. 1 Summary
2	The Evaporation Ponds(ii)	EPA approval of NFA given in January 1994. Investigative process complete. Follow-up monitoring required. Survey plat submitted. Five-year sampling required again in 2001	Appendix I-2: Evaporation Ponds – SWMU No. 2 Summary
3	Empty Container Storage Area(v)	EPA approval of NFA given January 1994. Investigative process complete. Survey plat submitted to EPA	Appendix I-3: Empty Container Storage Area – SWMU No. 3 Summary
4	Old Burn Pit(viii)	RFI 1990. Sampling report identified corrective action. Site capped in 1998. Investigative process complete. Survey plat submitted.	Appendix I-4: Old Burn Pit – SWMU No. 4 Summary
5	Landfill Areas(vii)	VCAP submitted February 1993 and approved in January 1994. Closure plan prepared and certified by PE, 1998.	Appendix I-5: Landfill Areas – SWMU No. 5 Summary
6	The Tank Farm – Leaded Gasoline Tanks(iii)	VCAP submitted in April 1996. Investigative process complete. Corrective action currently underway. Survey play submitted.	Appendix I-6: The Tank Farm-Leaded Gasoline Tanks – SWMU No. 6 Summary
7	Fire Training Area(iv)	VCAP submitted in March 1993, and approved via fax in March 1996. RFI sampling complete. Investigative process complete. Survey plat submitted. Corrective action on going.	Appendix I-7: Fire Training Area – SWMU No. 7 Summary
8	The Railroad Rack Lagoon(vi)	VCAP submitted in December 1993, and approved in November 1994. RFI sampling complete. Investigative process complete. Corrective action ongoing. Survey plat submitted	Appendix I-8: Railroad Rack Lagoon – SWMU No.8 Summary
9	The Drainage Ditch Near the Inactive Land Farm(x)	RFI sampling complete. Report on additional RFI sampling suggested NFA. Investigative process complete. Survey plat submitted to EPA.	Appendix I-9: Drainage Ditch and Inactive Land Farm – SWMU No. 9 Summary
10	The Sludge Pit(ix)	VCAP submitted in December 1992, and approved in January 1994. RFI sampling complete. Investigative process complete. Proceed with closure activities. Survey plat submitted.	Appendix I-10: Sludge Pits – SWMU No. 10 Summary
11	Secondary Oil Skimmer(xi)	RFI Sampling complete. Report on additional RFI sampling suggested NFA. Investigative process complete. Corrective action on going. Survey plat submitted	Appendix I-11: Secondary Oil Skimmer – SWMU No. 11 Summary
12	Contact Wastewater Collection System (CWWCS)(xii)	Investigative process complete. EPA requires inspection every five years. The Gallup Refinery is currently repairing and inspecting the system. Will notify NMOCD upon completion.	Appendix I-12: Contact Wastewater Collection System – SWMU No. 12 Summary
13	The Drainage Ditch Between API Evaporation Ponds and Neutralization Tank Evaporation Ponds(xiv)	EPA approval of NFA given in January 1994. Follow up monitoring required. Survey plat submitted to EPA. Soil sampling collected around drainage ditch required again in 2001.	Appendix I-13: The Drainage Ditch Between API Evaporation Ponds and Neutralization Tank Evaporation Ponds – SWMU No. 13 Summary

Table J-1. Solid Waste Management Units (Continued)

SWMU No.	SWMU Title	STATUS	REPORT
14	Old API Separator	Investigation Work Plan submitted on 2/5/2010 to NMED HWB to conduct site investigation to evaluate and determine presence of contaminants.	Appendix I-14: Old API Separator – SWMU No. 14 Summary

(*Notes: Solid Waste management unit numbers as designated in the RCRA Facility Investigation Work Plan (submitted May 1990). Solid Waste Management Unit umbers are designated in the HSWA Permit (Section C, Correction Actions for Continuing Releases, 5(a) (1).December 1988. Survey Plat – See Figure J-14.)*

TABLE J-2. GALLUP REFINERY – SOLID WASTE MANAGEMENT UNIT IDENTIFICATION

DESCRIPTION	HSWA[1] PERMIT 1988	RFI[2] WORK PLAN 1990	EPA [3]LETTERS 1994	LTU[4] POST CLOSURE PART B 1998	EPA[5] LETTER 2010
Aeration Basin	i	1	1	1	
Evaporation Ponds	ii	2	2	2	
Empty Container Storage Area	v	3	5	3	
Old Burn Pit	viii	4	8	4	
Landfill Areas	vii	5	7	5	
Tank Farm	iii	6	6	6	
Fire Training Area	iv	7	4	7	
Railroad Rack Lagoon, Overflow Ditch and Fan Out Area	vi	8	8	8	
Inactive Land Treatment Area	x and xiii	9	-	9 and 14	
Sludge Pits	ix	10	9	10	
Secondary Oil Skimmer and Associated Drainage Ditch	xi	11	11	11	
Contact Waste Water Collection System	xii	12	13	12	
Drainage Ditch Between APIs, Evaporation Ponds and Neutralization Tank Evaporation Ponds	xiv	13	13	13	
Drainage Ditch near the Inactive Land Treatment Area		14			
Old API Separator					14

[1] Solid Waste Management Unit Numbers as designated in the HSWA Permit (Section C, Corrective Actions for Continuing Releases, 5(a) (1), December 1988.
[2] Solid Waste Management Unit Numbers as designated in the RCRA Facility Investigation Work Plan (submitted May 1990)
[3] Solid Waste Management Unit Numbers as designated in the EPA letters (provided as Attachment O-1)
[4] Solid Waste Management Unit Numbers as designated in the RCRA Part B Post Closure Application (Volume III, Appendix O-1 thru O-13)
[5] Solid Waste Management Unit Number as assigned in RCRA Part B Post Closure Investigation Work Plan. (Volume III, Appendix J-14)

J.0 SOLID WASTE MANAGEMENT UNITS

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- Container storage units
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verification and source characterization study and developed a site specific Resource Conservation Act Facility Investigation (RFI) Work Plan. In the RFI Work Plan, the 14 SWMUs were reduced to 13 because the Inactive Land Treatment Area and the Drainage Ditch were combined to become SWMU No. 9, the Drainage Ditch near the Inactive Land Treatment Area.

The Gallup Refinery (Ciniza) SWMU numbering system differs in the various Ciniza and EPA reference documents related to SWMUs. The 1998 HSWA permit lists each SWMU preceded by a lowercase roman numeral reflects the document numbering format, not SWMU identification number. The 1990 RFI Work Plan provides the first SWMU numbering system for the 14 SWMUs. EPA letters, 1994, refer to both the RFI Work Plan numbering system and to Arabic numbers assigned to the roman numerals used in the HSWA permit as a format numbering system. On August 17, 2000, the NMED issued a Post-Closure Care Permit ("Permit") to the former owner, Giant Refining Company. The Permit authorized the post-closure care at the hazardous waste land treatment unit and also includes corrective action provisions. The API Separator was not originally included as a SWMU in the 1988 Hazardous and Solid Waste Act (HSWA) permit or the subsequent 1990 RFI Work Plan. The "API Separator" was first added as SWMU-14 in the August 2000 Post-Closure Care Permit. Table J-2 provides a crosswalk between the SWMU numbers designated in the various reference documents. This Part B closure permit application uses the SWMU numbering system from the RFI 2000 Post-closure Care Permit.

Between November 1990, and October 1992, Ciniza prepared three RFI reports covering the original 14 SWMUs (i.e. before SWMU-9 and SWMU-14 were combined, and a new SWMU-14 added) and submitted them to the EPA for review and comment. Based on the nature and extent of contamination detected during the RFI, 10 of the SWMUs were recommended for no further action. The four remaining SWMUs were recommended for corrective action. Voluntary Corrective Action Plans (VCAPs) were prepared for these four SWMUs and submitted to EPA for review. The following sections describe the activities conducted during the RFIs and corrective actions conducted, as required. Table J-1 provides the SWMU number, SWMU title, and current status of the Gallup Refinery SWMUs; Figure J-14 depicts the 14 current SWMUs on the survey plat; and Volume III of this Part B post closure application provides SWMU Summary Reports as Appendices I-1 thru I-14.

J.1 SWMU No. 1 Aeration Basin

SWMU No. 1 (Figure J-1) consists of three cells located west of the tank farm. The three cells include two aeration lagoons and evaporation pond 1. The aeration basins site was identified as a SWMU, and designated as SWMU No. 1 during a RFI conducted at the refinery in the early 1990's. Soil samples were collected on the perimeter of the site and analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals. Based on soil sample results, Ciniza recommended NFA for SWMU No.1 EPA formerly agreed with this finding (Attachment J-1); however, EPA required periodic soil sample collection around the aeration basin every five years. Ciniza submitted a survey plat of the site to EPA in 1995. Ciniza conducted the first sampling even in October 1996, and submitted results the New Mexico Oil Conservation Division (NMOCD) in their Quarterly Progress Report for fourth quarter 1996. *The Aeration Basin – SWMU No. 1 Summary* is included in Appendix I-1.

Two wells (GMW-1 and GWM-2) located along the down-gradient side of the aeration lagoons have been installed. Analyses of ground water samples collected at GWM-1 and GWM-2 have indicated low concentrations of constituents such as benzene that would indicate a potential for historical releases in the area.

A Corrective Measures Implementation Work Plan was recently submitted to the NMED for SWMU No. 1 Wastewater Aeration Lagoons, which includes a Scope of Work to conduct an investigation of environmental media around the aeration lagoons and the benzene strippers.

J.2 SWMU No. 2, Evaporation Ponds

SWMU No. 2 (Figure J-2) consists of a series of evaporation ponds located west and northwest of the tank farm. The evaporation pond area was identified as a SWMU, and designated as SWMU No. 2 during a RFI conducted at the refinery in the early 1990's. This investigation included both soil and groundwater sampling and analysis. Samples were collected around the perimeter of the ponds and were sampled for VOCs, SVOCs, and metals. Ciniza recommended NFA for this SWMU and EPA formally approved the finding of NFA on January 7, 1994 (Attachment O-1); however, EPA requested follow up groundwater sampling from the seven groundwater wells surrounding the evaporation ponds every five years, with analysis identical to

that required in the RFI. Ciniza initiated the five-year sampling schedule in 1996. The survey plat, as required, was submitted to EPA in 1995. *The Evaporation Ponds – SWMU No. 2 Summary* is included as Appendix I-2.

J.3 SWMU No. 3, Empty Container Storage Area

SWMU No. 3 (Figure J-3) consists of the empty container storage area, which was located behind the maintenance buildings. The area was used for storing empty drums awaiting recycling. The empty container storage area was identified as a SWMU, and designated as SWMU No. 3, during the RFI conducted at the refinery in the early 1990's. The investigation focused on soil sampling and analysis. Soil borings were drilled to a depth of 4.5 feet, within the perimeter of the empty container storage area. Samples were collected from each boring in accordance with procedures specified in the Ciniza Sampling and Analysis Plan. Samples were analyzed for priority VOCs using the EPA-approved methods.

Ciniza recommended NFA for this SWMU and EPA formally approved the finding of the NFA on January 7, 1994 (Attachment J-1). The survey plat as required was submitted to EPA in 1995. *The Empty Container Storage – SWMU No. 3 Summary* is included as Appendix I-3.

J.4 SWMU No. 4, Old Burn Pit

SWMU No. 4 (Figure J-4) consists of the old burn pit located just north of the tank farm. The old burn pit was used to burn acid-soluble oils (ASOs). ASOs are heavy molecular weight, asphalt type, cross polymerized hydrocarbons. The old burn pit was identified as a SWMU, and designed as SWMU No. 4, during a RFI conducted at the refinery during the early 1990's. The RFI investigation included soil sampling and analysis. Soil borings were drilled to a depth of 4.5 feet, within the perimeter of the old burn pit. Soil samples were collected from each boring and analyzed for VOCs, SVOCs, total metals, and pH using EPA approved methods. Trace organics and metals were detected. Ciniza recommended NFA for this SWMU, which was rejected by EPA (Attachment J-1). The EPA required additional borings with samples collected at 6 and 10 feet. As an interim measure, an engineered earthen cap composed of low hydraulic conductivity, native soil has been installed over the site. *The Old Burn Pit – SWMU No. 4 Summary* details these activities and is included as Appendix I-4.

J.5 SWMU No. 5, Landfill Areas

In 1987 five inactive solid waste landfill areas were identified a SWMU during a RFA. No further action was recommended at one site, but further evaluation was required at the other four landfill areas. A subsequent RFI designated these four inactive solid waste landfill areas collectively as SWMU No. 5. SWMU No. 5 (Figure J-5) is located midway between the Ciniza tank farm and the air strip. Three of the landfill areas are contiguous, and the fourth is located approximately 50 feet north of the main landfill area. The landfills were used to dispose of non-regulated materials from refinery construction, maintenance, and operational activities. The landfills have been inactive since the early 1980s.

Landfill Area SWMU No. 5, was recommended for corrective action in the Phase III RFI. A VCAP was submitted in March 1993; the recommendation was regarding of the landfills, compaction and placement of a 6 inch vegetated cover layer. EPA approved the VCAP on January 5, 1994 (Attachment J-1). Ciniza proceeded with capping the landfills in accordance with the approved VCAP. This activity has been documented in the Landfill Area – SWMU No. 5 Closure Certification. The closure certification report is included in Appendix I-5 and provides certification of closure by a registered Professional Engineer.

J.6 SWMU No. 6 Tank Farm – Leaded Gasoline Tanks

SWMU NO. 6 (Figure J-6) consists of 10 tanks in the refinery storage area that were used for the storage of leaded gasoline. The tank farm area was identified as a SWMU, and designated as SWMU No. 6, during a RFI conducted at the refinery in the early 1990's. Trace organics and metals were detected. In 1994, EPA requested additional sampling at greater depth (Attachment J-1). Vertical borings were made near the manway of each tank and an angle boring was made a pre-approved location around each tank. Soil samples were collected and analyzed for benzene, toluene, ethylbenzene3, and xylene (BTEX); lead; and nickel. Laboratory analysis of the free product indicated that it was gasoline.

Ciniza submitted a VCAP in April 1996 (Giant 1996). The VCAPO proposed product recovery from the two investigation wells, with down gradient well monitoring thereafter. The NMOCD approved the VCAP with modifications, which included drilling six borings to identify the vertical and horizontal extent of the gasoline plume. Corrective action is proceeding in

accordance with the VCAP. *The Tank Farm – Leaded Gasoline Tanks – SWMU NO. 6 Summary* is included in Appendix I-6.

J.7 SWMU No. 7, Fire Training Area

SWMU No.7 (Figure J-7) consists of the fire training area located adjacent to the idle process equipment storage area. It consists of a fire water header, a 4 feet high by 16 feet Diameter tank, and an industrial pump on a cement pedestal. The fire training area was used two to three times a year to train Ciniza Refinery fire crews. The fire training area was identified as a SWMU, and designated as SWMU No.7 during a RFI conducted at the refinery in the early 1990's. The investigation included soil sampling and analysis. Soil borings were drilled to a depth of 4.5 feet around the perimeter of the fire training area. Soil samples were collected at each boring and sampled for oil and grease and total petroleum hydrocarbons (TPH) using EPA approved methods.

The Fire Training Area SWMU No. 7 was recommended for corrective action in the Phase III RFI and a VCAP was submitted in March 1993 (Giant 1993a). The VCAP recommends removing the existing steel tank, aeration of soils beneath the tank to a depth of 5 feet, amending soils with fertilizer and water to increase biological degradation, and quarterly monitoring. When oil and grease are at, or below cleanup levels, closure will be initiated. The EPA approved the VCAP January 5, 1994. Corrective action is proceeding in accordance with the VCAP. *The Fire Training Area – SWMU No. 7 Summary* is included in Appendix I-7.

J.8 SWMU No. 8, Railroad Lagoon

SWMU No. 8 (Figure J-8) consists of the railroad rack lagoon, and its overflow ditch and fan-out. This area is located to the north of the refinery tank farm area near the railway spur. The railroad rack lagoon was identified as a SWMU, and designated as SWMU No. 8, during a RFI conducted at the refiner in the early 1990's. Soil samples from adjacent and under the railroad rack lagoon and within the overflow ditch and fan-out area were collected and analyzed during this initial investigation. A Final Remedy Plan was proposed in the Phase I RFI supplemental report, which included diverting drainage water around the railroad rack from the existing lagoon to the refinery wastewater system; plugging the old system; transferring the lagoon liquids to the refinery wastewater system, and treating contaminated soils. This procedure was formalized

through a VCAP for the Railroad Rack Lagoon. The VCAP was submitted to the EPA in December 1992 and approved in November 1993 (Attachment J-1); however, additional site monitoring during soil remediation is required. Ciniza completed the piping modifications and evacuation of lagoon liquids by June 1994. Corrective action is ongoing in accordance with the approved VCAP criteria. *The Railroad Rack Lagoon – SWMU No. 8 Summary* is included as Appendix I-8. An updated summary of the corrective actions is included in Appendix I-8A.

J.9 SWMU NO. 9 and No. 14, Drainage Ditch Near the Inactive Land Farm

SWMU No. 9 (Figure J.9) consists of an inactive treatment area and associated drainage ditch. This SWMU is located north of the tank farm. In 1990, the Inactive Land Treatment Unit and Drainage Ditch were identified as SWMU No. 9 and SWMU No. 14, respectively. They were combined to become SWMU No. 9, the Drainage Ditch Near the Inactive Land Treatment Area. Specific sample activities at SWMU No. 9 included vertical soil borings at the inactive treatment area. The soil samples were analyzed for VOCs, SVOC, and total metals. Ciniza recommended NFA for the Drainage Ditch Near the Inactive Land Treatment Area; a survey plat was submitted to EPA in July 1995 (Attachment J-1). *The Drainage Ditch Near the Inactive Land Farm SWMU NO. 9 and 14 Summary* is included as Appendix I-9).

J.10 SWMU No. 10, Sludge Pits

SWMU No. 10 (Figure J-10) consists of two former American Petroleum Institute (API) separator sludge pits located to the west of the existing API separator. The pits were backfilled in 1980. The sludge pit area was identified as a SWMU, and designated as SWMU No. 10, during a RFI conducted at the refinery in the early 1990's. Soil borings were advanced at this site, and samples were collected and analyzed for VOCs, SVOCs, and metals. Soil sampling results detected organic contaminants. A Final Remedy Plan was proposed in the Phase I, RFI supplemental report, which included remediation of the soils. In Place remediation of the soils was formalized in the VCAP for the Sludge Pits submitted to the EPA in December 1992. The EPA approved the VCAP in November 1993, requiring additional site monitoring. The additional monitoring was completed in 1994. Ciniza is proceeding with corrective action in accordance with approved VCAP criteria. *The Sludge Pits – SWMU No. 10 Summary* is submitted in Appendix I-10.

J.11 SWMU No. 11, Secondary Oil Skimmer

SWMU No. 11 (Figure J-11) consists of the secondary oil skimmer located south of the main evaporation ponds. Prior to removal, it was used as a backup oil skimmer during maintenance activities on the primary oil skimmer. During a 1987 RFA the secondary oil skimmer was identified as a unit of concern. Subsequent investigation determined this area to be a SWMU, designated as SWMU No. 11. Soil samples were collected from the oil skimmer area in accordance with the Ciniza Sampling and Analysis Plan. Each of the borings was analyzed for VOCs and SVOCs using EPA approved methods. Based on the sample results, Ciniza recommended NFA. The EPA rejected the recommendation and required two additional borings with samples collected at 10 feet. Additional monitoring was completed. Ciniza is proceeding with corrective actions in accordance with the approved VCAP criteria. *The Secondary Oil Skimmer – SWMU No. 11 Summary* is submitted in Appendix I-11.

J.12 SWMU No. 12, Contact Wastewater Collection System

SWMU No. 12 (Figure J-12) consists of the piping runs and catch basins of the Contact Wastewater Collection System (CWWCS). A Vactor system was used to clean the sewer boxes and underground lines. Once cleaned, the lines were inspected by inserting TV cameras inside the pipe and video taping the inside of the lines. The inspection showed evidence of pitting and corrosion throughout the CWWCS; however, it did not show any evidence of leaks or exfiltration of hydrocarbons into the surrounding soil. NFA was recommended for the CWWCS in the Phase I RFI report. EPA rejected the NFA recommendation and required inspection of the CWWCS every five years, beginning in calendar year 1996. The inspection was to be identical to the one performed in the RFI unless better technologies are proposed by Ciniza and approved by EPA. The Gallup Refinery is currently inspecting the system and will notify the NMOCD upon completion. CWWCS is also regulated by the NMOCD pursuant to the Clean Water Act (G10-32-Part A). Because the CWWCS is a closed loop system connected to a permitted unit, it is exempt from HSWA based on Criterion 2 (Attachment J-1). *The Contact Wastewater Collection System – SWMU No. 12 Summary* is submitted in Appendix I-12.

J.13 SWMU No. 13, Drainage Ditch Between API Evaporation Ponds and Neutralization Tank Evaporation Ponds (a.k.a. Drainage Ditch Between API Evaporation Ponds and the North Series and South Series of Ponds)

SWMU No. 13 (Figure J-13) consists of the small overflow lagoon known as Pond No. 10 and its associated drainage ditch. The drainage ditch site was identified as a SWMU, and designated as SWMU No. 13 during a RFI conducted at the refinery in the early 1990's. Based on the results of soil collected on the perimeter of the pond and beside the ditch, Ciniza recommended NFA for this SWMU. The EPA concurred with this finding of NFA and approved cessation of the investigative process; however, they required soil sample collection around the drainage ditch every five years, with analysis identical to that required in the RFI. The EPA reviewed Ciniza's proposal and in August 1994, agreed to the five-year sampling schedule to begin in 1995. Ciniza also submitted a survey plat of the site in July 1995. Ciniza conducted the first sampling event in October 1996, and submitted results to the NMOCD in their Quarterly Progress Report for the fourth-quarter 1996. *The Drainage Ditch Between API Evaporation Ponds and Neutralization Tank Evaporation Ponds – SWMU No. 13 Summary* is submitted as Appendix I-13.

J.14 SWMU No. 14, API Separator

The API Separator was not originally included as a SWMU in the 1988 Hazardous and Solid Waste Act (HSWA) permit or the subsequent 1990 RFI Work Plan. The "API Separator" was first added as a SWMU in the August 2000 Post-Closure Care Permit. There are two API Separators at the refinery as shown in Figure J-14. The original separator, now referred to as the Old API Separator was put into service in 1957. The OAPIS initially only received process wastewater and in 1996 a stormwater sewer system was installed that also flowed to the OAPIS. A new API Separator was put into service in October 2004 and the process wastewater was redirected to the New API Separator. The intention was that only the stormwater sewer system would continue to be directed to the OAPIS.

After the wastewater flows were diverted to the New API Separator, all residual materials were removed from the OAPIS in October 2004. The material was removed using vacuum trucks and sent off-site for recycling at the NORCO refinery. The OAPIS was steam cleaned and sand blasted in preparation for inspection and repairs. The concrete was patched in numerous locations in both bays and the weir wall down-stream of the pipe skimmer was rebuilt on both bays. Stained soil (approx. 4,500 lbs) identified around the perimeter of the separator was removed and sent off-site for disposal as hazardous waste (K051).

In 2006, Western identified potential "dry weather" flows into the OAPIS and undertook an investigation of the sewer systems to determine if process wastewater was continuing to flow to the OAPIS. Flows from the OAPIS were directed to the New API Separator to ensure any potential process wastewaters entering the OAPIS were appropriately managed. A dye tracer study did not identify any cross-connections between the process wastewater and stormwater sewers. To help reduce the potential for process wastewater to flow to the OAPIS, numerous changes were made to both the stormwater drains and the process sewer drains in the summer of 2006.

The OAPIS is currently in service to handle stormwater flows but in spite of extensive efforts to eliminate dry weather flows, it appears that some dry weather flow still enters the unit. The discharge from the OAPIS is directed to the New API Separator to ensure appropriate treatment of any dry weather flow that may enter the OAPIS. A new wastewater treatment plant is planned for the Gallup Refinery and the OAPIS will no longer be required when the new treatment plant is put into operation.

The material handled in the OAPIS has primarily been petroleum hydrocarbons, with a lesser potential for refinery catalyst and gasoline additives to enter the sewer systems. As the solids that accumulate in the bottom of the separator are routinely removed, the greatest potential for a release from the unit would be the liquid phase containing dissolved petroleum hydrocarbons. Liquids could leak from the unit along cracks in the below ground concrete structure or from piping that transfers liquids into and from the unit.

There has not been an investigation of soils or ground water in the immediate vicinity of the OAPIS. There are existing monitoring wells in the general area, with two wells (GMW-1 and GWM-2) located along the down-gradient side of the aeration lagoons and also possibly down-gradient of the OAPIS and four monitoring wells near the New API Separator (NAPIS 1, NAPIS 2, NAPIS 3, and KA-3), which are cross-gradient to the OAPIS. Analyses of ground water samples collected at GWM-1 and NAPIS 2 have indicated only very low concentrations of constituents such as BTEX and methyl tertiary butyl ether (MTBE) that would indicate a potential for historical releases in the area. The fact that the well GMW-1 is located immediately adjacent to the aeration lagoons makes it impossible to determine if the impacts are from the lagoons or other possible up-gradient sources (e.g., the OAPIS) without additional ground water information.

On August 17, 2000, the NMED issued a Post-Closure Care Permit ("Permit") to the former owner, Giant Refining Company. The Permit authorized the post-closure care at a hazardous waste land treatment unit and also includes corrective action provisions. Section IV.B.5.a requires the Permitee to prepare and submit a RCRA Facility Investigation Work Plan after notice from the NMED that an RFI is required under Sections IV.B.4 or IV.b.2.d. On April 15, 2009, the NMED provided such notice to Western and

requested a schedule for submittal of an investigation work plan to address releases from the Old API Separator.

An Investigation Work Plan has been prepared for the SWMU No. 14 Old API Separator (OAPIS). The purpose of the site investigation is to determine and evaluate the presence, nature, and extent of releases of contaminants in accordance with 20.4.1.500 New Mexico Administrative Code (NMAC) incorporating 40 Code of Federal Regulations (CFR) Section 264.101. The investigation activities will be conducted in accordance with Section IV.B.5 of the Post-Closure Care Permit. *The Old API Separator – SWMU No. 14 Summary* is submitted as Appendix I-14.

Table J-1. Solid Waste Management Units

SWMU No.	SWMU Title	STATUS	REPORT
1	The Aeration Basin(i)	EPA approval of NFA given in January 1994. Survey Plat submitted to EPA. Investigative process complete. Five-year sampling of soil around basin required again in 2001	Appendix I-1: Aeration Basin – SWMU No. 1 Summary
2	The Evaporation Ponds(ii)	EPA approval of NFA given in January 1994. Investigative process complete. Follow-up monitoring required. Survey plat submitted. Five-year sampling required again in 2001	Appendix I-2: Evaporation Ponds – SWMU No. 2 Summary
3	Empty Container Storage Area(v)	EPA approval of NFA given January 1994. Investigative process complete. Survey plat submitted to EPA	Appendix I-3: Empty Container Storage Area – SWMU No. 3 Summary
4	Old Burn Pit(viii)	RFI 1990. Sampling report identified corrective action. Site capped in 1998. Investigative process complete. Survey plat submitted.	Appendix I-4: Old Burn Pit – SWMU No. 4 Summary
5	Landfill Areas(vii)	VCAP submitted February 1993 and approved in January 1994. Closure plan prepared and certified by PE, 1998.	Appendix I-5: Landfill Areas – SWMU No. 5 Summary
6	The Tank Farm – Leaded Gasoline Tanks(iii)	VCAP submitted in April 1996. Investigative process complete. Corrective action currently underway. Survey play submitted.	Appendix I-6: The Tank Farm-Leaded Gasoline Tanks – SWMU No. 6 Summary
7	Fire Training Area(iv)	VCAP submitted in March 1993, and approved via fax in March 1996. RFI sampling complete. Investigative process complete. Survey plat submitted. Corrective action on going.	Appendix I-7: Fire Training Area – SWMU No. 7 Summary
8	The Railroad Rack Lagoon(vi)	VCAP submitted in December 1993, and approved in November 1994. RFI sampling complete. Investigative process complete. Corrective action ongoing. Survey plat submitted	Appendix I-8: Railroad Rack Lagoon – SWMU No.8 Summary
9	The Drainage Ditch Near the Inactive Land Farm(x)	RFI sampling complete. Report on additional RFI sampling suggested NFA. Investigative process complete. Survey plat submitted to EPA.	Appendix I-9: Drainage Ditch and Inactive Land Farm – SWMU No. 9 Summary
10	The Sludge Pit(ix)	VCAP submitted in December 1992, and approved in January 1994. RFI sampling complete. Investigative process complete. Proceed with closure activities. Survey plat submitted.	Appendix I-10: Sludge Pits – SWMU No. 10 Summary
11	Secondary Oil Skimmer(xi)	RFI Sampling complete. Report on additional RFI sampling suggested NFA. Investigative process complete. Corrective action on going. Survey plat submitted	Appendix I-11: Secondary Oil Skimmer – SWMU No. 11 Summary
12	Contact Wastewater Collection System (CWWCS)(xii)	Investigative process complete. EPA requires inspection every five years. The Gallup Refinery is currently repairing and inspecting the system. Will notify NMOCD upon completion.	Appendix I-12: Contact Wastewater Collection System – SWMU No. 12 Summary
13	The Drainage Ditch Between API Evaporation Ponds and Neutralization Tank Evaporation Ponds(xiv)	EPA approval of NFA given in January 1994. Follow up monitoring required. Survey plat submitted to EPA. Soil sampling collected around drainage ditch required again in 2001.	Appendix I-13: The Drainage Ditch Between API Evaporation Ponds and Neutralization Tank Evaporation Ponds – SWMU No. 13 Summary

Table J-1. Solid Waste Management Units (Continued)

SWMU No.	SWMU Title	STATUS	REPORT
14	Old API Separator	Investigation Work Plan submitted on 2/5/2010 to NMED HWB to conduct site investigation to evaluate and determine presence of contaminants.	Appendix I-14: Old API Separator – SWMU No. 14 Summary

(*Notes: Solid Waste management unit numbers as designated in the RCRA Facility Investigation Work Plan (submitted May 1990). Solid Waste Management Unit umbers are designated in the HSWA Permit (Section C, Correction Actions for Continuing Releases, 5(a) (1).December 1988. Survey Plat – See Figure J-14.)*

TABLE J-2. GALLUP REFINERY – SOLID WASTE MANAGEMENT UNIT IDENTIFICATION

DESCRIPTION	HSWA[1] PERMIT 1988	RFI[2] WORK PLAN 1990	EPA [3]LETTERS 1994	LTU[4] POST CLOSURE PART B 1998	EPA[5] LETTER 2010
Aeration Basin	i	1	1	1	
Evaporation Ponds	ii	2	2	2	
Empty Container Storage Area	v	3	5	3	
Old Burn Pit	viii	4	8	4	
Landfill Areas	vii	5	7	5	
Tank Farm	iii	6	6	6	
Fire Training Area	iv	7	4	7	
Railroad Rack Lagoon, Overflow Ditch and Fan Out Area	vi	8	8	8	
Inactive Land Treatment Area	x and xiii	9	-	9 and 14	
Sludge Pits	ix	10	9	10	
Secondary Oil Skimmer and Associated Drainage Ditch	xi	11	11	11	
Contact Waste Water Collection System	xii	12	13	12	
Drainage Ditch Between APIs, Evaporation Ponds and Neutralization Tank Evaporation Ponds	xiv	13	13	13	
Drainage Ditch near the Inactive Land Treatment Area		14			
Old API Separator					14

[1] Solid Waste Management Unit Numbers as designated in the HSWA Permit (Section C, Corrective Actions for Continuing Releases, 5(a) (1), December 1988.
[2] Solid Waste Management Unit Numbers as designated in the RCRA Facility Investigation Work Plan (submitted May 1990)
[3] Solid Waste Management Unit Numbers as designated in the EPA letters (provided as Attachment O-1)
[4] Solid Waste Management Unit Numbers as designated in the RCRA Part B Post Closure Application (Volume III, Appendix O-1 thru O-13)
[5] Solid Waste Management Unit Number as assigned in RCRA Part B Post Closure Investigation Work Plan. (Volume III, Appendix J-14)

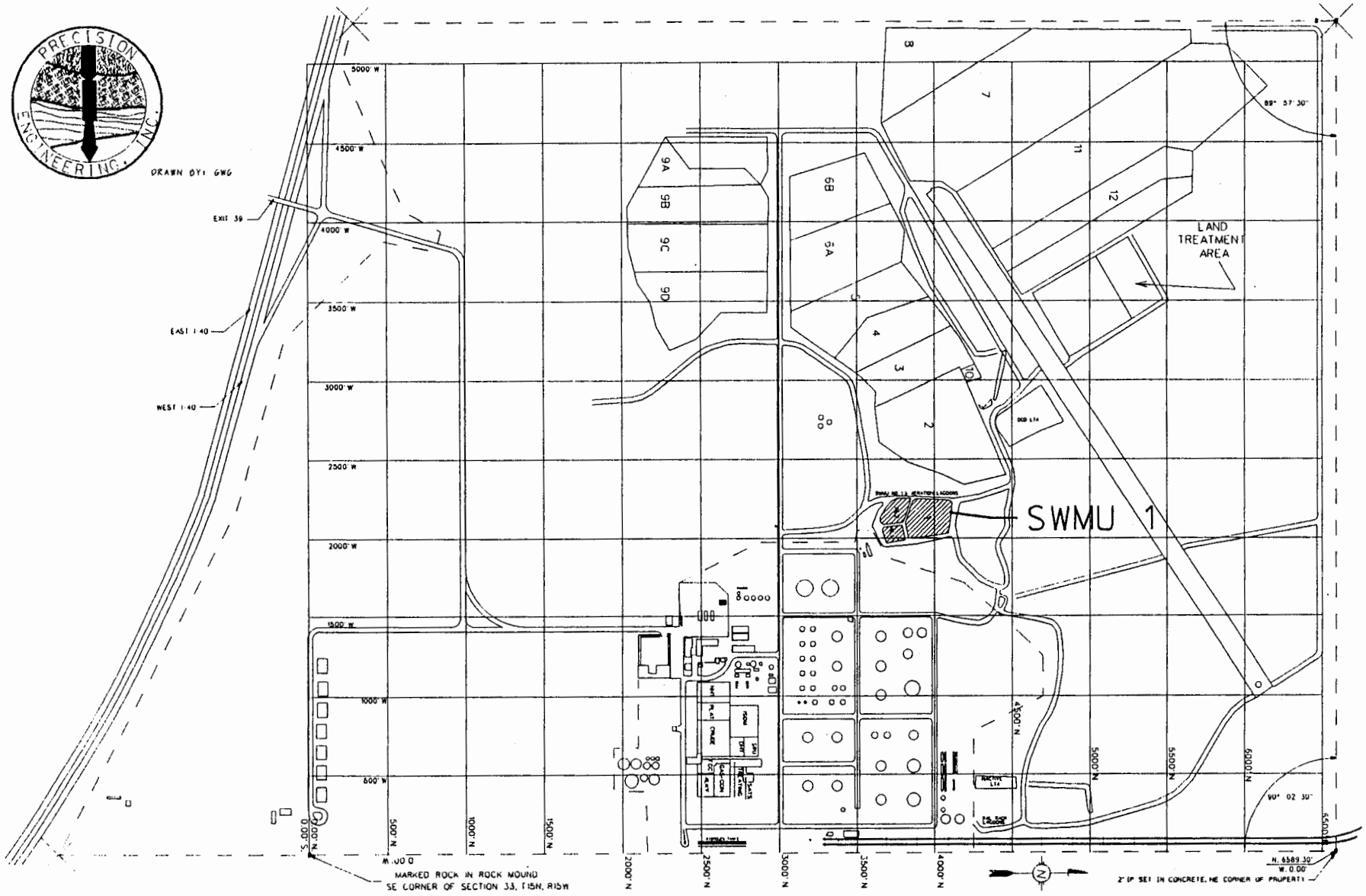

Figure J-1a. SWMU No. 1, Aeration Basin

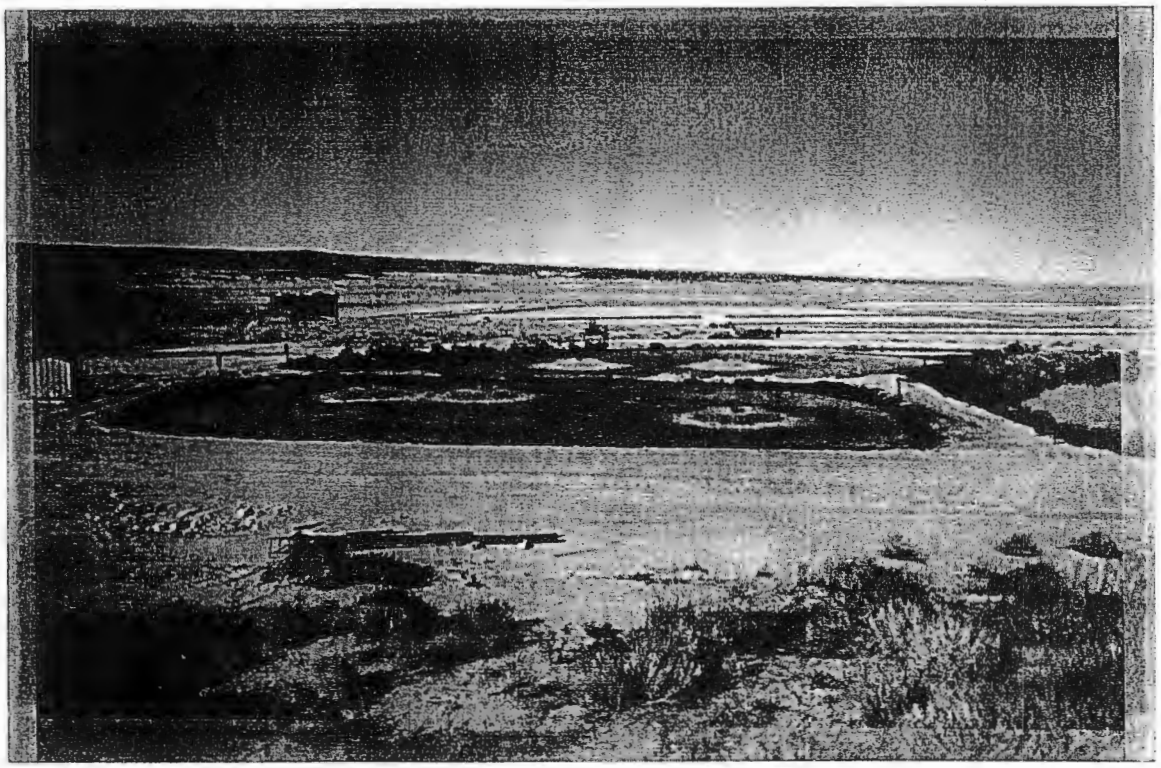

Figure J-1b. SWMU No. 1, Aeration Basin Detail Photo

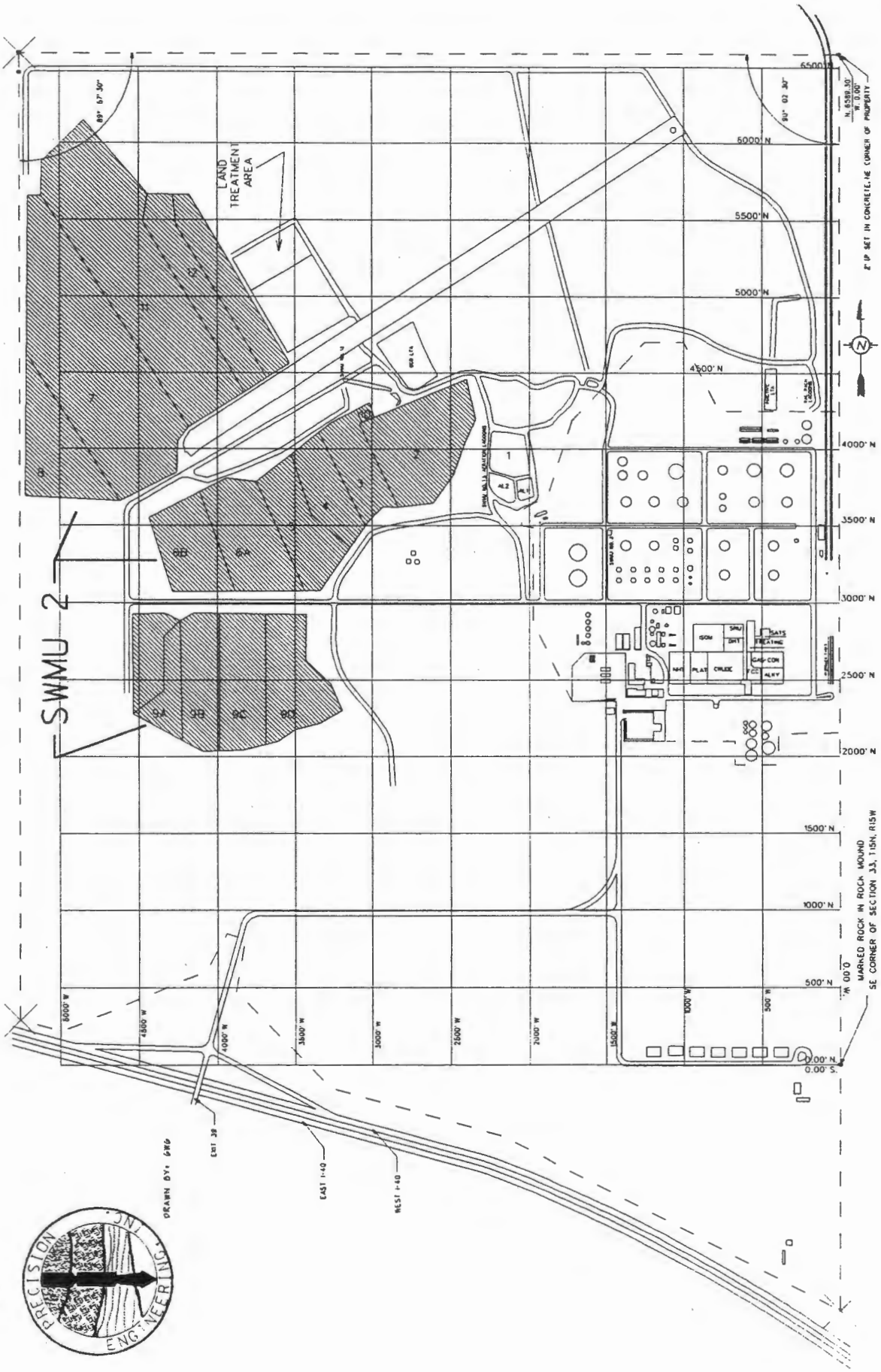

Figure J-2a. SWMU No. 2, Evaporation Ponds

Figure J-2b. SWMU No. 2, Evaporation Ponds Detail Photo

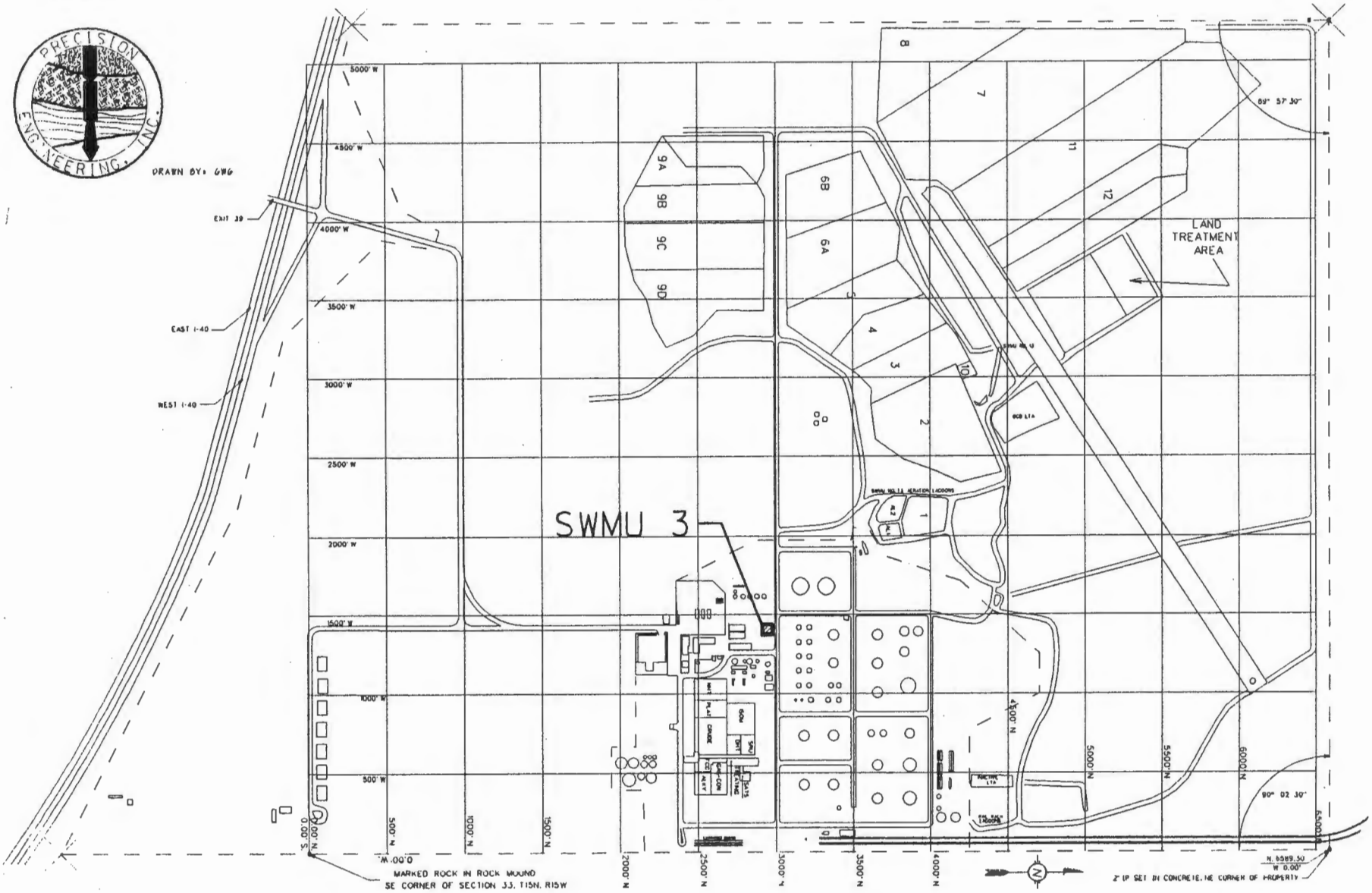

Figure J-3a. SWMU No. 3, Empty Container Storage Area

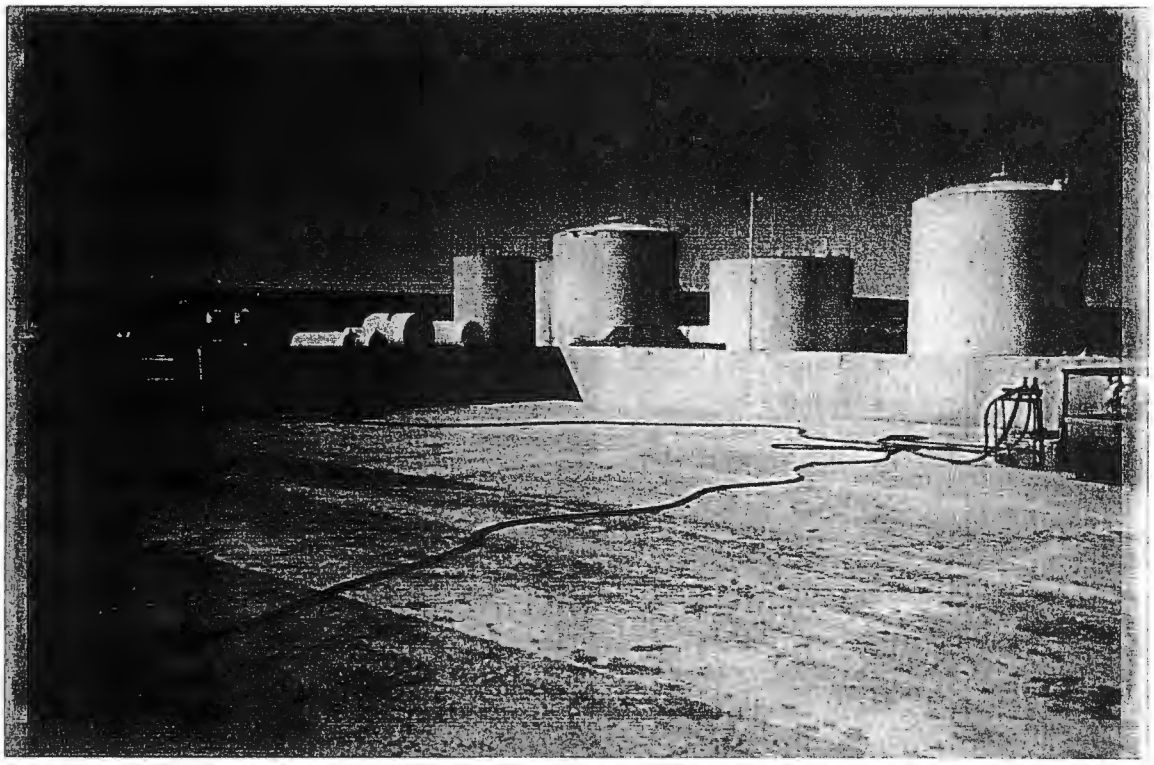

Figure J-3b. SWMU No. 3, Empty Container Storage Area Detail Photo

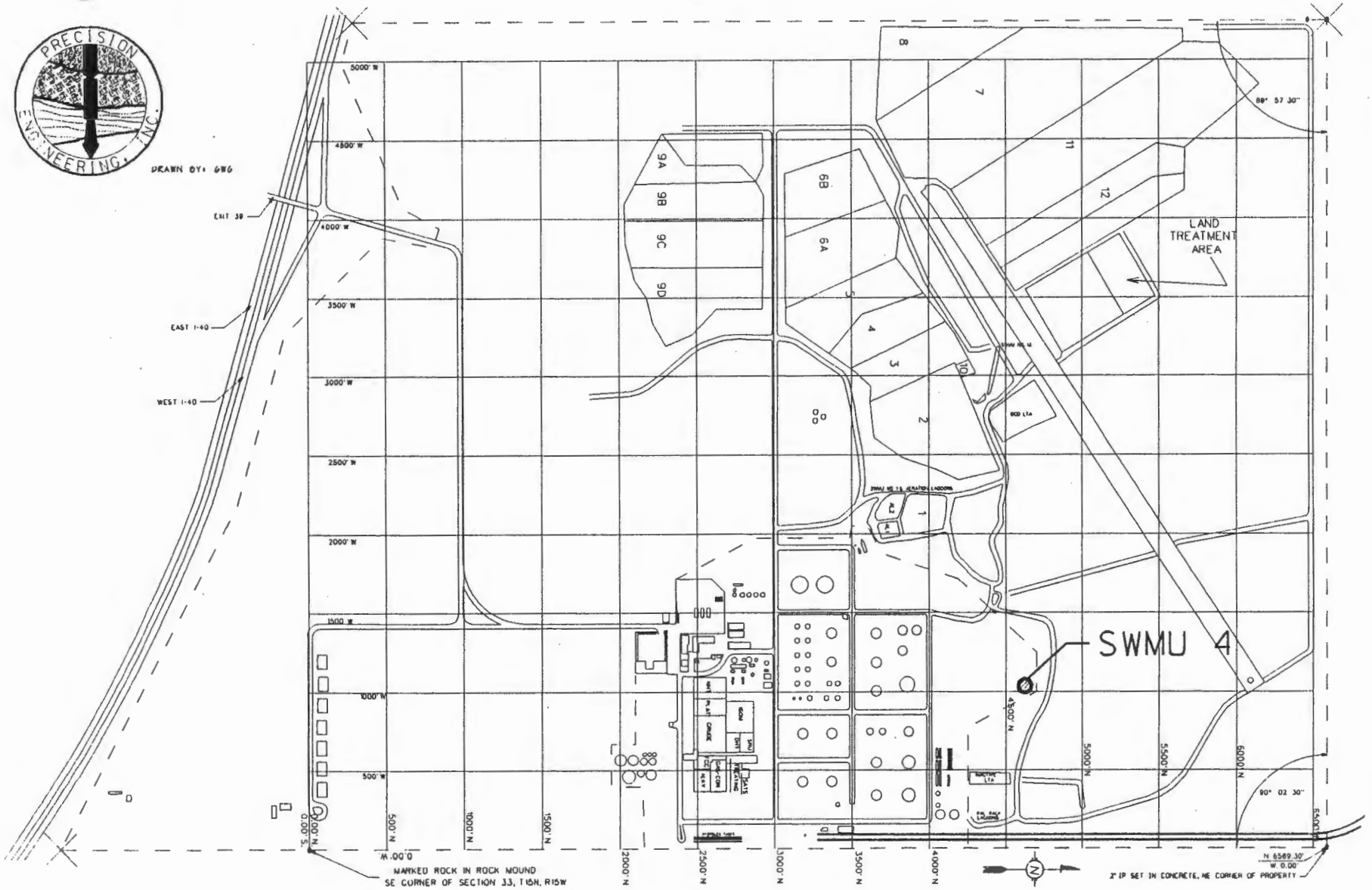

Figure J-4a. SWMU No. 4, Old Burn Pit

Figure J-4b. SWMU No. 4, Old Burn Pit Detail Photo

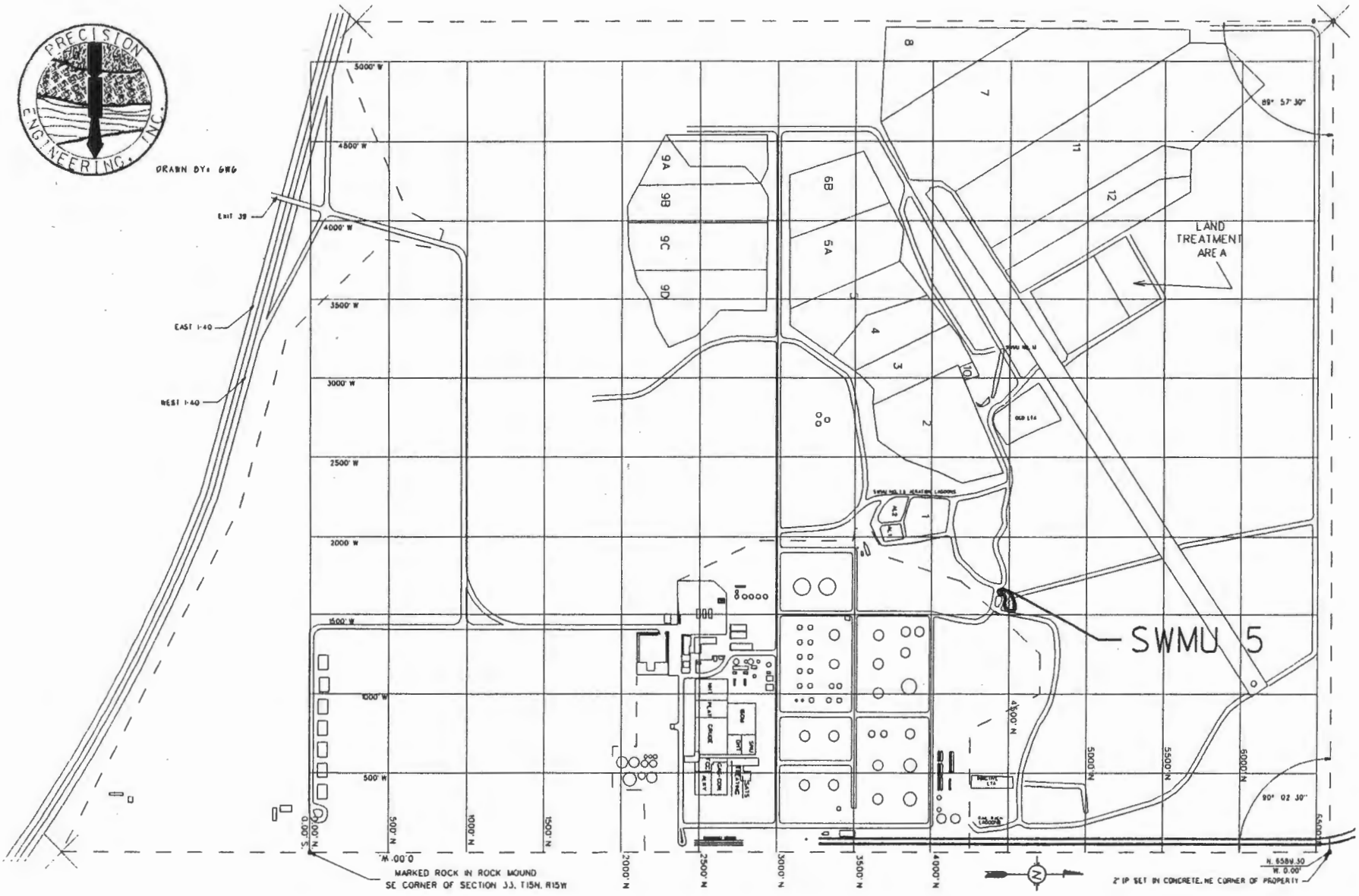

Figure J-5a. SWMU No. 5, Landfill Areas

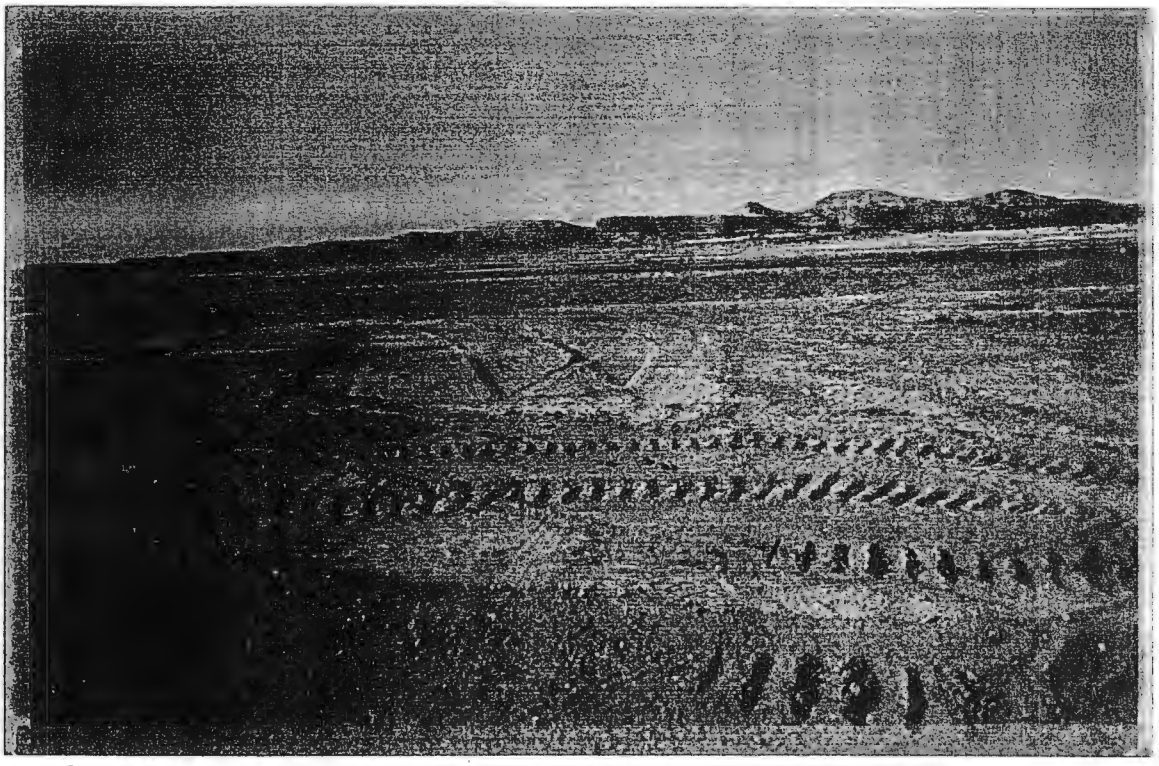

Figure J-5b. SWMU No. 5, Landfill Areas Detail Photo

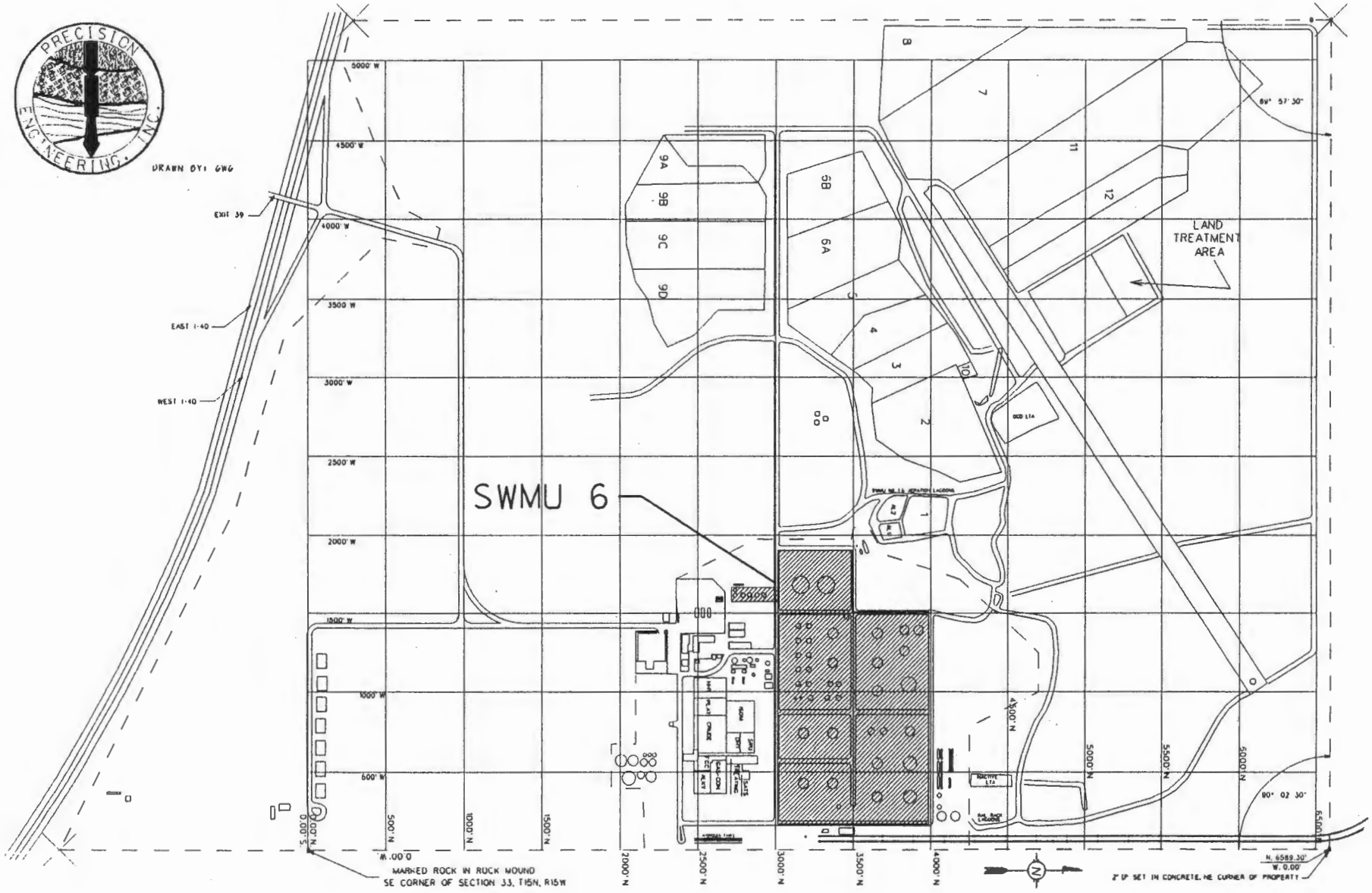

Figure J-6a. SWMU No. 6, Tank Farm—Leaded Gasoline Tanks

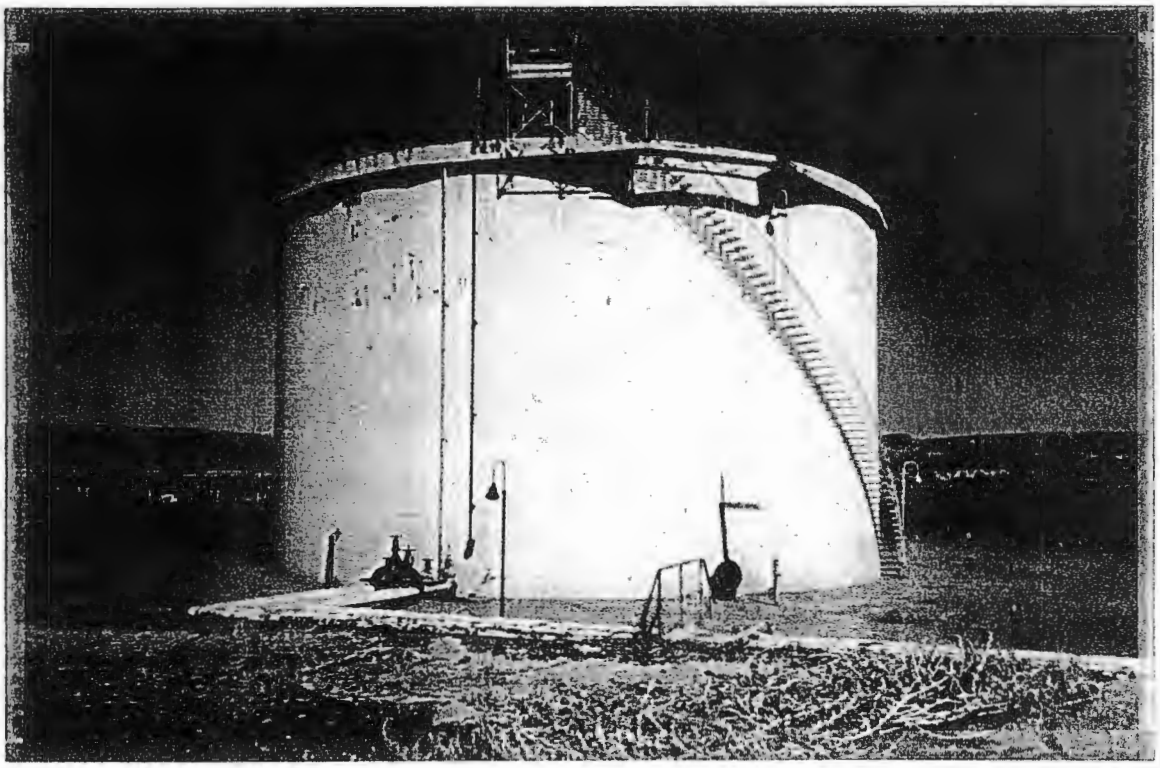

Figure J-6b. SWMU No. 6, Tank Farm—Leaded Gasoline Tanks Detail Photo

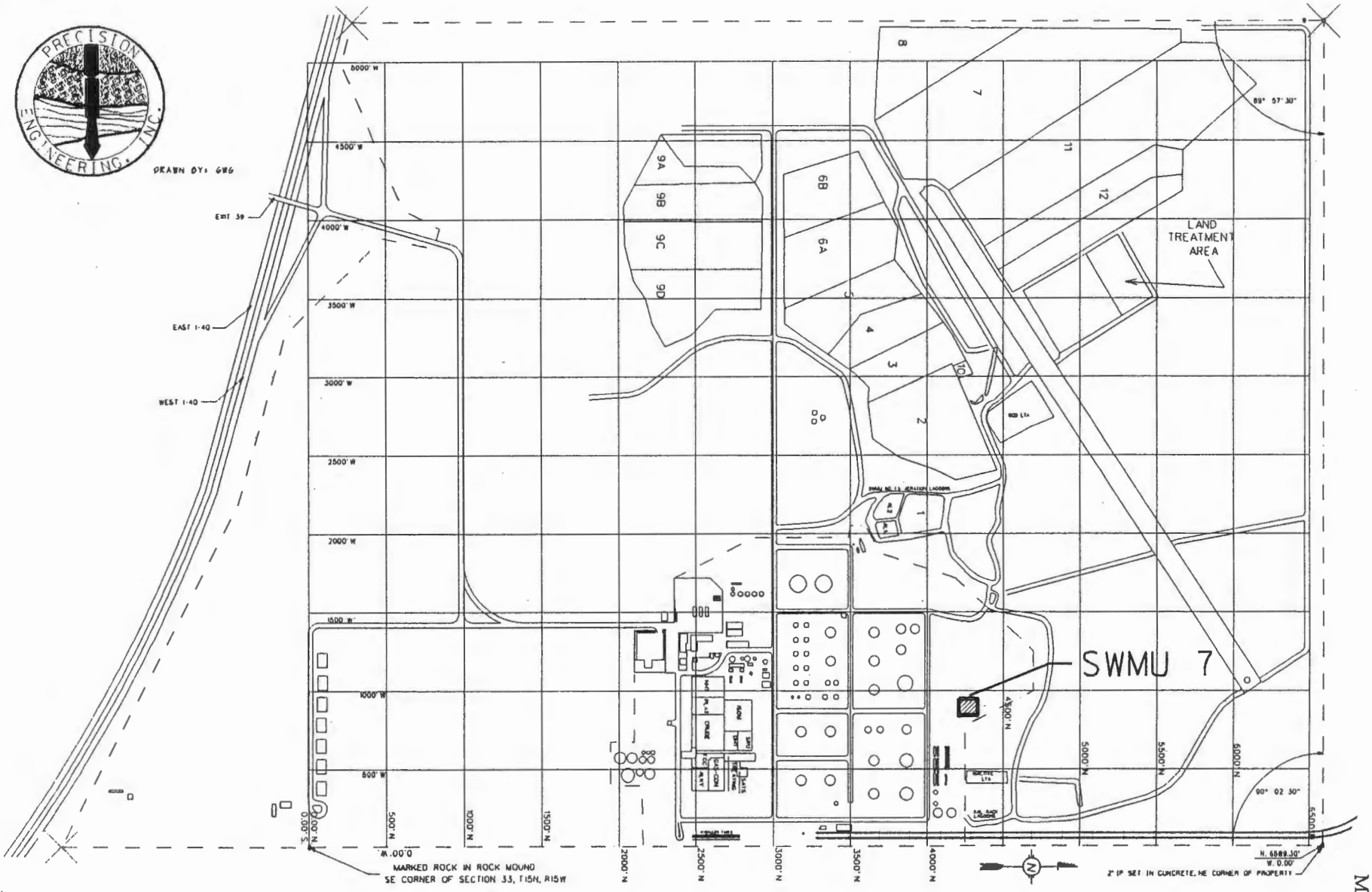

Figure J-7a. SWMU No. 7, Fire Training Area

Figure J-7b. SWMU No. 7, Fire Training Area Detail Photo

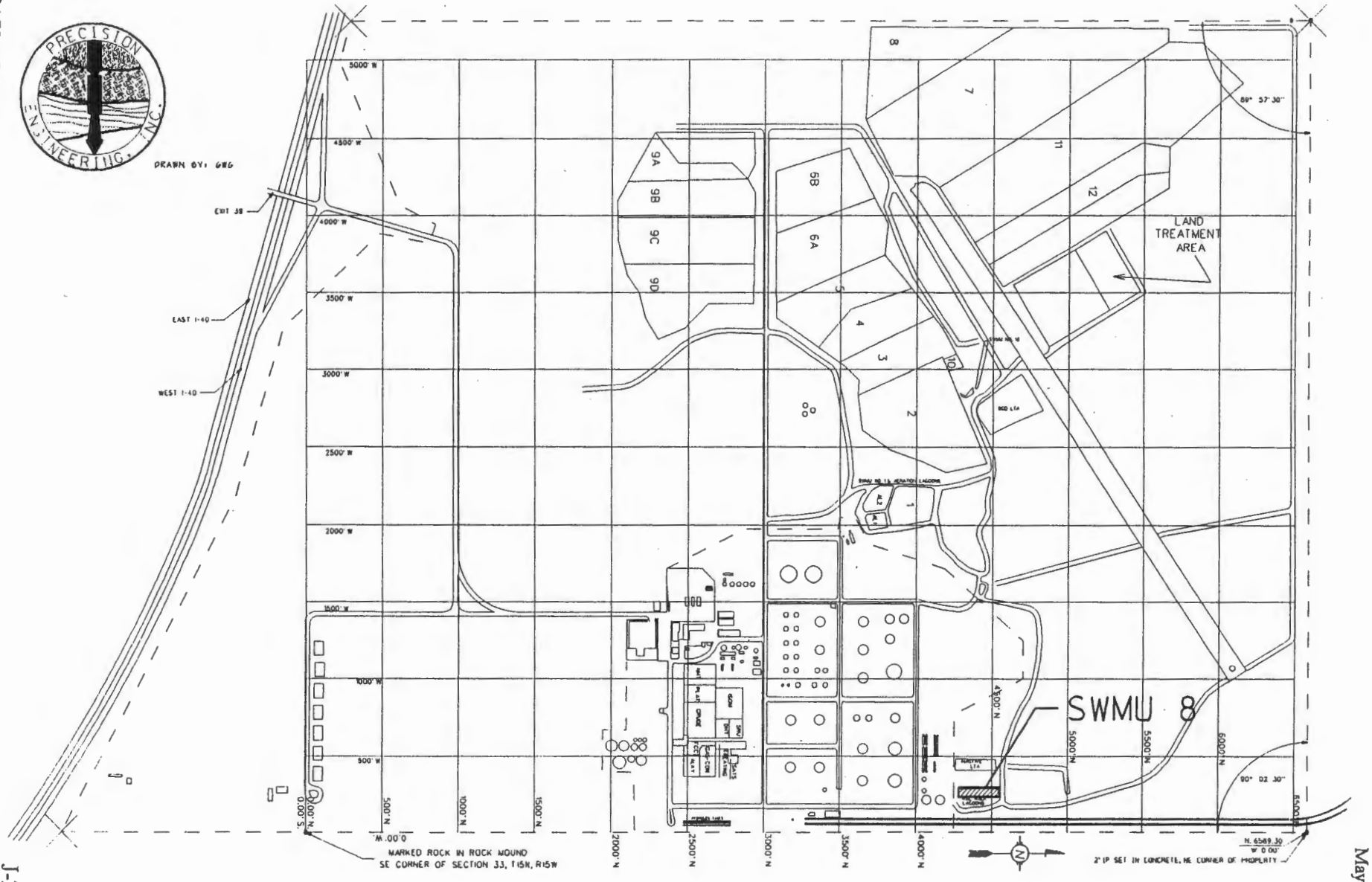

Figure J-8a. SWMU No. 8, Railroad Rack Lagoon

Figure J-8b. SWMU No. 8, Railroad Rack Lagoon Detail Photo

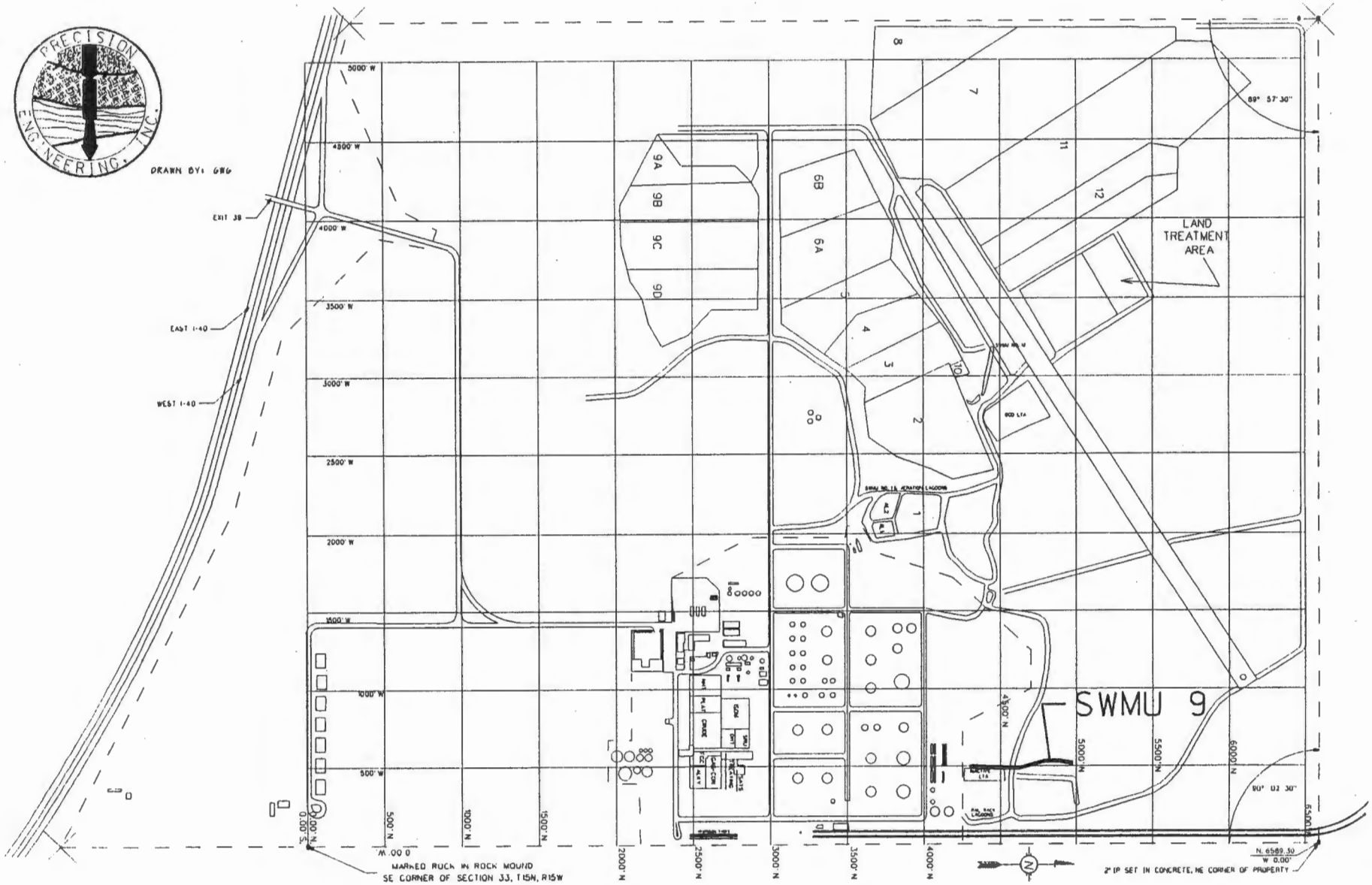

Figure J-9a. SWMU No. 9, Drainage Ditch Near the Inactive Land Farm

Figure J-9b. SWMU No. 9, Drainage Ditch and the Inactive Land Farm Detail Photo

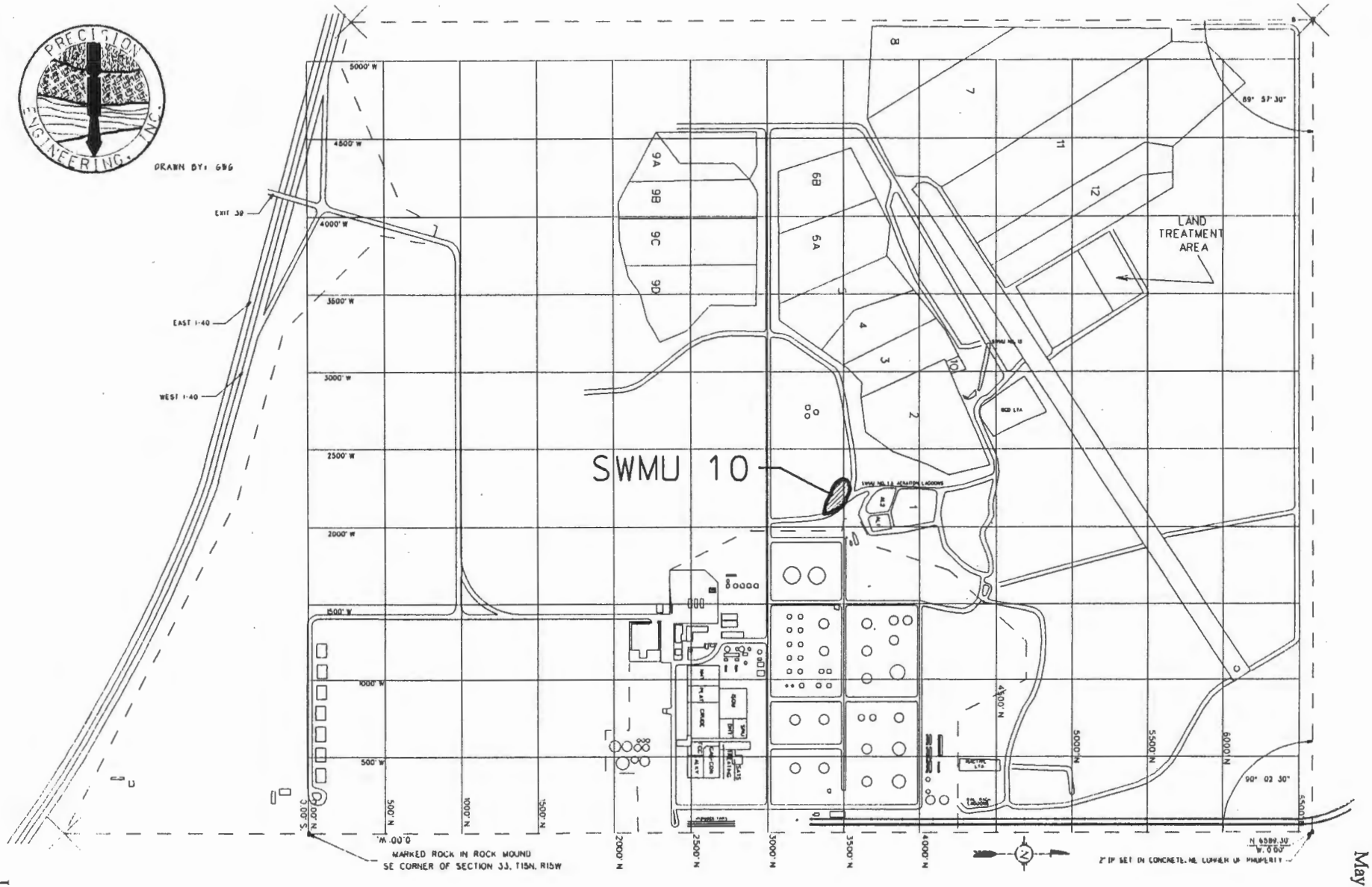

Figure J-10a. SWMU No. 10, Sludge Pits

Figure J-10b. SWMU No. 10, Sludge Pits Detail Photo

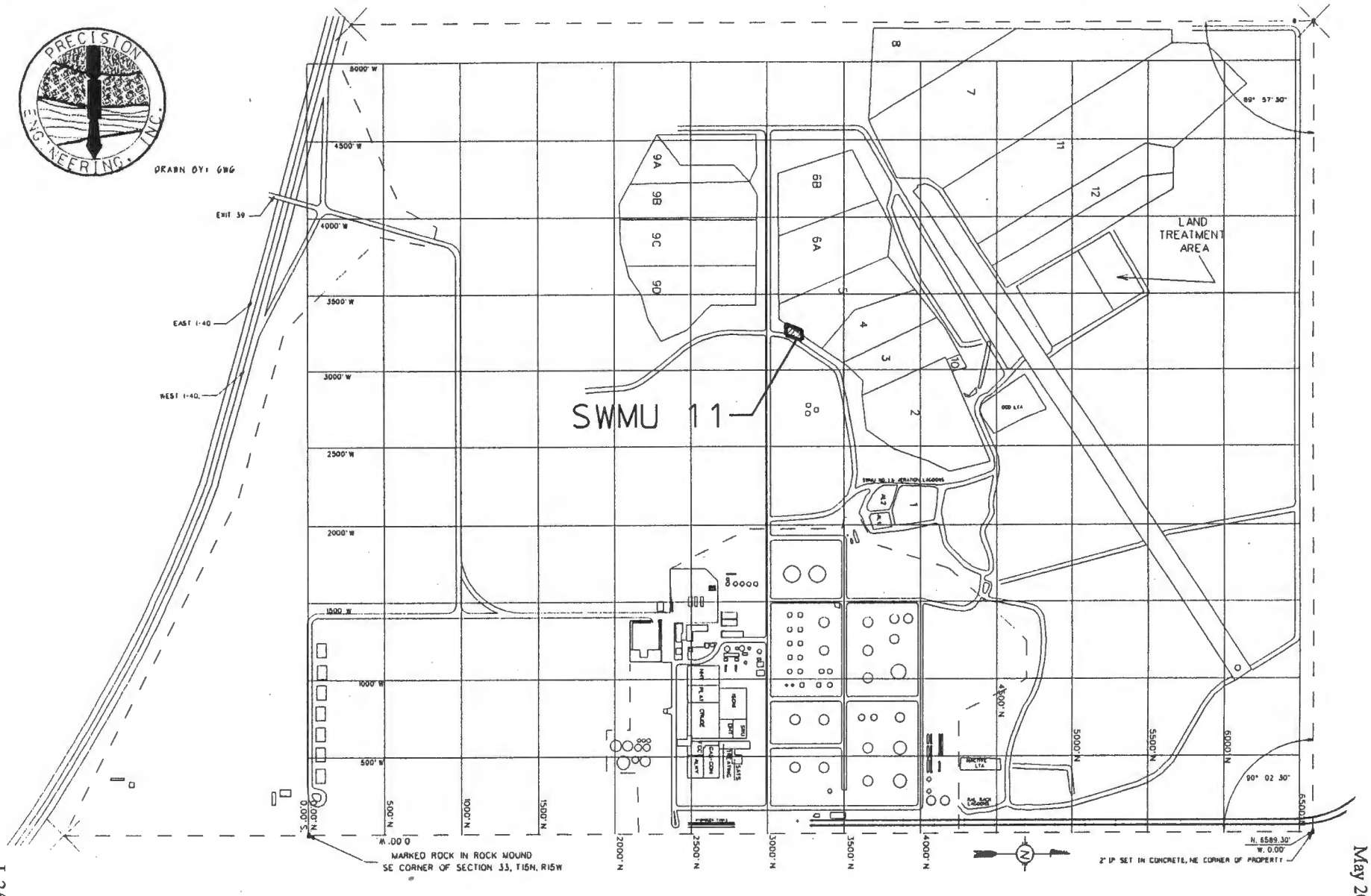

Figure J-11a. SWMU No. 11, Secondary Oil Skimmer

Figure J-11b. SWMU No. 11, Secondary Oil Skimmer Detail Photo

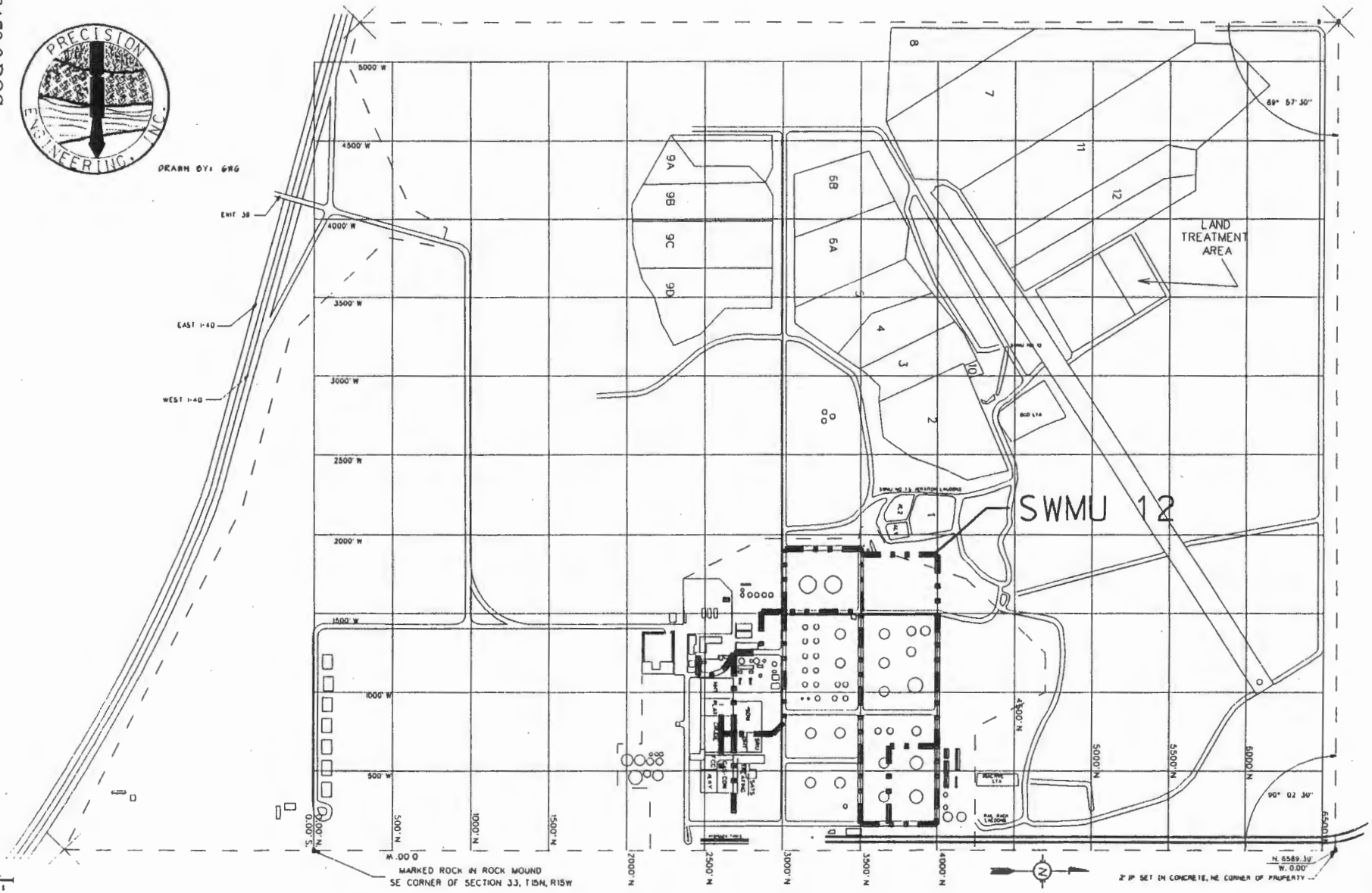

Figure J-12a. SWMU No. 12, Contact Wastewater Collection System

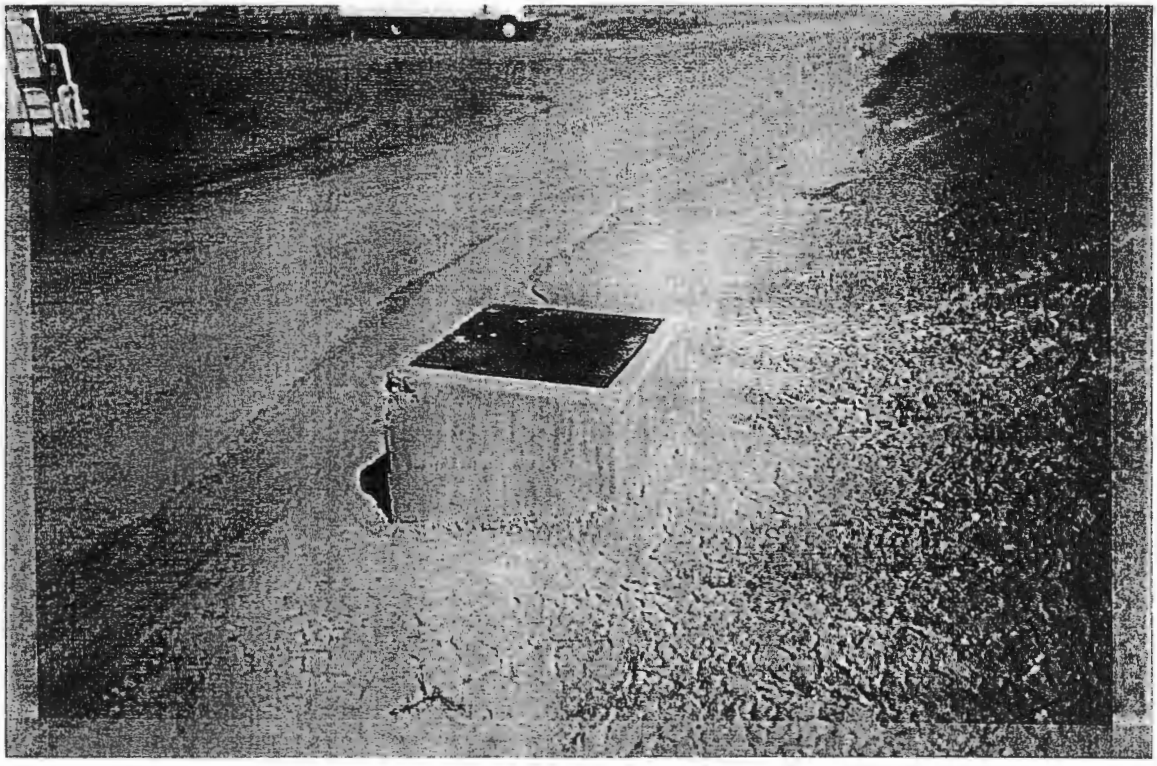

Figure J-12b. SWMU No. 12, Contact Wastewater Collection System Detail Photo

CINIZA REFINERY
SITE MAP

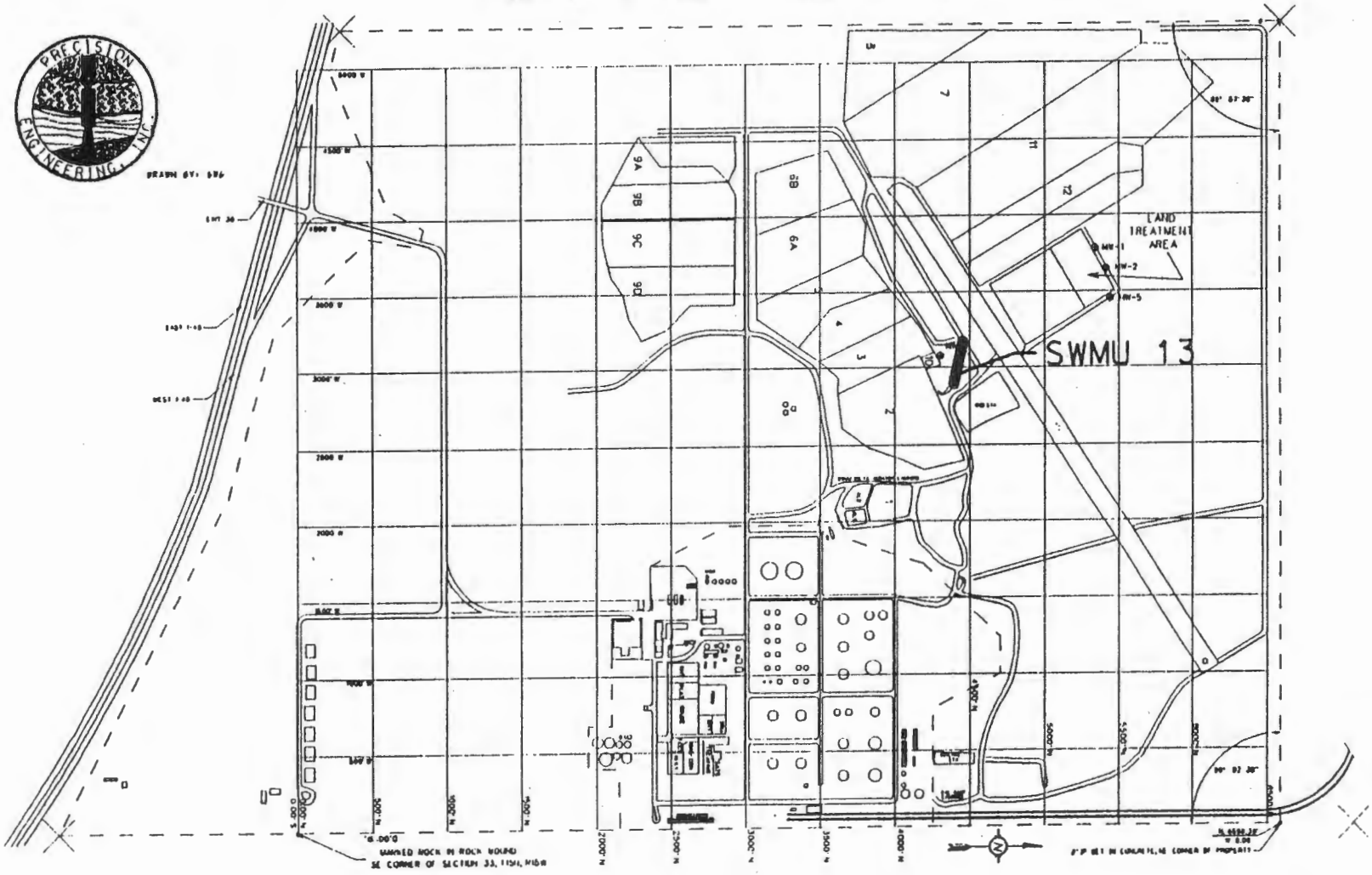

Figure J-13a. SWMU No. 13, Drainage Ditch Between API Evaporation Ponds and Neutralization Tank Evaporation Ponds

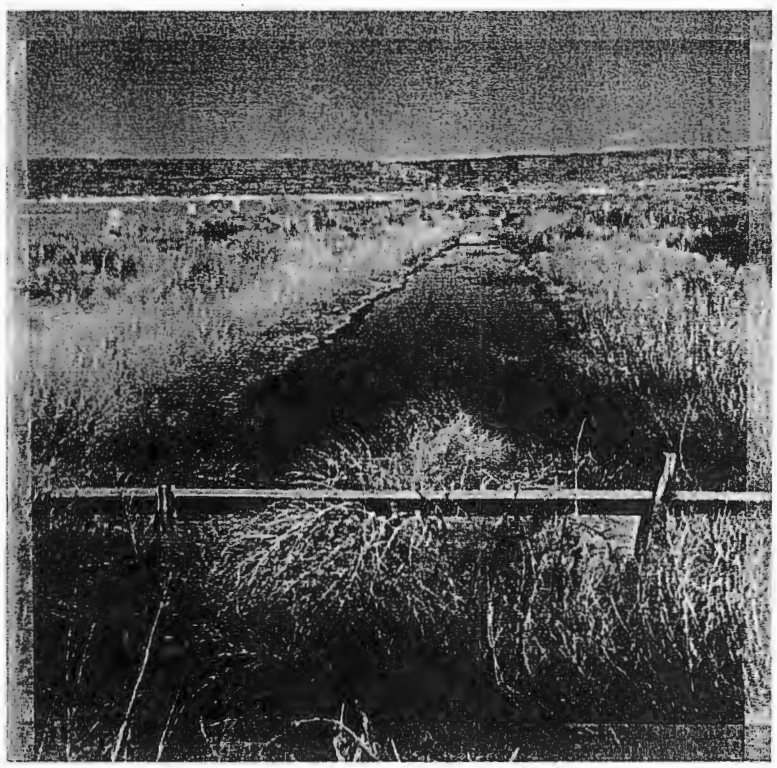

Figure J-13b. SWMU No. 13, Drainage Ditch Between API Evaporation Ponds and Neutralization Tank Evaporation Ponds Detail Photo

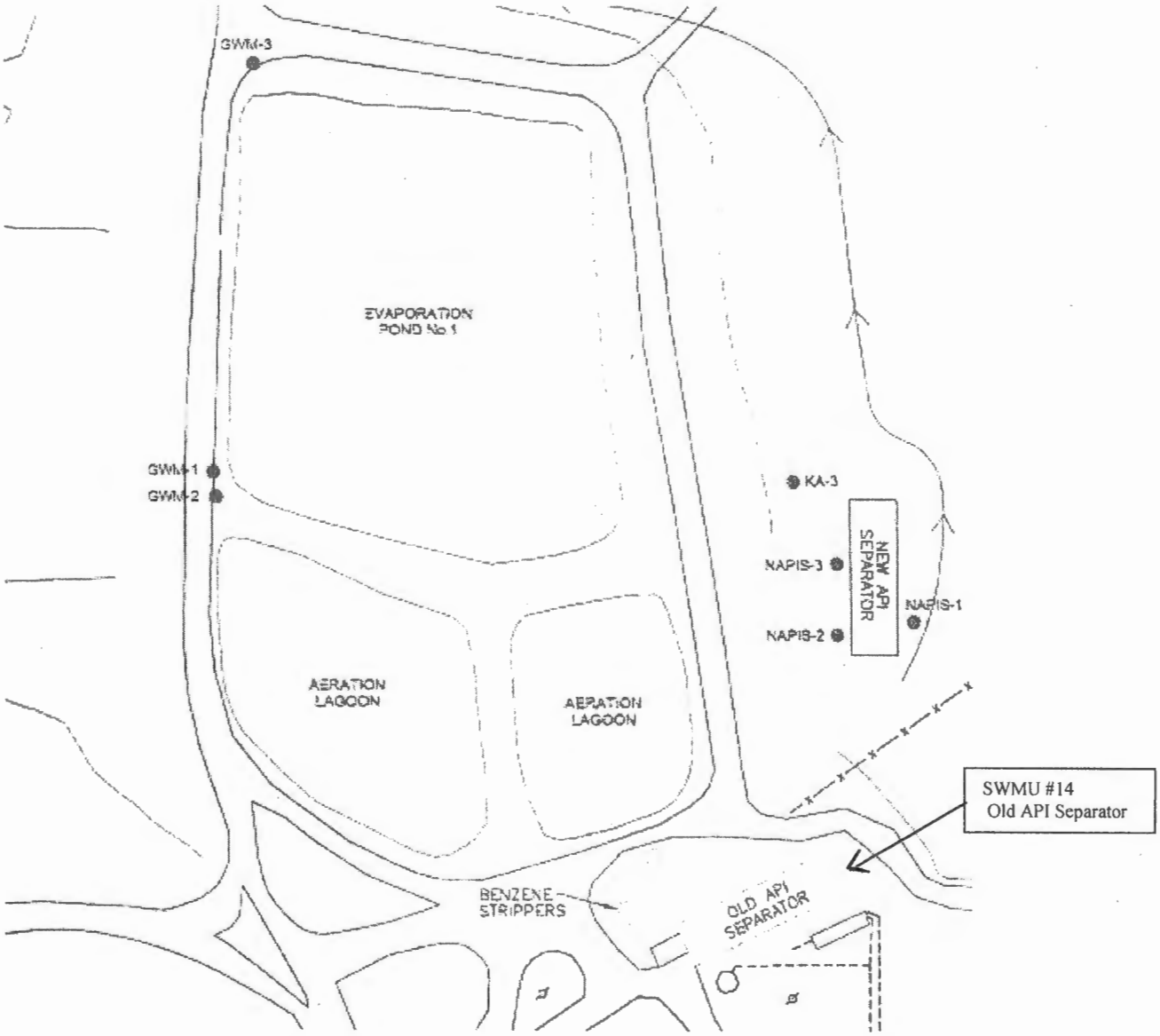

Figure J-14: Locations of SWMU-14 – API Separator (made up of the Old API Separator and the New API Separator)

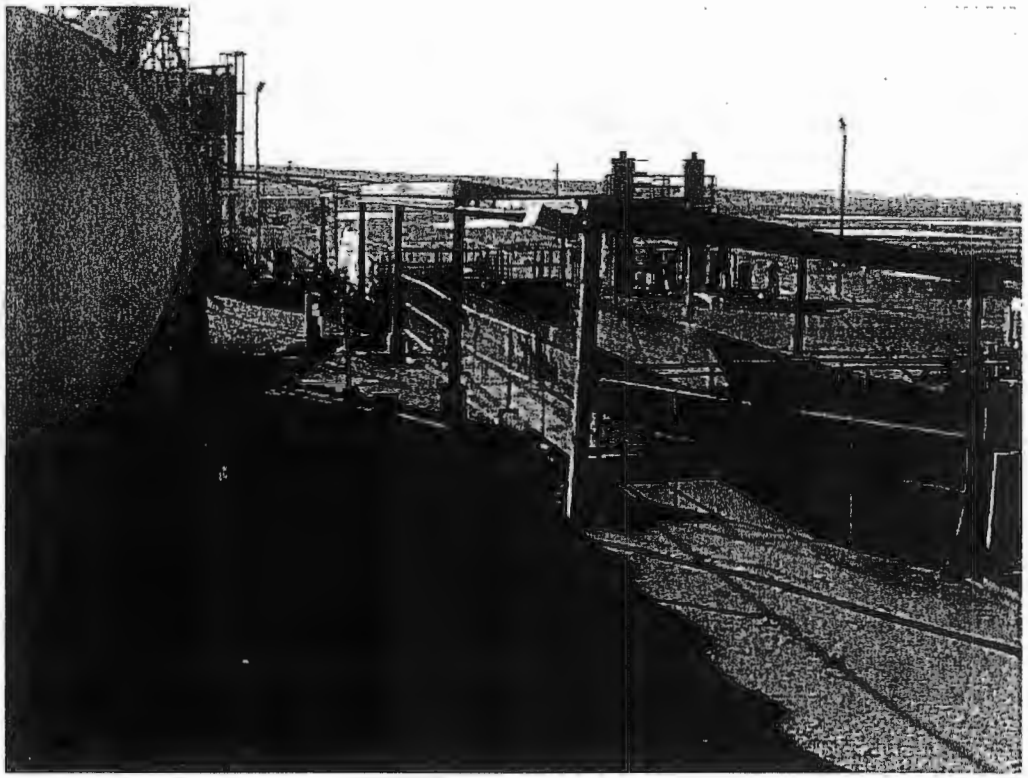

Photo 1
Looking west at south side of OAPIS.

Section K.0

K.O OTHER FEDERAL LAWS

Title 20, New Mexico Administrative Code, Chapter 4, Part I, subpart IX, §270.3 and §270.14 (b) (20 requires that the following federal laws be given consideration when applying for a Resource Conservation and Recovery Act permit. When any of these laws is applicable, its procedures must be followed:

- The Wild and Scenic Rivers Act (16 United States Code [U.S.C.] 1270 et seq.). This Act provides for a national wild and scenic rivers system and prohibits construction of any waterway that would have a direct adverse effect on the values for which a wild and scenic river was established.

- The National Historic Preservation Act of 1966 (16 U.S.C. 470 et seq.). This Act establishes a program for the preservation of historic properties throughout the country; the Act has provisions that require mitigation of adverse effects to registered properties.

- The Endangered Species Act of 1973 (16 U.S.C. 1531). This Act provides for the conservation of endangered and threatened species of fish, wildlife, and plants. It requires assurance that any action will not jeopardize the continued existence of any endangered or threatened species or adversely affect its
critical habitat.

- The Coastal Zone Management Act of 1972 (16 U.S.C. 1451 et seq). This Act establishes national policy for the management, use, protection, and development of land and water resources of the nation's coastal zones. Section 307© of the Act and implementing regulations prohibit the EPA from issuing a permit for any activity affecting coastal zone land or water without the certification from the applicant that the activity is in compliance with the state Coastal Zone Management Program.

- The Fish and Wildlife Act of 1934, as amended (16 U.S.C. 661 et seq). This Act promotes the conservation of wildlife, fish, and game, and integrates this conservation with water resource projects. Certain provisions of the Act require that permits proposing or authorizing the impoundment, diversion, or other control or modification of any body of water be considered by the appropriate state agency for impacts to wildlife resources.

Because the Gallup Refinery has on going programs subject to the National Historic Preservation Act, the Endangered Species Act and the Fish and Wildlife Act, consideration was given to these federal laws. Provisions in the Wild and Scenic Rivers Act and the Coastal Zone Management Act are not applicable to Gallup Refinery's activities.

Section L.0

L.0 CERTIFICATION

In accordance with the New Mexico Administrative Code, Title 20, Chapter 4, Part I, subpart IX, §270.11 (d), revised January 1, 1997, I certify under penalty of the law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure 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.

Mark B. Turri

Mark B. Turri, General Manager
Western Refining Southwest, LLC
Gallup Refinery

2/23/10

Date

Section M.0

M.O REFERENCES

50 FR 278702. July 15, 1985. Federal Register 50: 278702

20 NMAC 4.1 Subpart V, Title 20, New Mexico Administrative Code, Chapter 4, Part 1, Subpart V, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities," Santa Fe, New Mexico, New Mexico Environmental Improvement Board.

20 NMAC 4.1 Subpart IX, Title 20, New Mexico Administrative Code, Chapter 4, Part 1, Subpart IX, "The Hazardous Waste Permit Program," Santa Fe, New Mexico Environmental Improvement Board.

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RCRA
PART A AND PART B
POST CLOSURE
PERMIT APPLICATION

LAND TREATMENT UNIT
WESTERN REFINING COMPANY
GALLUP REFINERY

VOLUME II

APPENDICES A – H

APPENDICES

Appendix	
A	Chemical and Physical Properties of Hazardous Waste Streams
B	Deleted – Waste Analysis Plan
C	Land Treatment Unit Historical Information and Data
D	Land Treatment Demonstration Engineering Report
E	Post-Closure Monitoring Plan
F	Deleted
G	Well Construction Logs
H	Financial Test and Corporate Guarantee (Closure and Post-Closure)

ACRONYMS AND ABBREVIATIONS

%C	percent of completeness
%R	percent recovery
20NMAC 4.1	Title 20 New Mexico Administrative Code, Chapter 4, Pat 1
ASO	Acid-soluble oil
BFB	4-Bromofluorobenzene
BTEX	benzene, toluene, ethyl benzene, and xylene
BTZ	below the treatment zone
CAP	Corrective Action Plan
CEC	carbon exchange capacity
CFR	Code of Federal Regulations
Ciniza	Giant Refining Company – Ciniza Refinery
CME	comprehensive monitoring evaluation
C: N: P:	Carbon: nitrogen: phosphorus
COC	chain of custody
CWWCS	Contact Wastewater Collection System
DMP	detection monitoring plan
DOT	U.S. Department of Transportation
DQO	data quality objective
EDP	early detection plan
EDS	early detection system
EDW	early detection well
EM	environmental manager
EPA	U.S. Environmental Protection Agency
ERC	Emergency Response Coordinator
FR	Federal Register
FRP	facility response plan
Gallup	Gallup Refining Company
Giant	Giant Refining Company
I-40	Interstate 40
LCS	laboratory control sample
LTD	land treatment demonstration
LTU	land treatment unit
MDL	method detection limit
MW	monitoring well
NFA	no further action
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMED/HRMB	New Mexico Environment Department/Hazardous & Radioactive Material Bureau
NMOCD	New Mexico Oil Conservation Division
PHC	principal hazardous constituent
PPE	personal protective equipment
PVC	polyvinyl chloride
QA	quality assurance

ACRONYMS AND ABBREVIATIONS - Continued

QA/QC	quality assurance/quality control
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFA	Resource Conservation Recovery Act Facility Assessment
RFI	Resource Conservation Recovery Act Facility Investigation
RPD	relative percent difference
SAL	screening action level
SAP	sampling and analysis plan
SMW	shallow monitoring well
SOP	standard operating procedure
SVOC	semi-volatile organic compound
SWMU	solid waste management unit
TPH	total petroleum hydrocarbons
TZ	treatment zone
TEGD	RCRA Ground Water Monitoring Technical Enforcement Guidance Document (EPA 1986)
U.S.C.	United States Code
UST	underground storage tank
VCAP	Voluntary Corrective Action Plan
VOA	volatile organic analyte
VOC	volatile organic compound
WAP	waste analysis plan
Western	Western Refining
ZOI	zone of incorporation

Appendix A

APPENDIX A

Chemical and Physical Properties of Hazardous Waste Streams

2.0 CHEMICAL AND PHYSICAL PROPERTIES OF HAZARDOUS WASTES

The Ciniza Refinery generates the following listed hazardous wastes:

ID	HAZARDOUS WASTE
D007	Cooling water filter sludge
K049	Slop Oil emulsion solids
K050	Heat Exchanger Bundle Cleaning Sludge
K051	API separator sludge
K052	Leaded Tank bottoms

The wastes are generated through intermittent cleaning operations. Because small volumes are generated on an intermittent schedule, development of characterization analysis is accomplished by waste analyses at each cleaning event. The following sections provide characterization based on industry-wide reports and available Ciniza Refinery data.

2.1 Hazardous Waste Properties - Industry Data

2.1.1 Waste: API Separator Sludge

Reference: Brown, K.W.; Deuel, Jr., L.E.; Thomas, J.C.; Land Treatability of Refinery and Petrochemical Sludges; July 30, 1982; Grant No. R 805474013; USEPA, Cincinatti, OH 45268; pages 15 and 101.

Analysis A:

Parameter	Value
Density	1.2g/cm3
Cd	3.3 ppm
Cr	51.0 ppm
Cu	227.7 ppm
Pb	14.1 ppm
Ni	14.1 ppm
Se	9.2 ppm
Na	1,734.8 ppm
Va	6.5 ppm
Zn	555.2 ppm
Percent H_2O	46.0 percent
Residue	49.3 percent
Total Carbon	7.3 percent
Ash	41.0 percent
Sulfur	0.9 percent
Total N	0.1 percent
Total extractable C	10.0 percent
Pentane extractable	72.0 percent
Benzene extractable	22.0 percent
CH_3C_{12} extractable	6.0 percent

Analytical Method A

Water content was determined by distillation. Solvent extractables were quantified gravimetrically after being refluxed five times with the respective solvents in a Soxhlet apparatus. Residues were heated at 750°C to determine ash content. Total sulfur was ascertained by an iodometric titration of SO_2 after oxidative combustion using a Leco induction furnace. Total N was found by Nesslerization following ammonification of all N sources with a H_2SO_4:K_2SO_4 and mercuric oxide solution. Wet combustion with potassium dichromate and H_2So_4:H_3PO_4 was used to determine C by gravimetric analysis of CO_2 evolution. Metals were measured using atomic absorption spectrophotometry following a HNO_2-H_2O_2 digestion of the sludge.

Analysis B:

Parameter	New Percent (weight) of Bulk Sludge
Water	45.7
Soxhlet Extractable (total)	9.93
Pentane fraction	7.17
Benzene fraction	2.20
Dichloromethane fraction	0.56
Residue	
Air dry	40.6
Stable to 750.C	37.8
Sulfur	0.88
Nitrogen	0.09
Carbon (wet combustion)	7.3

Distribution of hydrocarbons gravimetrically determined after fractionation of extracts on silica gel.

Saturates, percent	64
Aromatics, percent	36

Analytical Method B:

Composition of the API separator sludge is in percent of wet weight. Sequential Soxhlet extraction showed that 9.9 percent of the waste was solvent extractable. Reversing the order of solvent had no affect on the total extractable value but drastically altered the distribution. Dichloromethane extracted 100 percent of the materials partitioned by solvents, with succeeding benzene and pentane fractions coming up clean. Greater than 85 percent of the API separator sludge wet mass was attributed to water and a non-extractable residue. An average of 37.8 percent of the wet weight components or 95 percent of the non-extractable and heat stable residue is attributed to structural water loss from the mineral fraction. The average total organic carbon (TOC) determined by wet oxidation and gravimetric assay of CO_2 absorbed

was 7.3 percent on a wet weight basis. This value compares favorably to the total extracted value considering that hydrocarbons contain other elements than just carbon.

The API separator sludge material contained approximately 10 percent extractable hydrocarbons distributed as 60 percent saturates and 40 percent aromatic in character. Eighty-six percent of the carbon value assayed by wet combustion technique was quantified by GLC, standardized to a carbon response. Nearly 80 percent of the total extracted hydrocarbons were recovered following fractionation on silica gel. The saturate fraction was characteristically 88 percent carbon. No attempt was made to characterize the aromatic fraction of the API separator sludge, other than by gas-liqud chromatographic analysis.

2.1.2 Waste: API Separator Sludge

Reference: Berkowitz, J.B. et al; A.D. Little, Inc.; Land Treatment Field Studies, Volume 2. Oily Waste From a Petroleum Refinery; May 1981; Contract No. 60-03-2602; USEPA, Cincinnati, OH 45268; page 7.

Analysis:

Parameter	Percent by Weight
Water	55
Oil	11
Solids	34

Analytical Method:

No Data Available

2.1.3 Waste: API Separator and Cooling Tower Sludge

Reference: Environmental Research and Technology, Inc.; The Land Treatability of Appendix VIII Constitutents Present in Petroleum Industry Wastes; Document B-974-220, May 1984, American Petroleum Institute (API).

ANALYSIS:

Waste	Percent		
	Hydrocarbons or oil	Water	Solids
API Separator Sludge	8	73	19
Cooling Tower Sludges	1	74	25

Analysis Method:

Engineering-Science, Inc. 1976. The 1976 API Refinery Solid Waste Survey. Prepared for the American Petroleum Institute, Washington, D.C.

2.1.4 Waste: API Separator Sludge, Leaded Tank Bottoms, Cooling Tower Sludge, Heat Exchange Bundle Cleaning Sludge, Slop Oil Emulsion Solids

ReferenceEMT, May 1984, page 3-8

Analysis: Parameter (mg/kg)[a]

Waste	Arsenic		Beryllium	Cadium		Chromium		Cyanide		Fluoride	Lead	
	Eng/Sc	Jacobs	Jacobs	Eng/Sc	Jacobs	Eng/Sc	Jacbos	Eng/Sc	Jacobs	Eng/Sc	Eng/Sc	Jacobs
API Separator Sludge	2.0	6.2	0.0025	1.04	0.42	161.5	253.0	0.29	0.001	4.5	45.0	26.0
Tank Bottoms (Leaded)	NA	294	0.0025	NA	6.3	NA	11.4	NA	0.009	NA	NA	790.0
Cooling Tower Sludge[b]	8.3	8.2	0.0013	0.9	0.3	865.0	554.0	NA	0.1	NA	40.0	38.0
Heat Exchange Bundle Cleaning Sludge	NA	10.6	0.20	NA	1.3	NA	311.0	NA	1.7	NA	NA	78.0
Slop Oil Emulsion Solids	NA	7.4	0.0025	NA	0.19	NA	525.0	NA	0.001	NA	NA	28.1

Waste	Mercury		Nickel		Selenium		Vanadium		Copper		Zinc	
	Eng/Sc	Jacobs	Eng/Sc	Jacobs	Eng/Sc	Jacobs	Eng/Sc	Jacobs	Eng/Sc	Jacobs	Eng/Sc	Jacobs
API Separator Sludge	0.3	0.4	11.7	19.3	0.2	0.001	13.7	9.8	55.2	18.6	191.6	298.0
Cooling Tower Sludge[b]	0.12	0.09	15.0	6.8	1.6	0.015	29.0	7.8	170.0	50.0	490.0	675.0
Tank Bottoms (Leaded)	NA	0.57	NA	314.0	NA	6.95	NA	5.4	NA	141.0	NA	9092.0
Heat Exchange Bundle Cleaning Sludge	NA	1.9	NA	116.0	NA	27.2	NA	25.0	NA	71.0	NA	194.0
Slop Oil Emulsion Solids	NA	0.59	NA	50.0	NA	1.0	NA	25.0	NA	40.0	NA	250.0

[a] Jacobs data reported on a dry weight basis, Eng/Sc is on a whole/weight basis.
[b] Engineering Science (Eng/Sc) data is for solid phase only.
NA = Not Analyzed

2.1.5 Waste: API Separator Sludge, Leaded Tank Bottoms, Cooling Tower Sludge, Heat Exchanger Bundle Cleaning Sludge, Slop Oil Emulsion Solids

Reference: ERT, MAY 1984

Analysis:

Waste	Benzo-a-Pyrene mg/kg	Phenol mg/kg
API Separate Sludge	0.004	6.5
Leaded Tank Bottoms	0.21	126
Cooling Tower Sludge	0.004	3.5
Heat Exchanger Bundle Cleaning Sludge	2.2	13.3
Slop Oil Emulsion Solids	0.003	15.0

Analysis Method:

Jacobs Engineering Co., 1976. Assessment of Hazardous Waste Practices in the Petroleum Refining Industry. PB-219-059. USEPA.

2.1.6 Waste: API Separator Sludge

Reference: ERT, May 1984

Analysis:

Parameter	mg/kg
Benzene	230
Toluene	1200
Phenol	0.19
Benzo-a-anthracene	160
Chrysene	140

Analysis Method:

Can Viro Consultants, 1983. The Significance of Trace Substances in Petroleum Industry Sludges Disposed of on Land: A Literature Survey. PACE Report No. 83-2.

2.1.7 WASTE: API Separator and Slop Oil Solids

Reference: ERT, MAY 1984

Analysis:

Parameter	EP Toxicity Extracts mg/l in extract[a] API Separator	Slop Oil Emulsion Solids
Toluene	0.31 - 5.7	4.8 - 13
Napthalene	0.01 - 0.24	0.14 - 1.6
Fluoranthene	0.035 - 9.4	1.7
Chrysene/ Benzanthracene	0.14 - 15	0.40 - 1.5
Benzo-a-pyrene/ Benzofluoranthene	22.7	2.9

[a]The concentration in micrograms/grams of original solid is at least 20 times the value given for mg/l in extract

Analysis Method:

Burke, S.L. and Wagner, I, 1982. Characterization and Treatment of Aqueous Waste and Residues from Petroleum Refineries. EPA Cooperative Agreement No. CR 806798.

2.1.8 Waste: Refinery Sludges

Reference:

(ERT, June 1983) Environmental Research and Technology, Inc. June 1983; Land treatment Practices in the Petroleum Industry; prepared for the American Petroleum Institute (API).

Analysis:

Parameter	mg/kg Range of values Mean of values Median of values Number of samples
Arsenic	0 - 317 31.3 8.3 30

Cadmium	0 - 19.4 4.3 1.59 30
Chromium, Total	1 - 5009 387.3 66.6 30
Copper	0 - 527 80.5 17.6 29
Lead	0 - 1914 191.6 31.2 30
Mercury	0 - 26.4 2.5 0.4 30
Nickel	2.3 - 520 57.3 20.7 30
Selenium	0 - 437.7 33.7 4.15 30
Vanadium	0 - 176.9 30.1 10.6 30
Zinc	2.5 - 3130 413.5 66.1 30

Analysis Method:

Engineering Science, Inc., 1976. The 1976 API Refinery Solid Waste Survey. Prepared for the American Petroleum Institute (API), Washington, D.C.

2.1.9 Waste: API Separator Sludge and Composite Oily Sludge (Slop Oil Emulsion Solids)

Reference: ERT, June 1983, page 2-8.

Analysis:

API Separator Sludge

Parameter	Value, percent (weight)/range
Sludge Oil Content	9.0 4.6 - 17.6
Oil Phase Hydrocarbon Fractions	
Saturates	53.5 48.0 - 66.1
Olefins	1.3 0 - 2.3
Aromatics	33.3 30.3 - 36.0
Polar/Asphaltenes	12.6 8.5 - 19.9
Phenols	2.8 mg/l

Composite Oily Sludge

Parameter	Value, percent (weight)/range
Sludge Oil Content	21.8 3.2 - 41.0
Oil Phase Hydrocarbon Fractions	
Saturations	59.6 51.3 - 70.2
Olefins	2.6 0.9 - 2.9
Aromatics	30.2 24.7 - 35.5
Polar/Asphaltenes	7.6 5.9 - 12.8

Phenols	6.7 mg/l 0.9 - 14.9 mg/l

Analysis Method:

Weldon, R., 1982. Biodegradation of Oily Sludge by Soil Microorganisms. Prepared for the American Petroleum Institute (API), Washington, D.C.

2.1.10 Waste: API Separator Sludge

Reference: ERT, June 1983, page A-12

Analysis:

Parameter	Value
Oil	25 percent
Water	60 percent
Solids	15 percent
Chromium	100-500 ppm
Copper	500-1500 ppm
Nickel	100-500 ppm
Zinc	500-1000 ppm
pH	8.0

Analysis Method:

American Petroleum Institute, 1983. Personal communique with participating companies. API, Washington, D.C.

2.2 Hazardous Waste Properties - Ciniza Refinery Data

Appendix A contains reports for the wastes land treated at Ciniza Refinery which cover the period November 1980 through March 1984 and where performed by the private laboratory, Controls for Environmental Pollution, Inc., Santa Fe, New Mexico.

Based on the recent analyses of the wastes to be land treated at Ciniza, suggestions of Region VI EPA staff, and the Appendix VIII 40 CFR 261 constituent list, waste sampling and analyses listed in Table 2.2-1 are being completed.

TABLE 2.2-1

CINIZA REFINERY WASTES PHYSICAL AND CHEMICAL PARAMETERS REQUESTED NOVEMBER, 1984[a]

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Listed analyses for D007, K049, K050 and K051 shall be submitted to USEPA in a timely manner after receiving the revised Appendix VIII procedures guidance; waste K052 shall be analyzed after the next leaded tank cleaning event.

Physical Parameters

1. Bulk density
2. Solids weight fraction
3. Oil weight fraction
4. Water weight fraction

Chemical-Inorganic Parameters

5. Electrical conductivity
6. pH
7. Antimony (App. VIII)
8. Arsenic (App. VIII)
9. Barium (App. VIII)
10. Beryllium (App. VIII)
11. Cadmium (App. VIII)
12. Chromium (App. VIII)
13. Mercury (App. VIII)
14. Lead (App. VIII)
15. Nickel (App. VIII)
16. Selenium (App. VIII)
17. Vanadium (App. VIII)

Chemical - Organic Parameters

18. Volatile organic compounds fraction

19. Total organic carbon

Appendix VIII Constituents

20. Acetonitrile (Ethanenitrile)
21. Acrolein (2-Propenal)
22. Acrylonitrile (2-Propenenitrile)
23. Aniline (Benzenamine)
24. Benz (c) acridine (3,4-Benzacridine)
25. Benz (a) anthracene (1,2-Benzanthracene)
26. Benzene (Cyclohexatriene)
27. Benzenethiol (thiophenol)
28. Benzidine (1,1-Biphenyl-4, 4-diamine)

29. Benzo (b) fluoranthene (2,3-Benzofluoranthene)
30. Benzo (j) fluoranthene (7,8-Benzofluoranthene)
31. Benzo (a) pyrene (3,4-Benzophyrene)
32. Benzyl chloride (Benzene, (Chloromethyl)-)
33. Bis (2-chloroethyl) ether (Ethane, 1,1-oxybis (2-chloro-)
34. Bis (2-chloroisopropyl) ether (Propane, 2,2-oxybis (2-chloro-))
35. Bis (chloromethyl) ether (Methane, oxybis (chloro))
36. Bis 2-ethylhexyl) phthalate (1,2-Benzenedicarboxylic acid, bis (2-ethylhexyl) ester)
37. Butyl benzyl phthalate (1,2-Benzenedicarboxylic acid, butyl phenylmethyl ester)
38. Carbon disulfide (carbon bisulfide)
39. p-Chloro-m-cresol
40. Chlorobenzene (Benzene, chloro-)
41. Chloroform (Methane, trichloro-)
42. Chloromethane (Methyl chloride)
43. 2-Chloronapthalene (Naphthalene, beta-chloro-)
44. 2-Chlorophenol (Phenol, o-chloro-)
45. Chrysens (1,2-Benphenanthrene)
46. Cresols (Cresylic acid) (Phenol, methyl-)
47. Crotonaldehyde (2 Butenal)
48. Cyanide
49. Dibenz (a,h) acridine (1,2,5,6-Dibenzacridine)
50. Dibenz (a,j) acridine (1,2,7,8-Dibenzacridine)
51. Dibenz (a,h) anthracene (1,2,5,6-Dibezanthracene)
52. 7H-Dibenzo (c,g) carbazole (3,4,5,6-Dibenzcarbazole)
53. Dibenzo (a,e) pyrene (a,2,4,5-Dibenzpyrene)
54. Dibenzo (a,h) pyrene (1,2,5,6-Dibenzpyrene)
55. Dibenzo (a,i) pyrene (1,2,7,8-Dibenzpyrene)
56. 1,2-Dibromoethane (Ethylene-dibromide)
57. Di-n-butyl phthalate (1,2-Bezenedicarboxylic acid, dibutyl ester)
58. Dichlorobenzenes
59. 1,2-Dichloroethane (Ethylene dichloride)
60. trans-1,2-Dichloroethene (1,2-Dichlorethylene)
61. 1,1-Dichloroethylene (Ethene, 1,1-dichloro)
62. Dichloromethane (Methylene chloride)
63. Dichloropropane
64. Dichloropropanol
65. Diethytl phthalate (1,2-Benzenedicarboxylic acid, dimethyl ester)
66. 7,12-Dimethyl-benz(a)anthracene
67. 2,4-Dimethylphenol (Phenol, 2,4-dimethyl-)
68. Dimethyl phthalate (1,2-Benzenedicarboxylic acid, dimethyl ester)
69. 4,6-Dinitro-o-cresol
70. 2,4-Dinitrophenol (Phenol, 2,4-nitro-)
71. 2,4-Dinitrotoluene (Benzene, 1-methyl-2,4-dinitro-)
72. Di-n-octylphthalate (1,2-Benzenedicarboxylic acid, dioctyl ester)
73. 1,4-Dioxane (1,4-Diethylene oxide)
74. 1,2-Diphenylhydrazine (Hydrazine, 1,2-diphenyl-)
75. Ethyleneimine (Azridine)
76. Ethylene oxide (Oxirane)
77. Fluoranthene (Benzo (j,k) fluorene)
78. Formaldehyde
79. Hydrogen sulfide (sulfur hydride)
80. Indeno (1,2,3-cd)pyrene (1-10(1,2-phenylene)pyrene)
81. Methanethiol (Thiomethanol)

82. 3-Methylchlolanthrene (benz (j) aceanthrylene, 1,2-dihydro-3-methyl-)
83. Methyl ethyl ketone (MEK) (2-Butanone)
84. Naphthalene
85. p-Nitroaniline (Benzenamine, 4-nitro-)
86. Nitrobenzene (Benzenamine, 4-nitro-)
87. Nitrobenzene (Benzene, nitro-)
88. 4-Nitrophenol (Phenol, pentachloro-)
89. Pentachlorophenol (Phenol, pentachloro-)
90. Phenol (Benzene, hydroxy-)
91. Pyridine
92. Tetrachloroethanes
93. Tetrachloroethylene (Ethene, 1,1,2,2-tetra chloro-)
94. Toluene (Benzene, methyl-)
95. Trichlorobenzenes
96. Trichloroethanes
97. Trichloroethene (Trichloroethylene)
98. Trichlorophenols

NON-APPENDIX VIII CONSTITUENTS EXPECTED TO BE PRESENT

99. Cobalt
100. 1-Methylnapthalene
101. Styrene
102. Hydroquinone
103. Anthracene
104. Indene
105. 5-Nitro acenapthene
106. Quinoline
107. Phenanthrene
108. Pyrene

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[a]Parameters include those requested in the Region VI technical review comments of September 21, 1984 and the Appendix VIII constituents listed in the Memorandum dated April 3, 1984 from John Skinner, Director, Office of Solid Waste Analysis for Land Treatment Permit Applications.

The analytical methods employed to analyze the parameters listed in Table 2.2-1 are shown in Table 2.2-2.

Table 2.2-2 ANALYTICAL METHODS FOR CINIZA HAZARDOUS WASTE CHARACTERIZATION

Non-Appendix VIII Constituents

Parameter/Constituent	Method/Reference
Bulk density	213 E/a
Solids weight fraction	209 E/a
Oil weight fraction	503 A/a
Water weight fraction	503 A/a
Electrical Conductivity	120.1/b
pH	150.1/b
Volatile organic compounds	c
Total organic carbon	415.1/b
Table 2.2-1, 99-108	Same as Appendix VIII

Appendix VIII Constituents[e,f]

Parameter/Constituent	Test Method/Reference
all metals	3050/d
Volatile compounds	8240 with polyethylene glycol (PEG)/d
semi-volatile compounds	Attachment 2/e

[a]Standard Methods for the Examination of Water and Wastewater, Fifteenth Edition American Public Health Associates, Inc., North York, N.Y. 10019

[b]EPA-600 4-79-020; Methods for Chemical Analysis of Water and Waster, March 1979.

[c]SW-874 Hazardous Waste Land Treatment; USEPA, April 1983: volatile organic compound fraction determination; page 114.

[d]SW-846 Test Methods for Evaluating Solid Waste-Physical/Chemical Methods; Second Edition; USEPA, July 1982

[e]Memorandum: Guidance on Petroleum Refinery Waste Analysis for Land Treatment Permit Applications; John Skinner, Director of Office of Solid Waste; April 1984 (see Appendix A-2 of the Permit)

[f]Proposed sampling and Analytical Methodologies, supplemental to SW-846, FR Vol 49, No. 191, October 1, 1984; available as PB 85-103-026, National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161, 703-467--4600.

APPENDIX A

CUSTOMER Dames and Moore
ADDRESS Suite 398W, City Center
CITY 6400 Uptown Blvd., N.E.
ATTENTION Albuquerque, NM 87110
CODE NO Bill Mead
012050

REPORT OF ANALYSIS

SAMPLES RECEIVED 11/10/80 CUSTOMER ORDER NUMBER

TYPE OF ANALYSIS Sludge

EPA ID	Sample Identification	Type of Analysis		
K052	Leaded Tank Sludge;	Lead (Total)	690	ug/g
	Tank 59	EP Lead	0.08	mg/liter
	Date Collected 11/4/80	Total Organic Lead	2.4	ug/gm

APPROVED BY
Elmer D. Martinez, Operations Division, Mg
12/11/80 PAGE 19 OF 19 PAGE

Controls for Environmental Pollution, Inc.
P.O. Box 6251 • 1925 Rosina • Santa Fe, New Mexico 37502

CUSTOMER Dames & Moore
ADDRESS Suite 398W, City Center
CITY 6400 Uptown Blvd., N.E.
ATTENTION Albuquerque, NM 87110
FROM Bill Mead
012179

REPORT OF ANALYSIS

SAMPLES RECEIVED 11/10/80 CUSTOMER ORDER NUMBER

TYPE OF ANALYSIS Sludge (Date Collected 11/6/80)

Sample Identification	Type of Analysis	mg/liter
API Seperator Emulsion	Arsenic	< 0.01
[illegible] ID – K051	Barium	< 10
	Cadmium	< 0.001
	Chromium	0.006
	Chromium 6+	< 0.01
	Lead (Total)	6.1
	Mercury	< 0.004
	Selenium	< 0.01
	Silver	< 0.01
	Total Chrome	200 ug/gm
		percent by weight
	Total Organic Carbon	17.8

APPROVED BY
Elmer D. Martinez, Operations Division, Mgr
12/24/80 PAGE 1 OF 1 PAGE

Controls for Environmental Pollution, Inc.
Santa Fe, New Mexico 87502

Controls for Environmental Pollution, Inc.
P.O. Box 5351 • Santa Fe, New Mexico 87502

1 CEP, Inc. REPORT LAB # 84-03-404

!VED: 03/30/84 04/25/84 15:22:12

:PORT Giant Refining Company
TO Route 3 Box 7
Gallup, NM 87301

:TTEN R C Anderson

:IENT GIANT REF SAMPLES 3
:PANY Giant Refining Company
ILITY

:K ID Water Quality
TAKEN
TRANS Self
TYPE Sludge
O # 75623
/OICE under separate cover

PREPARED BY Controls for Environmental Pollution, Inc.
1925 Rosina Street
Santa Fe, NM 87502

ATTEN
PHONE (505) 982-9841

CERTIFIED BY

CONTACT GAIL

Analyses reported as mg/liter were done on an EP Toxicity prep

EAMPLE IDENTIFICATION

Cooling Tower Sludge
Heat Exchanger Sludge
API Seperator Sludge

CEP, Inc. TEST CODES and NAMES used on this report

AG 1	Silver
AS 1	Arsenic
BA 1	Barium
CD 1	Cadmium
CR 1	Chromium
CR 6 1	Chromium, Hexavalent (6+)
CR S	Chromium
HG 1	Mercury
O G 5	Oil and Grease
PB 1	Lead
PB S	Lead
PH S	pH
SE 1	Selenium
TOC 5	Total Organic Carbon

Controls for Environmental Pollution, Inc.
P O BOX 5351 • Santa Fe, New Mexico 87502
LOCAL 505/988-9611
OUT OF STATE 800/545-4188

2

REPORT OF ANALYSIS

LAB # 84-03-404

LE IDENTIFICATION	DATE COLLECTED	TYPE OF ANALYSIS	mg/liter	
ing Tower Sludge	03/29/84	Silver	<0.01	
		Arsenic	<0.01	
		Barium	0.4	
		Cadmium	<0.001	
		Chromium	0.063	
		Chromium, Hexavalent	<0.01	
		Chromium	170	(ug/gram)
		Mercury	<0.0004	
		Oil and Grease	29,000	(ug/gram)
		Lead	0.001	
		Lead	140	(ug/gram)
		pH	9.15	(units)
		Selenium	<0.01	
		Total Organic Carbon	>400,000	

Controls for Environmental Pollution, Inc.
P.O. BOX [illegible] • Santa Fe, New Mexico 87504
[illegible]

E 3

REPORT OF ANALYSIS

LAB # 84-03-404

PLE IDENTIFICATION	DATE COLLECTED	TYPE OF ANALYSIS	mg/liter	
t Exchanger Sludge	03/29/84	Silver	<0.01	
		Arsenic	<0.01	
		Barium	0.1	
		Cadmium	0.001	
		Chromium	<0.001	
		Chromium, Hexavalent	<0.01	
		Chromium	15	(ug/gram)
		Mercury	<0.0004	
		Oil and Grease	22,500	(ug/gram)
		Lead	0.003	
		Lead	330	(ug/gram)
		pH	11.2	(units)
		Selenium	<0.01	
		Total Organic Carbon	>400,000	

Controls for Environmental Pollution, Inc.
P.O. BOX 5351 • Santa Fe, New Mexico 87502
IN STATE 505/982-9041
OUT OF STATE 800/545-2100

REPORT OF ANALYSIS

LAB # 84-03-404

PLE IDENTIFICATION	DATE COLLECTED	TYPE OF ANALYSIS	mg/liter	
Seperator Sludge	03/13/84	Silver	<0.01	
		Arsenic	<0.01	
		Barium	0.4	
		Cadmium	<0.001	
		Chromium	0.036	
		Chromium, Hexavalent	<0.01	
		Chromium	10	(ug/gram)
		Mercury	<0.0004	
		Oil and Grease	26,000	(ug/gram)
		Lead	<0.001	
		Lead	340	(ug/gram)
		pH	9.30	(units)
		Selenium	<0.01	
		Total Organic Carbon	>400,000	

Appendix B

Appendix B

WASTE ANALYSIS PLAN

Hazardous waste application to the LTU ceased in 1990, and non-hazardous waste application ceased in 1993.

Appendix C

APPENDIX C

Land Treatment Unit Historical Information and Data

LAND TREATMENT UNIT HISTORICAL INFORMATION AND DATA

1.0 LAND TREATMENT HISTORY

Historical LTU information and data extracted from existing permit applications, operating permits, operating records, and other source documents are provided as Appendix C. The inclusion of this appendix does not imply that historical information and data have been verified.

In August 1980, Ciniza Refinery (Ciniza) notified U.S. Environmental Protection Agency (EPA) that it was a generator and operator of a hazardous waste management facility. In November 1980, Ciniza submitted a Part A permit application as an "existing facility" (defined at 40 Code of Federal Regulations §264.10). This granted Ciniza interim status for their Land Treatment Unit (LTU) operations. In response to notice from the Regional Administrator, Ciniza submitted a Part B permit application in December 1983. Based on changing guidance, Ciniza submitted a land treatment demonstration plan (LTD) and an application for a two-phase LTD permit in April 1985. On February 9, 1987, Ciniza was issued a short term LTD Permit (NMD000333211-1) to conduct a hazardous waste land LTD. The LTD was conducted to identify the land treatment capabilities for refinery waste generated by Ciniza. The LTD defined waste management parameters (e.g., rate limiting constituent, application limiting constituent, capacity limiting constituent, and unit life of the LTU). This was accomplished by identifying the Principal Hazardous Constituents (PHCs) present in refinery waste streams and measuring their degradation, transformation, and immobilization in the treatment zone of the LTU. From the results of the LTD and modified Part B permit application, Ciniza was issued a Hazardous Waste Facility Permit (NMD 000333211-2) on November 4, 1988. Ciniza has not applied hazardous wastes to the LTU since November 8, 1990. *Gallup Refinery* (formerly Ciniza) continues with the Post Closure Care of the LTU and conducted the 9-year Post Closure Soil Sampling Event on the Land Treatment Unit and conducted groundwater sampling on the monitoring wells associated with the LTU. The Gallup Refinery has applied for permit renewal for the LTU in February 2010.

1.1 Land Treatment Program [20 NMAC 4.1, subpart IX, §270.20(b)]

Ciniza's Hazardous Waste Facility Permit established operational requirements for the LTU. These requirements include procedural and engineering controls necessary to ensure that hazardous constituents are fully treated within the LTU without uncontrolled release to the environment.

The LTU consists of a treatment zone of soil extending 5 feet deep from the original soil surface. This depth is shallow enough to ensure that the treatment zone is more than 3 feet above the seasonal high water table. The zone of incorporation (ZOI) within the treatment zone is the volume of soil to which the waste was directly applied.

The ZOI for the Ciniza LTU is the top 12 inches of the treatment zone. The LTU was designed and constructed to prevent both washout of any hazardous waste and to prevent inundation of and discharge from the permitted unit through the use of a continuous dike which surrounds the LTU at an elevation of 3 feet above the natural grade.

The ZOI was tilled during permitted operations to encourage aerobic microbial activity and improve chemical reaction rates. During active treatment soil nutrients were applied, as necessary, to optimize carbon: nitrogen: phosphorous (C: N: P :) ratios. Applications of Ciniza wastes to the LTU were limited to ensure that treatment processes were not overwhelmed or poisoned. Performance indicators (e.g., soil moisture, pH, total organic carbon) were monitored in the ZOI to ensure that treatment was proceeding.

1.2 Treatment Zone Description [20 NMAC 4.1, subpart IX, §270.20 (b) (2) and §270.20 (b) (5)]

The LTU consists of three 480 by 240 feet sections, each of which contains 2.6 acres (1.0 hectares) of available treatment surface. Each section is delineated by a continuous dike to prevent run on and run off. The treatment zone extends 5 feet deep from the top of the soil within the dike section. The top 12 inches of the treatment zone is the ZOI. The ZOI is tilled when active to encourage aerobic degradation of organics and to maintain moisture content of the soil. This leaves 4 feet of the treatment zone undisturbed.

The soil within the treatment zone is silty clay containing closely-spaced root systems in the uppermost 3 to 4 feet. Field infiltration rates (the rate at which water penetrates into the soil surface) averages 1.0×10^{-3} cm/sec or 3.6 cm/hr. Soil permeability as determined by laboratory measurements averages 1.9×10^{-5} cm/sec or 6.8×10^{-2} cm/hr for three locations at the 6 to 12 inch depth. Field infiltration rate allows prediction of run off and erosion; permeability (hydraulic conductivity) allows estimation of vertical water movement rates in the soil. The treatment zone soils have a saturated hydraulic conductivity rating of "moderately low" by the U.S. Department of Agriculture Class (Giant Refining Company Part B Permit Application 1984). The low permeability of the treatment zone soil consists in retarding the vertical movement of hazardous constituents through the treatment zone.

The silty clay has a high cat ion exchange capacity (CEC). The CEC is the total amount of exchangeable cat ions that the soil has to exchange with cat ions in the soil solution. The exchangeable cat ions in the LTU are the heavy metals present in the Ciniza wastes. The high CEC results in high sorption of heavy metals in the LTU soils, assuming other factors (such as soil pH) are favorable.

1.3 List of Wastes [20 NMAC 4.1, subpart IX, §270.20 (b) (1)]

This section compiled from information found in Ciniza's Hazardous Waste Facility Permit, identifies the Ciniza waste streams approved for application to the LTU, their associated U.S. Environmental Protection Agency hazardous waste numbers, and their annual application limits. Table I-1 summarizes this information.

1.3.1 Potentially Ignitable Materials (D001)

Ignitable materials applied to the LTU from 1988 to 1990, were generated by refinery operations, specifically filter clay from kerosene filters, unleaded fuels tank bottoms, and soils contaminated by petroleum product spills occurring with the refinery grounds. The waste stream did not include degreasing solvents used within the plan or waste lubricants generated by refinery equipment and vehicles.

1.3.2 Cooling Water Filter Sludge (D007)

Cooling water filter sludge was approved for LTU application, but was never applied. Cooling water filter sludge was generated from the filtration of circulated cooling water to remove solids. The solids were removed to prevent sedimentation and fouling of heat exchangers. The filtered solids were predominately dusts aspirated into the cooling tower.

1.3.3 Slop Oil Emulsion Sludge (K047)

Slop oil emulsion sludge applied to the LTU from 1987 to 1990, was generated when oil collected in the refinery American Petroleum Institute (API) separator was pumped to slop oil recovery tanks. The oil eventually fed to the Crude Unit. The water that was collected in the tank was drained back into the API separator. The slop tanks are cleaned of sludge approximately every five years.

1.3.4 Heat Exchanger Bundle Cleaning Sludge (K050)

Heat exchanger bundle cleaning sludge applied to the LTU from 1987 to 1990, was generated as process units were shut down for maintenance and cleaning. The units were either steam cleaned or water washed with mechanical cleaning, where needed. The cleaning water and sludge was collected in the refinery sewer system which flows into an API separator. The remaining sludge was shoveled into barrels for treatment at the LTU.

1.3.5 API Separator Sludge (K051)

API separator sludge applied to the LTU from 1987 to 1990 was generated from the cleaning of the API separators. Refinery wastewaters, including those from the cooling tower and tank farm, were serviced by the oily water sewer system. The oily water sewer system discharged to a two-parallel-bay API separator. The oil collected from the separator was recovered as slop oil and charged as feed to the Fluid Catalytic Cracking Unit or the Crude Distillation Unit. The oil free and sludge free water from the API separator was discharged to the refinery evaporation ponds. The sludge collected in the bottom of the API separator was removed using a vacuum truck for treatment at the LTU.

1.3.6 Leaded Tank Bottoms (K052)

Leaded tank bottoms applied to the LTU in 1990, were generated when leaded gasoline tanks were cleaned. The leaded sludge was collected with a vacuum truck for treatment at the LTU.

1.4 Volume of Wastes [20 NMAC 4.1, subpart IX, §270.20 (b) (1)]

Table 1-2 (compiled from LTU log book entries) provides the volume, in barrels and tons, of each waste stream applied to the LTU from 1987 through 1993. Non hazardous waste applied to the LTU from 1990 through 1993, in compliance with the Hazardous Waste Facility Permit. Tonnages were calculated from barrel volumes. Permitted treatment application of waste was initiated in 1988, and was completed in 1990. Hazardous wastes generated (i.e., D001, D007, K049, K050, K051, and K052) after 1990, are managed off site at permitted treatment, storage, and disposal facilities.

1.5 Operating Procedures [20 NMAC 4.1,subpart IX, §270.20 (b) (2)]

Approved waste streams applied to the LTU were managed so that annual hazardous waste volumes did not exceed the 1270 tons authorized by the Hazardous Waste Facility Permit. The volume of each waste stream placed in the LTU was also monitored to ensure that annual application limits were not exceeded. These application limits were developed from the waste management parameters identified by the Land Treatment Demonstration Volume 1 – Engineering Report, (Giant Refining Company 1988) (Appendix D).

Wastes were collected from the plant using a vacuum truck or through mechanical methods and containerized within the vacuum truck or drums. Wastes were transported to the LTU via the vacuum truck or flatbed truck. All vehicles contaminated with LTU soils and wastes were washed sufficiently to prevent contamination from being transported to uncontaminated areas. Contaminated rinse water was either routed to the plant's API separator or spread on the LTU. Wastes were applied uniformly to the LTU to prevent pooling on the surface. The LTU is divided into three cells, as shown on Figure B-2. Hazardous wastes were applied to cells 1 and 2 from 1981 to 1990. No

hazardous wastes were ever applied to Cell 3. Wastes were distributed over the treatment areas not to exceed 10 percent by weight of oils and greases anywhere with the ZOI. Non hazardous waste application was managed to ensure that oil and grease loads did not exceed the 10 percent weight limit.

The top 12 inches of soil were tilled twice following waste application to distribute waste into the ZOI. During degradation season (April through October) cells 1, 2, and 3 of the LTU were tilled at least once per month to enhance microbial and chemical degradation of the waste.

To protect microbial viability, treatment maintenance parameters (e.g., oil and grease, pH, moisture content (C: N: P) have been monitored in the soils, as described in Section 1.9.1. Monitoring provided information necessary to ensure that treatment maintenance parameters did not exceed acceptable ranges. If acceptable ranges were exceeded, activities such as reduction in waste loading rates or addition of fertilizer, lime, acid, or moisture were conducted to maintain proper treatment. Ciniza personnel inspected the LTU weekly to ensure that run on and run off controls and soil moisture levels were monitored. Inspections were conducted in accordance with the Hazardous Waste Facility Permit (No. NMD 0000333211-2).

1.6 Surface Water Control [20 NMAC 4.1, subpart V, §264.273, subpart IX, §270.20 (c) (I)]

Figure B-3 shows the drainage areas and 100 year floodplain relative to the refinery and the LTU. Existing drainage channels can contain the 100 year event within the areas delineated on Figure B-3. Any future expansion of the refinery will not be constructed within the 100 year floodplain. Accumulation of on site flows is rare and standing water remains a maximum of three to five days due to the dry climate. Each LTU cell is surrounded by a continuous dike to prevent inundation of and discharge from the unit. The dike is maintained at an elevation of 3 feet above the natural grade. The vacuum truck and tilling equipment enter the sections by ramps located in the northeast corner and northeast side of the LTU.

1.7 Collection and Control of Run Off [20 NMAC 4.1, subpart V, §264.273, subpart IX, §270.20 (c) (2)]

The peak storm run off for the LTU is based on the 25 year, 24 hour storm, which specifies a four percent annual probability that the amount will be equaled or exceeded. For the Gallup area, direct run off during the peak storm is calculated at 1.6 inches. The 3 feet berm surrounding the LTU is more than adequate to contain the 1.6 inches peak storm run off. Gallup Refinery personnel inspect the LTU to ensure that the integrity of the berm is maintained.

1.8 Control of Wind Dispersal [20 NMAC 4.1, subpart V, 264.273 (f), subpart IX, §270.20 (c) (6)]

Waste was applied to the LTU when average wind speeds were below 10 miles per hour. Soil moisture and oil content levels retained particulates on the soil surface. During the winter months the soil surface is typically wet or frozen so that wind dispersal is controlled. Additionally native vegetation has grown in abundance in the LTU to control wind dispersal. Gallup Refinery personnel inspect the LTU to ensure that wind dispersal control is effective.

1.9 Unsaturated Zone Monitoring Plan [20 NMAC 4.1, subpart V, §264.278, Subpart IX, §270.20 (b) (3)]

Ciniza has conducted unsaturated zone monitoring of the LTU to verify that treatment operations are successfully degrading, transforming, or immobilizing hazardous waste constituents. Treatment performance has been tracked by measuring for migration of hazardous constituents to below the treatment zone (BTZ) soils (approximately 5.5 feet depth) and treatment maintenance parameters in ZOI soils (12 inches depth). To track treatment performance, four soil core samples were taken bi-monthly during the degradation season from ZOI soils, and four soil core samples were taken semi-annually from the BTZ soils according to the sample schedule in Figure E-1. Sample locations were selected randomly from each of the three LTU cells. Monitoring BTZ ensures that hazardous constituents are not released BTZ.

1.9.1 Sampling and Analysis Plan

Samples were obtained following the protocols in established sampling and analysis plans (SAPs). The SAPs identified procedures for obtaining soil samples, determining sampling locations, decontaminating equipment; chain of custody; analytical procedures; and quality assurance, quality control requirements. The SAPs implemented the requirements for sampling and analysis presented in the Ciniza Hazardous Waste Facility Permit. Table I-3 identifies the minimum analytical parameters for soil monitoring, their frequency, and rationale as presented in the permit. Analytical parameters were selected based on the PHCs identified in the LTD. The LTD also established the background soil values for the site. Climate and soil characteristics of the Gallup Refinery site are such that there is no appreciable soil-pre liquid.

1.9.2 Monitoring Results

Sampling and analysis of the LTU has been conducted in accordance with SAPs to meet the requirements of the Ciniza Hazardous Waste Facility Permit. Analytical results have been reported to the EPA or the New Mexico Environment Department/Hazardous and Radioactive Materials Bureau (NMED/HRMB) for review and comment. Anomalies or questions concerning analytical results were addressed on a case by case basis between Ciniza and EPA or NMED/HRMB. No release of hazardous constituents from the LTU has ever been confirmed. The detection of hazardous constituents above background levels has been sparse, erratic, and invalidated. Detections of hazardous constituents have been found, through data validation, to be laboratory contamination. Remaining detections have not been reproducible upon subsequent sampling events.

2.0 GROUNDWATER HISTORY

2.1 Interim Status Period Groundwater Monitoring Data [20 NMAC 4.1, subpart V, §265.90 thru §265.94 and subpart IX, §270.14 (c) (1)]

Operating under interim status from 180 to 1987, the LTU was subject to regulations under 40 Code of Federal Regulations (CFR) 265, Subpart F. These regulations require monitoring of the uppermost aquifer beneath the unit for possible effects upon the groundwater system. A groundwater monitoring well (MW) network of one up gradient

and three down gradient wells had to be in place and a program of monitoring procedures initiated by November 1981. Ciniza contracted Dames & Moore to develop a groundwater monitoring plan and install MWs necessary to meet the RCRA requirements. The MW system was completed and the program established by November 1981. The MW locations are shown on Figure B-3.

Background water (water that is unaffected by leakage from the LTU) was sampled from MW-4, which is completed in the Sonsela aquifer and located up gradient from the LTU as determined from the potentiometric surface associated with the Sonsela aquifer. Water that passed beneath the LTU in the Sonsela aquifer was sampled from MW-1, MW-2 and MW-3, located down gradient from the LTU. It was found later that MW-3 was not screened in the Sonsela aquifer. MW-3 was closed and replaced by MW-5 in 1987. MW-1, MW-2, MW-4, and MW-5 were cased with 5 inch schedule 160 PVC casing, and a gravel pack was placed in the annulus between the slotted casing and the borehole wall to enable collection of groundwater samples. The annulus above the screened aquifer was filled with bentonite cement of extremely low permeability to prevent contamination of samples.

MW series wells were sampled in accordance with Ciniza's Groundwater Monitoring Plan (Dames & Moore, 1981). The plan identified three groups of parameters to be analyzed in the sampling program (see Table 2-1). Analytical results were reported to the EPA and/or NMED/HRMB in annual reports. The reports include the values of all group parameters measured during each year in each MW; statistical evaluations (arithmetic mean and variance for comparison with initial background mean using the Student's t-test); and water table elevation evaluations.

In September 1985, the shallow monitoring wells (SMWs) were installed and sampled to establish an early detection system. The SMWs had been installed in the water-yielding sands above the Chinle slope wash. It appears that at least four thin lenses or pockets of sand exist above the Chinle shale between the ground surface and the top of the Sonsela sandstone. The upper two sands are dry. The third sand outcrops under the refinery

ponds south of the LTU and ends before reaching the north boundary of the LTU. SMW-1, SMW-2, and SMW-3 (up gradient wells) are completed in this sand. The fourth sand is saturated and is perched immediately above the Chinle shale. SMW-4, SMW-5, and SMW-5 (down gradient wells) are completed in the fourth sand.

EPA Region 6 inspected the Ciniza Refinery in February 1985. Based on this inspection, the EPA issued the Comprehensive Monitoring Evaluation (CME) report. The CME found that neither the MW nor the SMW series was adequate to meet the minimum requirements for monitoring of one up gradient well and three down gradient wells because MW-3 was not completed within the Sonsela aquifer and the up gradient and down gradient SMWs were completed in two different sands charged by different sources of water. Ciniza and the EPA negotiated a monitoring program, which was incorporated into the Hazardous Waste Facility Permit (issued November 1988).

2.2 Groundwater History – Permitted Groundwater Monitoring Data [20 NMAC 4.1, subpart V, §264.90 thru §264.94]

The permitted groundwater monitoring program included an early detection monitoring system consisting of wells SMW3, SMW-4, SMW-5 and SMW-6 and a detection monitoring system consisting of wells MW-1, MW-2, MW-4 and a new well, MW-5, completed within the Sonsela aquifer. Attachment H of the Hazardous Waste Facility Permit required Ciniza to identify a new background well designed to monitor the Sonsela formation aquifer. Well OW-11 was identified in the Hazardous Waste Facility Permit as the required background well.

The new monitoring program wells were sampled in accordance with Ciniza's Hazardous Waste Facility Permit. The permit identified three groups of parameters to be analyzed in the sampling program (see Table 2-2).

Semi-annual groundwater reports including tabulated results and graphs have been submitted to the EPA and/or the NMED/HRMB for review and comment. Anomalies or questions concerning analytical results were addressed on a case by case basis between Ciniza and EPA and/or NMED/HRMB. No release of hazardous constituents in the

Sonsela aquifer has ever been confirmed. Detection of hazardous constituents above background levels has been sparse, erratic, and invalidated. Most detection of hazardous constituents has been found to be laboratory contamination when data were validated. Remaining detections have not been reproducible upon subsequent sampling events.

Table 1-1. Approved Waste Streams Applied to the Land Treatment Unit (LTU)

EPA Hazardous Waste No.	Waste Description	Annual Application Limit (tons)
D001	Ignitable materials	50
D007	Cooling Water Filter Sludge	5
K049	Slop Oil Emulsion Sludge	200
K050	Heat Exchanger Bundle Cleaning Sludge	15
K051	API Separator Sludge	1000
K052	Tank Bottoms (leaded)	5

Table 1-2. Waste Stream Volumes Applied to Permitted Land Treatment Unit (1987 thru 1993)

Dated Units	Ignitable Material D001	CWT Sludge D007	Slop Oil K049	Heat Exch Sludge K050	API Sludge K051	Tank Btms K052	Non-Haz Waste	Assoc Waste Waters	Total**
1987* BBL	0	0	998	13	2171	0	0	628	3810
1987 Tons	0	0	200	3	434	0	0	126	763
1988 BBL	215	0	140	0	3435	0	15	3345	7150
1988 Tons	43	0	28	0	687	0	3	669	1430
1989 BBL	12	0	0	0	3675	0	4400	0	8087
1989 TONS	2	0	0	0	735	0	880	0	1617
1990 BBL	0	0	0	15	2345	25	6222	0	8607
1990 TONS	0	0	0	3	469	5	1244	0	1721
1991 BBL	0	0	0	0	0	0	3336	684	4020
1991 TONS	0	0	0	0	0	0	667	137	804
1992 BBL	0	0	0	0	0	0	1579	0	1579
1992 TONS	0	0	0	0	0	0	316	0	316
1993 BBL	0	0	0	0	0	0	1230	0	1230
1993 TONS	0	0	0	0	0	0	246	0	246
TOTAL TONS	**45**		**228**	**6**	**2325**	**5**			

Source: LTU Logbook entries.
BBL = Barrels
*1987 Land Treatment Demonstration
** Total Calculations corrected (Benchmark 1998).

Table 1-3. Permit Required Soil Monitoring Analytical Parameters

Depth	Parameter	Frequency	Method**	Rationale
ZOI	Oil and Grease	Bi-monthly	EPA-600/413 SW 846/9070	To determine whether soil loading rates have been within the 10% oil and grease loading limit
ZOI	pH	Semi-annually	EPA-600/150.1 SW 846/9040	To ensure that soil pH supports microbial degradation and chemical immobilization. Target 6.0 to 9.0.
ZOI	C:N:P	Semi-annually	EPA-600/31.3, 365.2	To ensure that an optimal ratio of nutrients is maintained for microbial activity and to support chemical reaction. Target 50:2:1
BTZ	Moisture Content	Semi-annually	ASTM	Required by permit
BTZ	pH	Semi-annually	EPA-600/150.1 SW 846/9040	Required by permit
BTZ	Total organic carbon	Semi-annually	EPA 600/415 SW 846/9060	Required by permit
BTZ	Ethyl benzene m-zylene o&p xylene o-cresol m&p-cresol Pyrene Phenanthrene 1-methylnaphthalene Benzo(a)pyrene Chrysene	Semi-annually	SW-846 / 8240, 8270	To determine whether PHCs identified in the LTD are migrating out of the treatment zone.

Source: NMEID (1988)

* Samples taken bi-monthly during the degradation season of April 1 thru October 31.

** Or other EPA-approved analytical procedure

Table 2.1 Groundwater Monitoring Plan (1981) Parameters Analyzed

Parameter Group	Group Description	Group Parameters	Sampling Frequency
1	Interim Primary Drinking Water Standards	Arsenic Barium Cadmium Chromium Fluoride Lead Mercury Nitrate (As N) Selenium Silver Endrin Lindane Methoxychlor Toxaphene 2,4-D 2,4,5-TP (Silvex) Radium Gross Alpha Gross Beta Coli form Bacteria	One sample taken from all wells quarterly for the first year
2	Groundwater Quality Parameters	Chloride Iron Manganese Phenols Sodium Sulfate	One sample taken from all wells quarterly for the first year; one sample taken from all wells annually for subsequent years
3	Indicator Parameters of Groundwater Contamination	pH Specific Conductance Total Organic Carbon Total Organic Halogen	Four samples taken from up gradient well; one sample taken from down gradient wells; quarterly for the first year; four samples taken from all wells semi-annually in subsequent years

Source: Dames and Moore (1981)

Table 2-2. Ciniza Hazardous Waste Facility Permit (1988) Groundwater Parameters Analyzed

Parameter Group Source	Monitoring Parameters			Monitoring Frequency
Table G-2	Temperature pH (Replicate of 4 samples) Conductivity (Replicate of 4 samples) Volatile Contaminants Water Level (Replicate of 2 measurements) Lead(total) (Early detection system only) Chromium (total) (Early detection system only)			Semi-annual
Table G-3	pH (replicate of 4 samples) Conductivity (Replicate of 4 samples) Volatile Contaminants (Replicate of 2 samples) Water Level (Replicate of 2 measurements) Arsenic Chromium Selenium Calcium Sulfate Carbonate and bi-carbonate	Barium Lead Silver Manganese TDS	Cadmium Mercury Sodium Chloride Phenol	Annual
Table G-4	**Organic PHCs** Ethyl benzene O&p-xylene m&p-cresol Phenanthrene Chrysene Benzo-b-fluoranthene Benzo-a-anthracene 2-Chlorophenol Fluoranthene 1,1,1-Trichloroethane Tetrachloroethene Toluene Naphthalene	m-xylene o-cresol Pyrene 1-methylnaphthalene 2,4,6-trichlorophenols 7,12-dimethylbenzanthracene Bis(2-ethylhexyl) phthalate Benzo-j-fluoranthene 1,1-Dichlorethane Benzene Benzo (a) pyrene Methylethylketone		When indicated by significant difference in above parameters
	Inorganic PHCs Barium Chromium Lead Selenium Zinc	Cadmium Copper Nickel Silver		

Appendix D

APPENDIX D

Land Treatment Demonstration Engineering Report

Lockwood, Andrews
& Newnam, Inc.

Engineering · Architecture · Planning · Project Management

GIANT REFINING COMPANY

GALLUP, NEW MEXICO

LAND TREATMENT DEMONSTRATION
VOLUME I - ENGINEERING REPORT

PRESENTED TO
NEW MEXICO HEALTH AND ENVIRONMENT DEPARTMENT
BY
APPLIED EARTH SCIENCES, INC.
MAY 1988

LAND TREATMENT DEMONSTRATION

ENGINEERING REPORT

PRESENTED TO

GIANT REFINING CO.

FOR

APPLIED EARTH SCIENCES

BY

LOCKWOOD, ANDREWS & NEWNAM, INC.

MAY, 1988

LAND TREATMENT DEMONSTRATION
DRAFT
ENGINEERING REPORT

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F METAL LOADING RATIO CALCULATION
G COMPOSITE WASTE CALCULATION
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1.0 EXECUTIVE SUMMARY

Giant Refining is an independently owned oil company which processes Four Corners crude oil in order to produce petroleum products for distribution in the New Mexico, Arizona and Colorado region. Major products produced at the refinery are gasoline, diesel fuel, jet fuel and residual fuel oil. The refinery process produces several wastes which are considered by the U.S. E.P.A. to be hazardous and are listed as such. These wastes are treated on site using conventional land treatment technology. As part of the permitting requirements for the treatment facility a land treatment demonstration was conducted.

The land treatment demonstration is designed to evaluate the principal processes involved in the treatment of hazardous waste applied to the land treatment unit. These processes include degradation, transformation and/or immobilization of the hazardous constituents found in the wastes.

The land treatment demonstration is designed to provide the New Mexico Health and Environment Department, Environmental Improvements Division the information necessary to define two elements of the land treatment program. First, the demonstration establishes what wastes may be managed by the treatment unit. Second, the results of the treatment demonstration will be available to define the waste management practices, including loading rates and unit life, that will be incorporated into the facility permit.

The treatment demonstration contains information derived from actual facility operating experience, published literature, laboratory analysis and field studies. With this information, the report will define the principal hazardous constituents (PHC's), and determine the degradation rates, the half lives and the migration times of the PHC's. From this information, the loading rates, based on the rate limiting constituent (RLC) and the application limiting constituent (ALC), are determined. Also determined are the capacity limiting constituent (CLC) and the unit life.

Determination of principal hazardous constituents is based on persistence and degradation criteria defined in NMHWMR-4, 206.D.9.f.(1)(b). Loading rates were based on degradation and toxicity criteria. The limiting constituents are presented in Table 1.0.

Parameters	Constituent	Amount of Waste
Capacity Limiting Constituent (CLC)	Zinc	7,125,000 lb waste/ac
Application Limiting Constituent (ALC)	M-Xylene	254,880 lb waste/ac/app
Rate Limiting Constituent (RLC)	1-methylnaphehalene	2,448,000 lb waste/ac

TABLE 1.0 LIMITING CONSTITUENTS

The following table is a summary of waste management parameters determined from the land treatment demonstration.

PHC's

Organics	Metals
Ethylbenzene	Barium
m-Xylene	Cadmium
o&p-Xylene	Chromium
o-Cresol	Copper
m&p-Cresol	Lead
Pyrene	Nickel
Phenanthrene	Selenium
1-Methylnaphthalene	Silver
Benzo(a)pyrene	Zinc
Chyrsene	

Loading Rates

Application	lb/ac/application
API Separator Sludge	254,880
Heat Exchanger Sludge	1,770
Slop Oil	93,810
Leaded Tank Bottoms	3,540
Total Waste	354,000

Annual	lb/ac/yr
API Separator Sludge	2,448,000
Heat Exchanger Sludge	17,000
Slop Oil	901,000
Leaded Tank Bottom	34,000
Total Waste	3,400,000

Facility Capacity 35,400,000 lb/ac

Facility Life* - 10 years

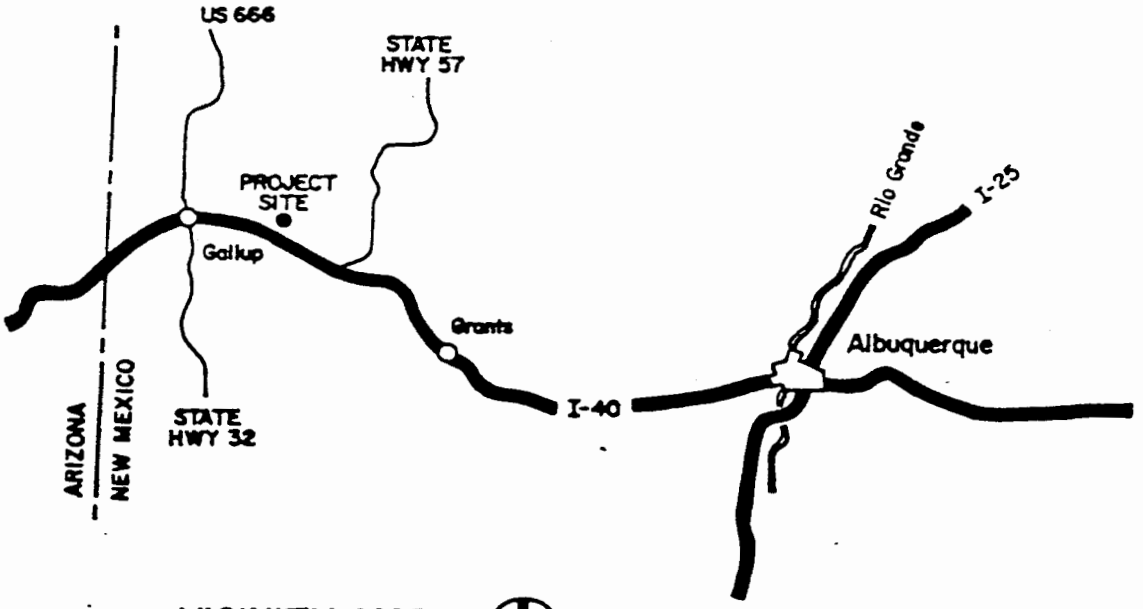
* Based on twice the present annual application rate to date.

TABLE 1.1 WASTE MANAGEMENT OPERATING PARAMETERS

2.0 PROJECT DESCRIPTION

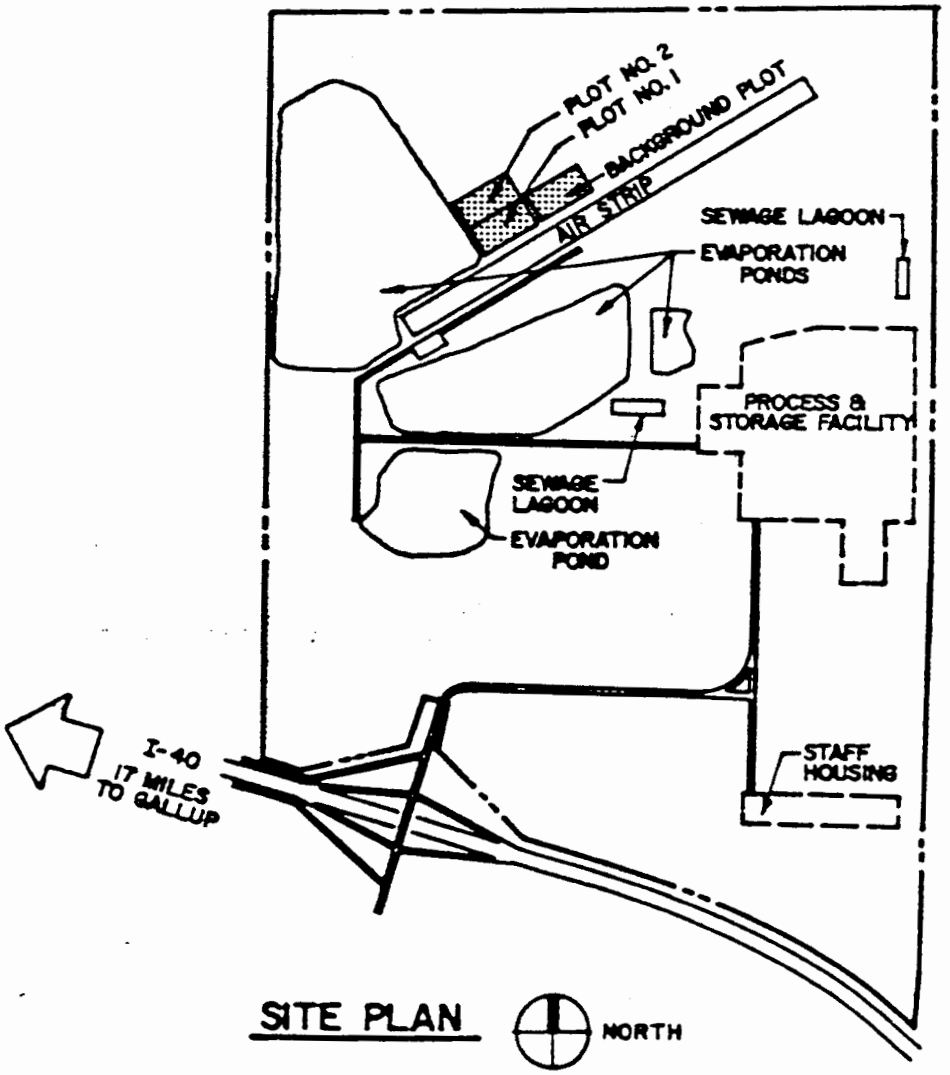
Based on the Demonstration Permit (NMD000333211-1) and the Permit Application Report (June 1986, Appendix A), a Land Treatment Demonstration was conducted to show treatment capabilities for refinery waste generated by Giant Refining Company. The demonstration occurred on Giant Refining Company land, approximately 17 miles east of Gallup, New Mexico, north of Interstate 40 (see Figure 2.0) utilizing the existing land treatment facility. The demonstration period lasted from April 1987 through March 1988.

The demonstration permit allowed the application of five types of waste. These waste types are listed in Table 2.0. Three of the original five designated wastes were applied to and incorporated into the treatment areas, Plots 1 and 2. On each 2.4-acre plot, the following wastes were placed: slop oil solids, API separator sludge and heat exchanger sludge. Cooling tower sludge has been eliminated from the waste stream, due to process changes that eliminated chromate in cooling water, and leaded tank bottoms are dumped at a frequency of about once every two years. The treatment area was then tilled after each waste application. The plots are surrounded by a dike. Adjacent to the treatment area is a background plot with no dikes or waste application. The background plot was monitored for any natural variations that could then be compared to the treatment plots' characteristics.



VICINITY MAP

NORTH



SITE PLAN

NORTH

FIGURE 2.0

Lockwood, Andrew & Newnam, Inc.

GIANT REFINING COMPANY - GALLUP, NM
LAND TREATMENT DEMONSTRATION
VICINITY & SITE PLAN

Cooling Tower Sludge
Slop Oil
API Separator Sludge
Heat Exchanger Sludge
Leaded Tank Bottoms

TABLE 2.0 WASTE TYPES AUTHORIZED FOR APPLICATION ON THE GIANT REFINERY LAND TREATMENT FACILITY

Quarterly soil sampling of the plots occurred during the demonstration, as well as sampling prior to and after the demonstration period. Sample points were established by a random point generation based on an established grid system.

3.0 DEMONSTRATION METHODS

3.1 WASTE APPLICATION

According to the Demonstration Permit, page 9, a maximum of 4,093 barrels, or 964 tons, of waste can be applied per year for both treatment areas combined. During the demonstration period, 3,045 barrels of waste or about 660 tons were applied to both Plots 1 and 2. The waste was applied during the degradation season (April through October) in six sequences as shown in Table 3.0.

1987	Waste Type	Amount* BBL's	Tons
April 29	Slop Oil/Heat Exchange Sludge	26	5.1
May 5	Slop Oil	225	38.8
May 7	Slop Oil	330	56.6
May 8	Slop Oil	55	9.5
July 15	Slop Oil	238	41.1
July 16-21	API Sludge	2,171	508.9
	TOTAL	3,045	660

* From Giant Refining Field Notes 1/87 through 3/88, Robert McClenahan, Jr.

TABLE 3.0 WASTE APPLICATION SEQUENCE

Estimated amounts and sources of wastes are shown in Table 3.1. This table also shows the percent each waste type contributes to the total waste applied.

Waste Type	Estimated Annual Quantity (Tons)	Annual Waste Loading Rate (BBL/Acre)	Annual Oil Loading Rate (BBL/Acre)	Weight Percent
Slop Oil	142	179	30.6	21.5
API Separator Sludge	509	452	25.8	77.0
Heat Exchanger Sludge	3.4	27	0.5	0.5
Leaded Tank* Bottoms	6.2	5.2	NA	1.0
TOTALS	660.6	663.2	56.9	100.0

TABLE 3.1 WASTE SOURCES AND AMOUNTS FROM LAND TREATMENT DEMONSTRATION
(*Estimated from Permit Application, Table 2.1)

Incorporation of the waste began with a vacuum truck equipped with a distribution system. The system fairly evenly distributed the waste behind the truck on the plots. When possible, within two days of waste application, the top 12 inches of soil was tilled to facilitate the breakdown of the waste by soil microbes. Since the soil pH was slightly alkaline to begin with, the applied waste did not alter the pH above 9.0 or below 6.0. Therefore, no pH adjustment was necessary during the demonstration period.

Plots were also plowed on a monthly basis to further degrade the waste. This was done during the degradation months (April through October). The demonstration area was also monitored weekly for berm damage and no berm damage was noted during the demonstration period.

Wastes applied included API separator sludge, heat exchanger sludge and slop oil emulsions. In Table 3.2, waste characteristics as of March 1986 are presented; only the detected amounts are reported. The complete laboratory reports are in the Permit Application Report found in Appendix A-2.

API sludges comprise the major volume (77 percent) of applied wastes. According to the March 1986 analysis, this waste is approximately 6 percent oil, 37 percent water and 57 percent solids. The slop oil emulsions make up about 21 percent of the waste and heat exchanger sludge about 0.5 percent of the waste. Although leaded tank bottoms were not applied, it is estimated they will make up about 1 percent of the applied waste.

	API Separator Sludge (mg/Kg)	Slop Oil (mg/Kg)	Heat Exchange Sludge (mg/Kg)	Leaded Tank Bottoms (mg/Kg)
Bis(2-ethylhexyl)phthate	<5.0	<5.0	<40	--
Anthracene	9	<5.0	<40	--
Benzo(a)anthracene	5	<5.0	220	--
Chrysene	13	<5.0	420	--
Fluoranthene	3	<2.5	34	<0.01
1-Methylnaphthalene	470	210	380	--
Naphthalene	120	64.0	50	--
Phenanthrene	85	22.0	280	--
Pyrene	16	5	120	--
Benzene	9	190	1.5	<0.01
Ethylbenzene	20	420	12.0	<0.01
Toluene	60	1200	20.0	<0.01
M-Xylene	61	1600	41.0	--
O&P-Xylene	52	1300	38.0	--
O-Cresol	47	8.1	<0.5	--
M&P-Cresol	230	33.0	0.7	--
Phenol	420	150	<1.0	--
2,4 Dimethylphenol	<2	1.1	<0.5	--
Benzene(b)fluoranthene	<4	<5.0	100	<0.01
Benzo(a)pyrene	<4	<5.0	83	--
V(vanadium)	14.0	1.8	40	--
Hg(mercury)	2.7	14.0	4.1	--
Sb(antimony)	2.4	ND	<2	6.8
As(arsenic)	19	4.0	60.0	40.0
Ba(barium)	760	520.0	120.0	934.0
Be(beryllium)	0.5	ND	0.4	0.1
Cd(cadmium)	3.6	1.8	2.7	80.0
Cr(chromium)	920	52.0	1000.0	250.0
Cu(copper)	760	86.0	830.0	600.0
Pb(lead)	330	80	73	17,800.0
Ni(nickel)	91	18	46	800.0
Se(selenium)	11	ND	11	2.0
Ag(silver)	1.6	0.4	0.6	23.0
Zn(zinc)	2040.0	1700.0	510.0	180.0
Co(cobalt)	22.0	3.4	12.0	--

TABLE 3.2 WASTE CHARACTERISTICS, MARCH 1986

3.2 SAMPLING

Pre-demonstration samples in all the plots were taken on April 28 and 29, 1987 to determine the existing soil constituents. Six soil borings were made in the background plot as well as twelve borings in each of the two treatment plots. Sample points in the treatment plots are shown in Figure 3.1 and in the background plot are shown in Figure 3.2.

Quarterly samples were then taken in September, 1987, December, 1987 and March, 1988, and the sample locations are shown in Figures 3.3, 3.4 and 3.5 respectively. The post demonstration sampling was taken in April, 1988 and the sample locations are shown in Figures 3.6 and 3.7.

Boring sites were chosen by generating random coordinates within each plot. Samples were then taken and organized relative to each plot, set of borings and depth interval. Table 3.3 shows the interval spacing and the number of borings composited per sample.

Interval one samples were composites of three borings from the same plot. Interval two through five were composites of the same six borings from the same plot. Interval six samples were not composited and are therefore individual samples from each boring.

Interval (Vertical)	Composite Range
One (0' to 1')	3 borings* composited
Two (1' to 2')	6 borings* composited
Three (2' to 3')	6 borings* composited
Four (3' to 4')	6 borings* composited
Five (4' to 5')	6 borings* composited
Six (5' to 6')	Each boring is sampled separately.

* Borings were located within the same plot.

TABLE 3.3 VERTICAL SAMPLE INTERVAL SPACING

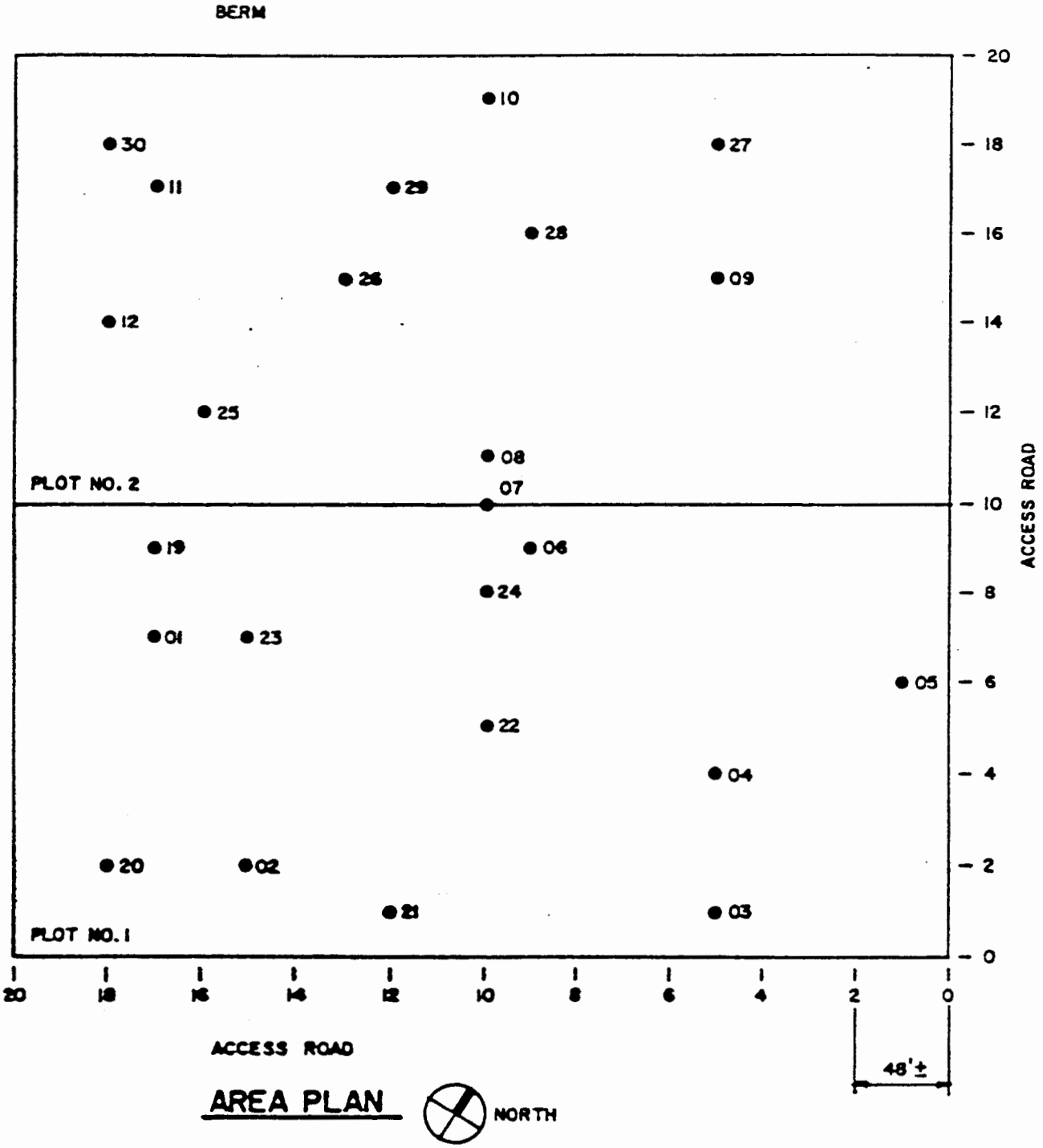
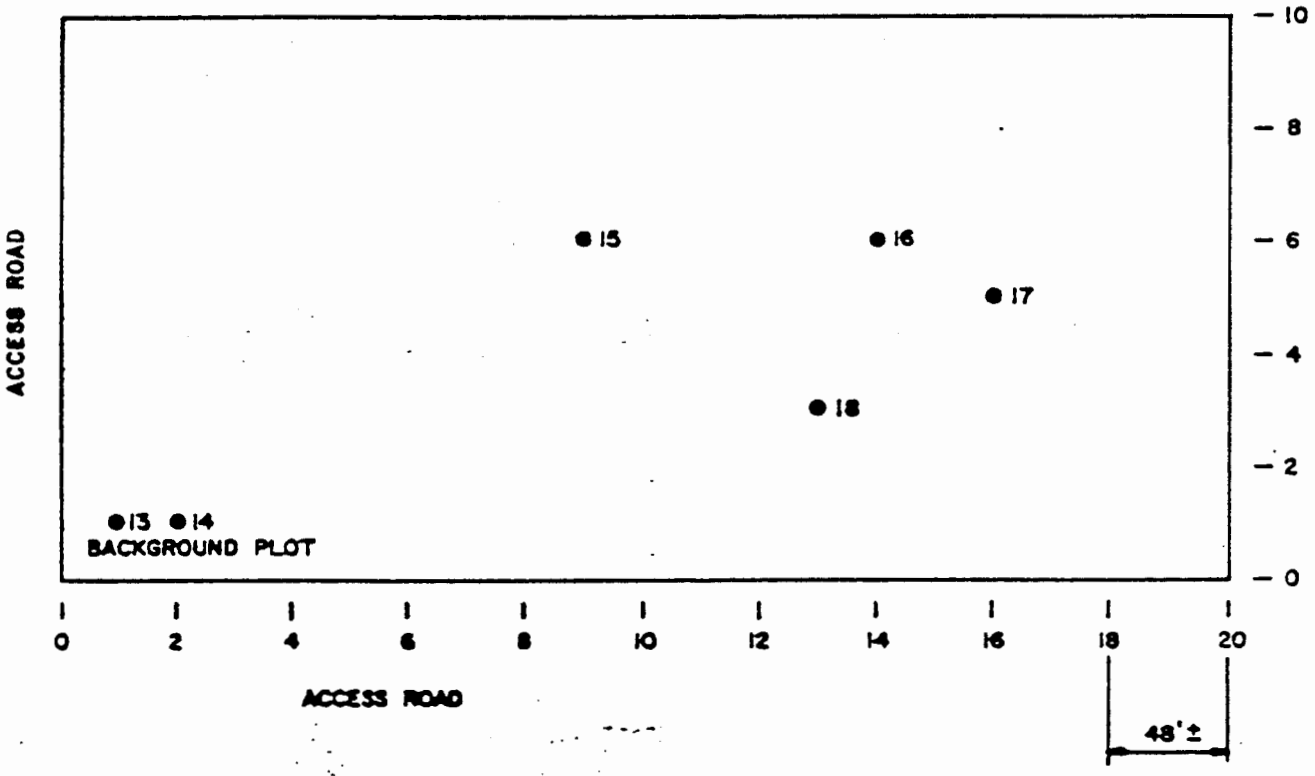


FIGURE 3.1

GIANT REFINING COMPANY - GALLUP, NM
LAND TREATMENT DEMONSTRATION
SAMPLE LOCATIONS - EVENT NO. 1, APRIL '87

Lockwood, Andrews & Newnam, Inc.



AREA PLAN

FIGURE 3.2

GIANT REFINING COMPANY-GALLUP, NM
LAND TREATMENT DEMONSTRATION
SAMPLE LOCATIONS-PRE DEMO EVENT, APR '87

Lockwood, Andrews & Newnam, Inc.

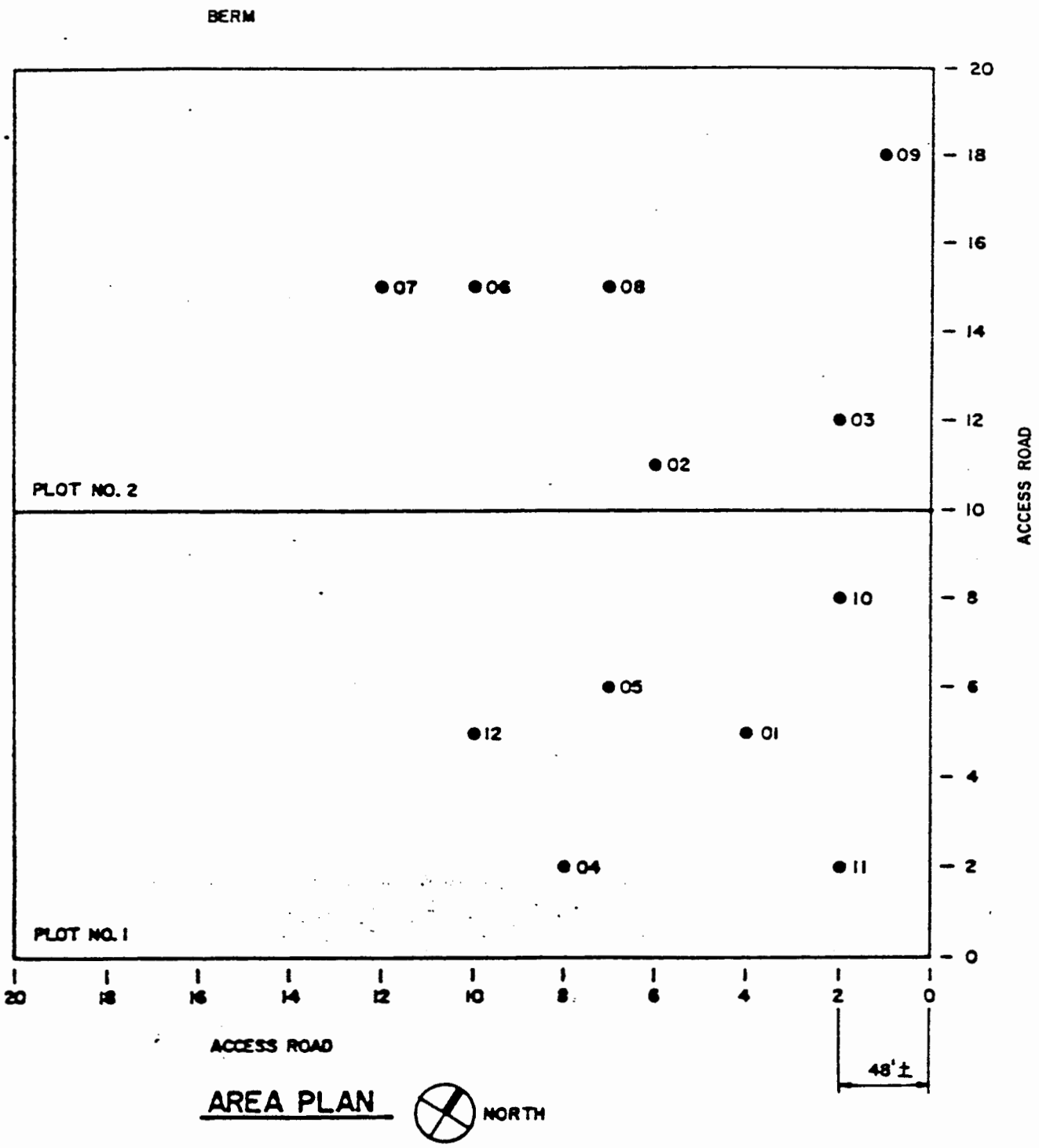


FIGURE 3.3

GIANT REFINING COMPANY - GALLUP, NM
LAND TREATMENT DEMONSTRATION

Lockwood, Andrews & Newnam, Inc.

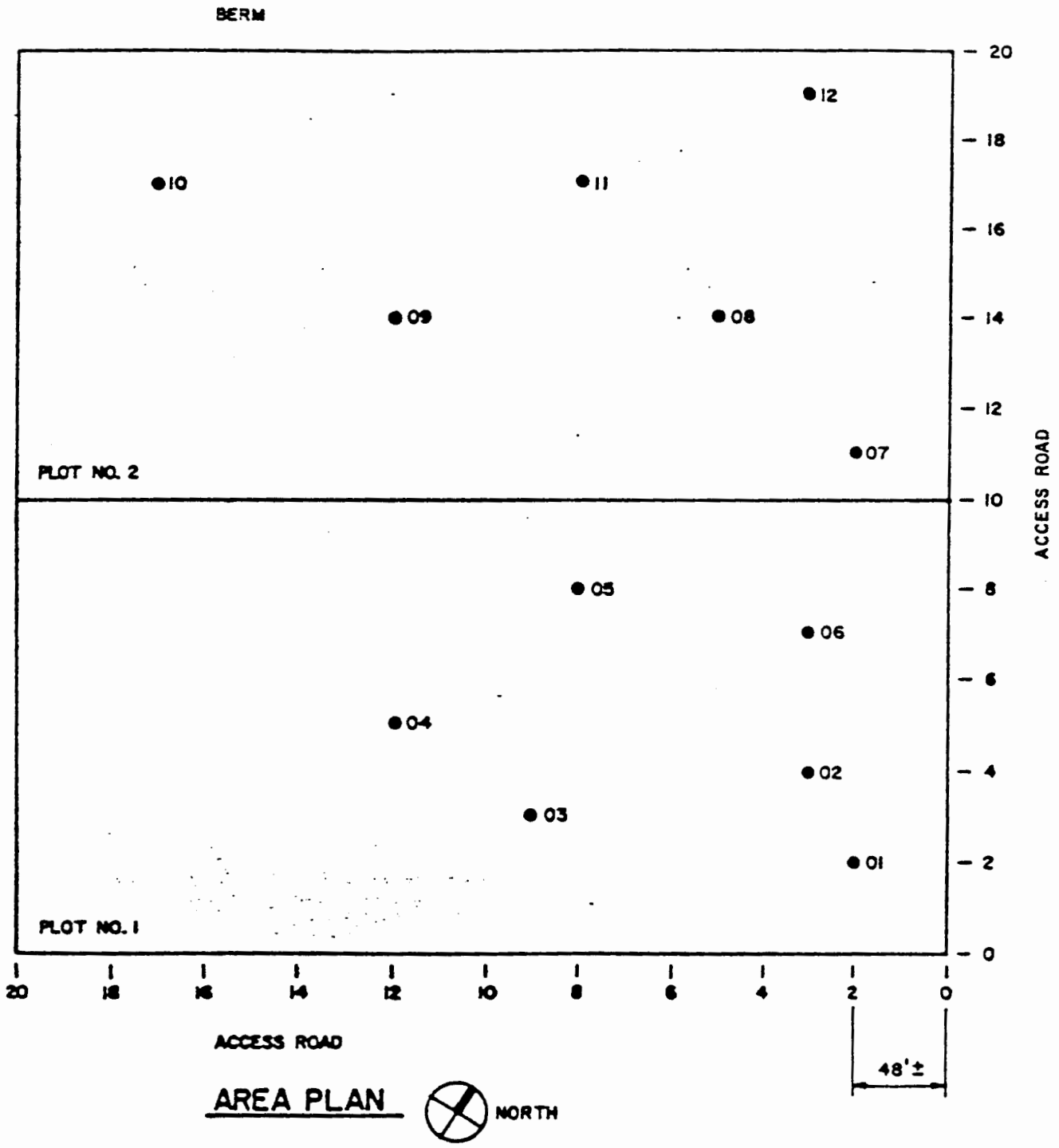


FIGURE 3.4

GIANT REFINING COMPANY - GALLUP, NM
LAND TREATMENT DEMONSTRATION
SAMPLE LOCATIONS - EVENT NO. 3, DEC '87

Lockwood, Andrew & Newnam, Inc.

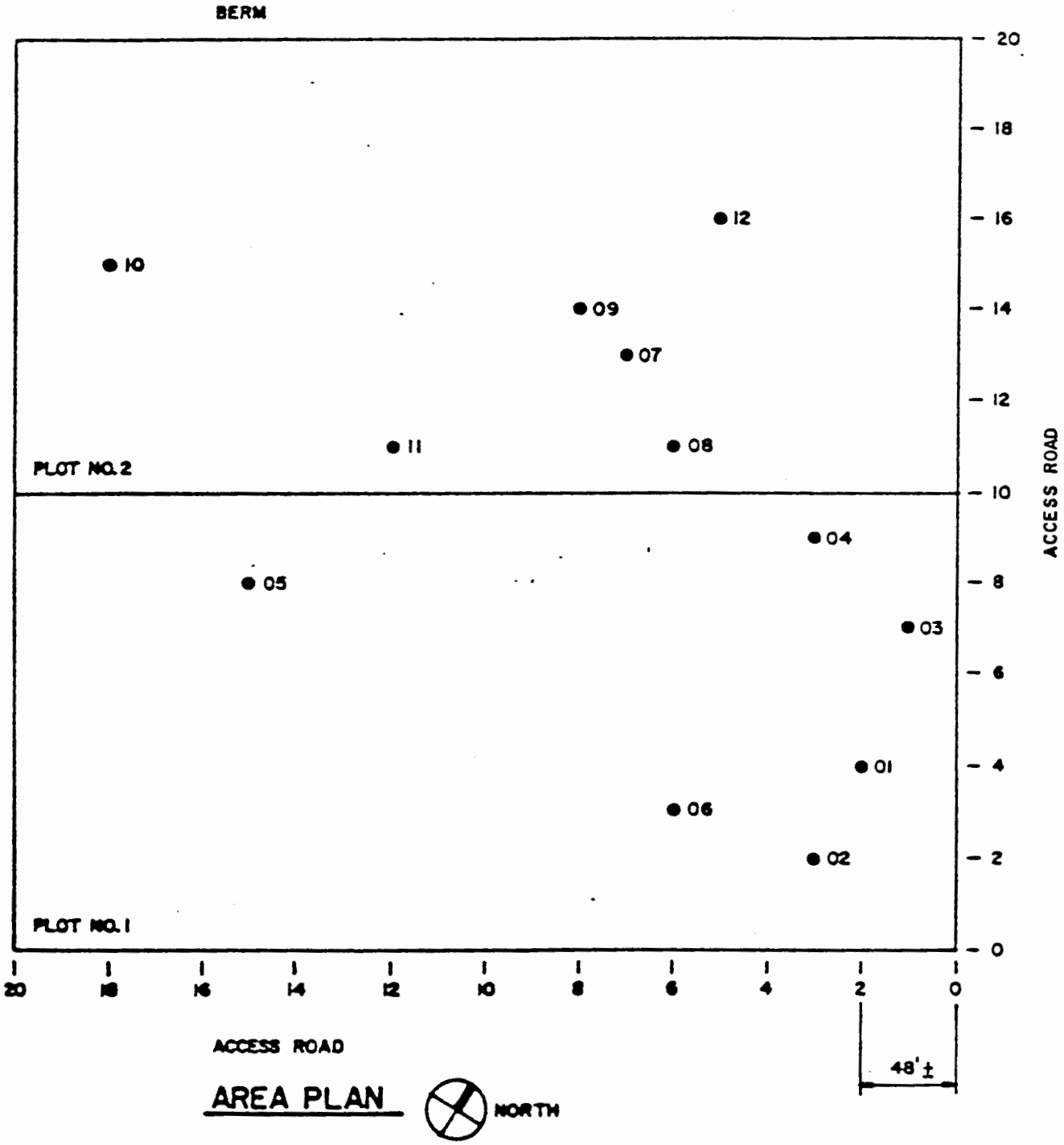
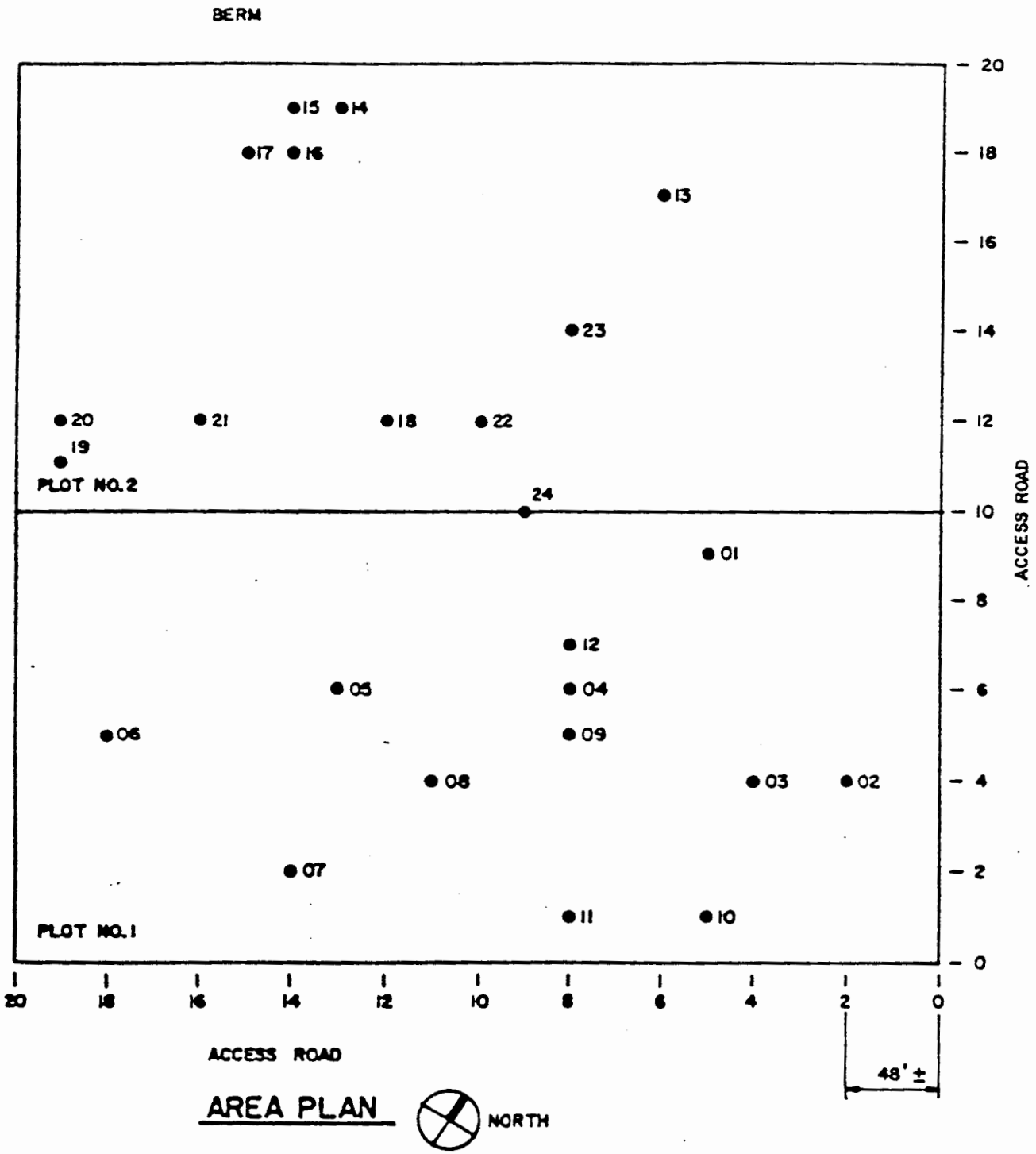


FIGURE 3.5

GIANT REFINING COMPANY - GALLUP, NM
LAND TREATMENT DEMONSTRATION
SAMPLE LOCATIONS - EVENT NO. 4, MAR '88

Lockwood, Andrews & Newnam, Inc.

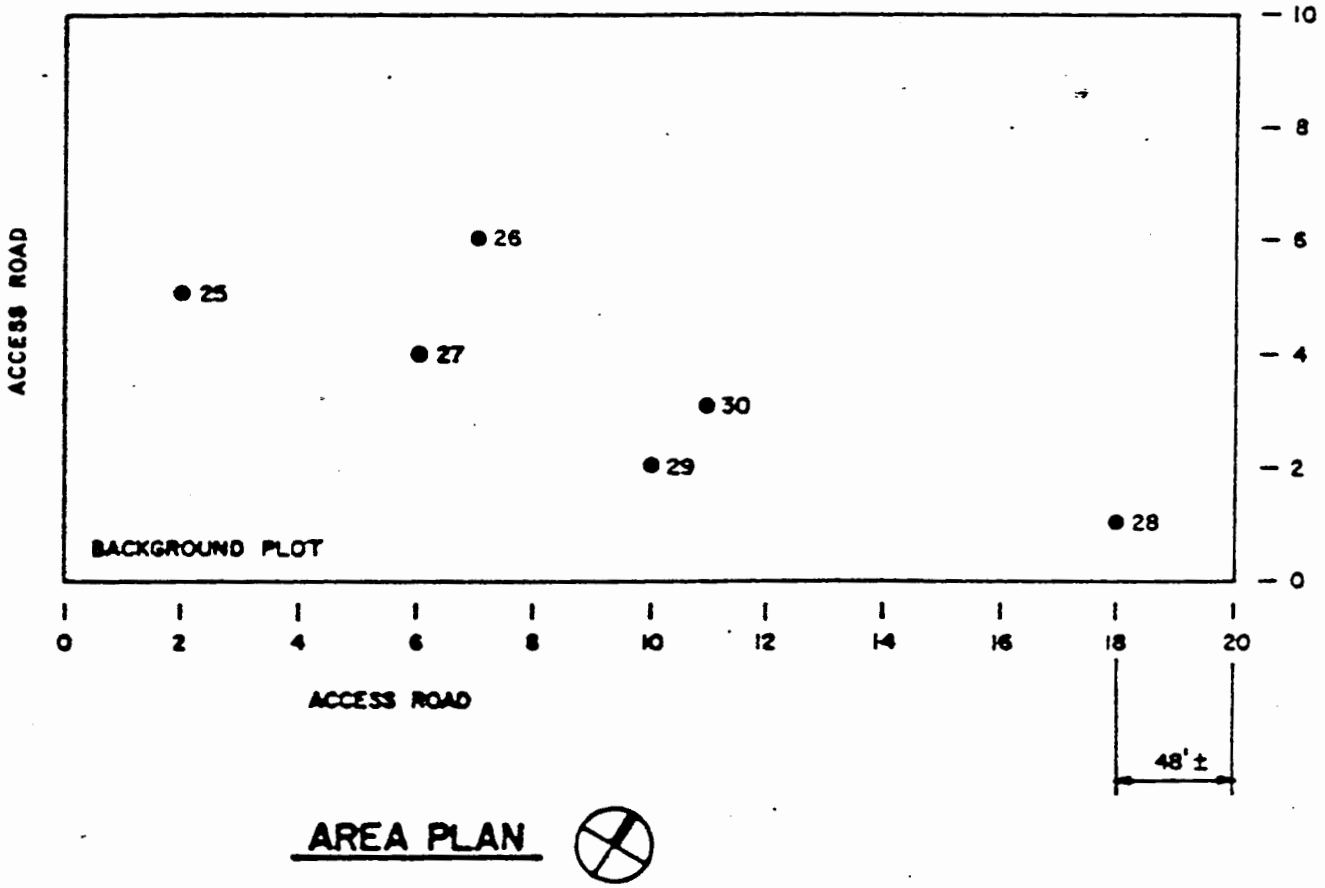


AREA PLAN

FIGURE 3.6

GIANT REFINING COMPANY - GALLUP, NM
LAND TREATMENT DEMONSTRATION

Lockwood, Andrews & Newnam, Inc.



AREA PLAN

FIGURE 3.7

GIANT REFINING COMPANY-GALLUP, NM
LAND TREATMENT DEMONSTRATION
SAMPLE LOCATIONS - EVENT NO. 5 . APR '88

Lockwood, Andrews & Newnam, Inc.

In Plots 1 and 2, both pre and post demonstration sampling efforts included all Intervals (One through Six). During the three quarterly sampling events only Intervals One through Five were sampled. The background plot was sampled at all Intervals (One through Six) prior to and after the demonstration period.

Parameter	Pre-Demo 4/87	9/87	12/87	3/88	Post-Demo 4/88
Modified Skinner List[1]	24	0	0	0	36
Total Metals (Ba Cr Pb Zn)	16	12	12	12	24
Polynuclear Aromatic Hydrocarbons (GC)	16	12	12	12	24
Tier I Parameters[2]	24	0	0	0	24

TABLE 3.4 NUMBER OF BORINGS ANALYZED FOR LISTED PARAMETERS
[1]Demonstration permit, Attachment I, page 7, Tables 2-3 and 2-4.
[2]Demonstration permit, Attachment I, page 20, Table 4-2.

Samples for each treatment area were taken from six soil borings and were composited and analyzed as follows:

1. Samples from Interval One were composited in groups of three borings, with those borings located within the same treatment plot. These samples were analyzed for Tier 1 parameters and "Modified" Skinner List. Both of these lists are located in the Permit Application Report, pages 7 and 20;

2. Samples from Intervals Two through Five were composited horizontally by depth interval within each treatment plot, in groups of six borings. Each composited sample was analyzed for barium, chromium, lead and zinc, in addition to selected "Modified" Skinner List parameters and;

3. Samples from Interval Six were analyzed on a individual boring basis for Tier 1 parameters and "Modified" Skinner List.

Background samples were taken from a minimum of six borings and were analyzed and composited as follows:

1. Samples from Interval One were composited in groups of three borings. The samples were analyzed for Tier 1 and "Modified" Skinner List parameters.

2. Samples from Intervals Two through Six were analyzed for barium chromium lead and zinc in addition to selected "Modified" Skinner List parameters.

In addition to the above stated analyses, microtox analysis of both background and treatment plots was conducted. These samples were taken before demonstration waste application (4/28/87), immediately after application (4/29/87), two months after last waste application (9/7/87), five months after last waste application (12/21/87), seven months after last waste application (3/17/88), and after the demonstration period (4/7/88). Bulk density, porosity and cation exchange capacity tests were performed after the demonstration period. Compiled waste analysis results can be found in Appendix C.

The following procedure was used to process samples:

Sampling Procedure

1. Move onto sample location.

2. Drill down to approximately two feet with a hollow stem auger equipped with a split spoon sampler.

3. Recover sampler and transport to sampling area.

4. Drill and collect rest of sample and transport to sampling area.

5. Open split spoon to expose and extricate sample.

6. After extrication, measure and vertically log sample.

7. Divide core into one foot intervals by cutting with a clean knife.

8. Put each Interval into an appropriately labeled Ziploc bag to hold until compositing time.

9. Put ziploc samples in cooler on ice.

10. Prior to compositing, label sample jars with time, date, name of sampler, project, and sample number and analysis required. Record information in field log.

11. Composite intervals by placing sample on decontaminated stainless steel cookie sheet and remove outer one-half inch of core. Place remaining sample into a stainless steel bowl and using a clean spoon and knife, break the sample into fine pieces and mix.

12. Divide the sample in the bowl into quarters. Take a spoonful out of each quarter and place in sample jars until full. Tighten cap on jar and place in cooler with ice.

13. Continue with Steps 4 through 10 until enough coring have been collected to composite those intervals. (Note: Three borings comprise an interval one sample and six borings comprise interval two through interval five samples.)

14. Follow Steps 12 and 13 to composite samples.

15. Continue until all soil samples have been collected, composited and sealed.

3.3 QUALITY ASSURANCE/QUALITY CONTROL

QA/QC was ensured by several methods. Field methods, sample chain of custody and laboratory methods are the main areas of QA/QC.

Field methods incorporated field duplicates and field blanks. Field duplicates ensure that compositing methods were effective in creating a homogeneous sample. Field blanks determined that equipment decontamination between sampling efforts was thorough.

As a part of QA/QC, chain of custodies were filled out and placed inside the cooler before it was sealed. Chain of custodies included such information as time, date, collector, and analysis required as well as date shipped. The cooler was then sealed with laboratory issued seals. Laboratory records indicate that all shipments arrived intact.

Laboratory methods are critical to obtain reliable results.

The Enseco (Rocky Mountain Analytical) laboratories operate a QA/QC program designed to ensure the generation of scientifically valid data by monitoring laboratory operations. Routine QA/QC procedures include the use of approved methodologies, independent verification of analytical standards, use of duplicate Laboratory Control Samples to assess the precision and accuracy of the methodology on a routine basis, and a system of data review.

In addition, the Enseco laboratories maintain a comprehensive set of certifications from both state and federal governmental agencies which require frequent analyses of blind audit samples. Enseco-Rocky Mountain Analytical Laboratory is certified by the EPA under the EPA/CLP program for both Organic and Inorganic analyses, under the USATHAMA (U.S. Army) program, by the Army Corps of Engineers, and the states of Colorado, New Jersey, New York, Utah, and Florida, among others.

3.4 CHEMICAL ANALYSIS

3.4.1 Methods

Enseco-Rocky Mountain Analytical Laboratory performs analytical services according to methods approved by EPA and other regulatory agencies, whenever possible.

Methods for metals and organic compounds are primarily derived from three sources of EPA methods: 1) the methods promulgated in 40 CFR 136 for priority pollutants, 2) the methods published in EPA Manual SW-846 and 3) methods developed by the EPA-EMSL/LV for Superfund investigations, as well as several documents published by the EPA and Enseco-Rocky Mountain Analytical Laboratory in 1984 and 1985. These methods all use the same generic technology as summarized below:

- Metals: acid digestion followed by analyses using Inductively Coupled Plasma (ICP) supported by graphite furnace Atomic Absorption (AA).

- Volatile Organics: purge and trap Gas Chromatography/Mass Spectroscopy (GC/MS) or purge and trap Gas Chromatography (GC) with a selective detector.

- Semivolatile (base/neutral and acid) organics: solvent extraction followed by capillary column GC/MS.

Exact method references are given in the following tables.

Test	Description	Methodology	Reference
VOA	Volatile Organics	Purge & Trap, GC/MS	624(1)/8240(2)
BNA	Semivolatile Organics	Extraction, GC/MS	625(1)/8270(2)
601	Halogenated Volatile Organics	Purge & Trap, GC/Hall	601(1)/8010(2)
THM	Trihalomethanes	Purge & Trap, GC/Hall	601(1)/8010(2)
602	Aromatic Volatile Organics	Purge & Trap, GC/PID[1]	602(1)/8020(2)
604	Phenols	Extraction, GC/FID[2]	604(1)/8040(2)
605	Benzidines	Extraction, HPLC[3]	605(1)/8050(2)
606	Phthalate Esters	Extraction, GC/FID	606(1)/8060(2)
PNA	Polynuclear Aromatic Hydrocarbons	Extraction, HPLC	610(1)/8310(2)
611	Haloethers	Extraction, GC/ECD[4]	611(1)
GC FID	Hydrocarbon Scan	Extraction,	D3328-78(3)

TABLE 3.4 ANALYTICAL METHODOLOGY - ORGANIC TESTS
[1]PID - Photo Ionization Detector
[2]FID - Flame Ionization Detector
[3]HPLC - High Performance Liquid Chromatography
[4]ECD - Electron Capture Detector

Test	Description	Methodology	Reference
ICP	Trace Metals	ICP Emission Spectroscopy	200.7(1)/6010(2)
FSB	Antimony	Furnace Atomic Absorption	204.2(1)/7041(2)
FAS	Arsenic	Furnace Atomic Absorption	206.2(1)/7060(2)
FCD	Cadmium	Furnace Atomic Absorption	213.2(1)/7131(2)
FPB	Lead	Furnace Atomic Absorption	239.2(1)/7421(2)
FSE	Selenium	Furnace Atomic Absorption	270.2(1)/7740(2)
FAG	Silver	Furnace Atomic Absorption	272.2(1)/7761(2)
FTL	Thallium	Furnace Atomic Absorption	279.2(1)/7841(2)
CVHG	Mercury	Cold Vapor Atomic	245.1(1)/7471(2)
CR+6	Chromium (VI)	Colorimetric	3128(3)
IC SO4	Sulfate	IC	300.0(1)
SPESO4	Sulfate	Manual Turbidmetric	375.4(1)
TECNOXT	Nitrate+Nitrite as N	Cd Reduction Colorimetric	353.2(1)
METPH	pH	Meter	150.1(1)/9045(2)
ICP	Total Phosphorus as P	Digestion-ICP/AES	200.7(1)
TOCTOC	Total Organic	UV Oxidation-IR	415.2(1)
BAL O&G	Oil and Grease	Freon Extraction-Gravimetric	413.1(1)
IR AO&G	Oil and Grease	Freon Extraction-IR	413.2(1)
STEPHEN	Phenolics	Distillation-Colorimetric	420.1(1)

TABLE 3.5 ANALYTICAL METHODOLOGY - INORGANIC TESTS

References:

(1) Code of Federal Regulations, Chapter 40, Part 136 (40 CFR 136)

(2) EPA Manual SW-846, 3rd Edition, 1987

(3) "Annual Book of ASTM Standards," Volume 11.01, 1985.

Another test performed was the Microtox analysis. The MICROTOX system is intended to determine the toxicity of aqueous samples or aqueous extracts of samples using a bacterial indicator system. The analysis may be used to test a variety of samples. These may include industrial discharges, POTW influent and effluent streams and other miscellaneous environmental samples.

The method uses bioluminescent bacteria as a test organism. Exposure of the bacteria, under controlled conditions, to toxicants will produce a diminished bacterial light output. This change is recorded and is used to calculate a value describing the relative toxicity of the test material.

The microtox analyzer utilizes a photomultiplier tube (PMT) to amplify the signal resulting from the bacterial photolumenescence. Accordingly, samples which are turbid or highly colored should be avoided or compensated for.

3.4.2 Data Reduction

Data reduction began in the laboratory when all the data for a sample was compiled into a set of meaningful numbers. The data was further reduced when it was compiled by depth and core composites. After compiling, the data was catalogued by analytical category (PNA, VOA, metals, inorganics and microtox). A spread sheet format was utilized to sort the analytical categories and create an easily read data report.

3.5 SURFACE WATER CONTROLS

Water is the principal route by which pollutants could be transported from the land treatment area. Contaminants may either be dissolved or suspended in water and potentially carried off-site by surface waters or to groundwater. Consequently, water control is of primary importance in the management of a land treatment facility. To provide proper water management, a water balance must be developed to determine the required water management controls.

3.5.1 Water Balance

The water balance is used not only to determine runoff and runon controls but also to develop hydraulic loading rates.

Peak Storm Requirements: The peak storm runoff for the land treatment facility is based on the 25-year, 24-hour storm, which specifies a 4 percent annual probability that the amount will be equaled or exceeded. Peak runoff calculations are based on the method in Section 8.3.4.1 of EPA Manual SW-874. Appendix D has a brief discussion of the methods and calculations used to determine the potential peak storm runoff for this region. For the Gallup Area, direct runoff during the peak storm is estimated to be 1.6 inches.

Normal Seasonal Requirements: The normal seasonal requirements are based on monthly data and assume that there is no net change in the volume of runoff on a long-term basis. The water budget is derived from the following expression:

$$P + W = Ev + L + R$$

where:

P = precipitation
W = water applied in waste
Ev = water lost in evaporation
L = water lost in leachate
R = runoff to be collected

Further, runoff R is the sum of the storage volume S plus the discharge volume D. The discharge is proposed to be held to zero; therefore, the entire runoff R is equal to the storage S. Also assumed is that the leachate volume L is zero, therefore increasing the required storage. The final water balance expression then is:

$$S = P + W - Ev - L - D$$

where the terms are defined as above.

Precipitation values used were for the most recent 2-year period available from the National Oceanographic and Atmosphere Administration. Evaporation data was taken from Figure 8.9 through 8.20, EPA Manual SW 874. The average water with the applied waste was 0.06 inch per month, during application months. Leachate and discharge were set to zero. Based on these assumptions and data, the water budget shows no storage required on either a monthly or yearly basis. Water balance calculations are presented in Appendix D.

3.5.2 Runon Controls

The land treatment area is enclosed by a continuous berm, 3 feet above the natural grade. From the permit application report, this is sufficient to protect from runon due to the 100-year flood.

3.5.3 Runoff Controls

No additional runoff controls are required for normal monthly operations because the water balance shows no storage requirements due to high regional evaporative conditions. For peak storm events, 1.6 inch of runoff is predicted and the 3-foot berm will easily accommodate this.

4.0 TECHNICAL

Data derived from field studies, laboratory analysis, published literature and actual facility operating experience is used to develop waste management parameters. The parameters are developed by evaluating the principal treatment processes, such as, degradation, transformation and immobilization. From this evaluation the PHC's are defined, and the degradation rates, the half lives and the migration times for the PHC's are determined. Also, the Rate Limiting Constituent (RLC), Application Limiting Constituent (ALC), Capacity Limiting Constituent (CLC) and the unit life of the facility will be determined.

4.1 PRINCIPAL HAZARDOUS CONSTITUENTS (PHC)

The first step in demonstrating the complete degradation, transformation and immobilization of the waste within the treatment zone is to determine the PHC's of the wastes. According to 40 CFR Section 264.278, PHC's are defined as "hazardous constituents contained in the waste to be applied to the unit that are the most difficult to treat, considering the combined effects of degradation, transformation, and immobilization".

PHC identification is divided into two sections. The first section deals with the organic fraction and is based on degradation rates. The second section deals with the inorganic fraction and is based on mobility and soil loading capacity.

4.1.1 PHC Determination - Organics

All Appendix VIII organic constituents of petroleum wastes which are land treated can be degraded in the soil under proper environmental

conditions. Furthermore, all the organics can be temporarily immobilized in the soil prior to degradation.

Preliminary estimates regarding the mobility of individual compounds can be made by comparing the time it takes to degrade a compound (td) to the time it takes the compound to migrate out of the tm. Then the zone of incorporation is defined as the top 12 inches of each plot. Giant has proposed to use only the top one foot to determine degradation and migration times since the demonstration project shows essentially no migration past this zone. Also, even though the treatment zone does extend to a depth of five feet, the conservative assumption is that the top one foot is the most biologically active treatment zone. If td is less than tm, then the compound will degrade before it moves past the actively tilled zone and the treatment is considered complete. The compounds with td values considerably less than tm values do not meet the persistence and mobility criteria of a PHC. Methods for determining tm and td are presented in Appendix E. Table 4.0 compares the tm and td values for all of the organic compounds found in the waste characterization studies. Where the concentration at time t (C_t) is greater than the initial concentration the td can not be determined.

Compound	tm (day)	td (days)
Anthracene	13400	1120
Benzo(a)anthracene	19300	110
Chrysene	19300	250
Fluoranthene	101400	70
1-methylnaphthalene	NA	200
Naphthalene	1100	240
Phenanthrene	13800	240
Pyrene	99200	475
Benzene	500	8.4
Ethyl Benzene	32	110
Toluene	230	104
m-Xylene	50	107
O&P-Xylene	50	105
O-Cresol	2.2	280
M&P-Cresol	2.2	220
Phenol	99	9
2,4-Dimethylphenol	985	$C_t > C_m$
Benzo(a)fluoranthene	1764500	$C_t > C_m$
Benzo(a)pyrene	520800	$C_t > C_m$
Bis(2-ethylhexyl)phthalate	31300	$C_t > C_m$

TABLE 4.0 DEGRADATION TIMES AND MIGRATION TIMES FOR THE ORGANIC COMPOUNDS FOUND IN THE WASTES

All compounds with td greater than tm could be considered potential PHC's. In addition to this criteria, five other compounds are also added to the potential PHC list. These compounds are pyrene, phenanthrene, 1-methylnaphthalene, benzo(a)pyrene and chrysene. These compounds are added because they are the only constituents which were present both in the characterization study and the analysis of field demonstration samples. The potential PHC's are shown in Table 4.1.

Ethyl Benzene
m-Xylene
O&P-Xylene
O-Cresol
M&P-Cresol
Pyrene
Phenanthrene
1-methylnaphthalene
Benzo(a)pyrene
Chyrsene

TABLE 4.1 POTENTIAL ORGANIC PHC's

4.1.2 PHC Determination - Inorganics

Studies have shown that, in general, Appendix VIII inorganics constituents are effectively immobilized in petroleum land treatment facilities (API No. 4379). However, because metals are a conservative species, i.e. nondegradable, there is a safe soil capacity (Ce) which can define the amount of waste load. For this report, the safe soil capacity has been set at the value established by the National Academy of Science and the National Academy of Engineering published in EPA SW874. Any metal whose waste concentration (Cm) is less than Ce is not capable of overloading the treatment unit. Cm is determined on a Residual Solids Basis. If the constituent Cm is greater than Ce, the constituent is a potential PHC. Table 4.2 is a list of the potential metal PHC's. The metal loading ratio calculations can be found in Appendix F.

Barium
Cadmium
Chromium
Copper
Lead
Mercury
Nickel
Selenium
Silver
Zinc

TABLE 4.2 POTENTIAL METAL PHC's

4.2 DEGRADATION COEFFICIENT

Degradation coefficients were calculated for all compounds in the waste characterization studies. These compounds are listed in Table 4.3.

Compound	Calculated Initial Conc. (mg/kg)	Final Conc. (mg/kg)
Anthracene	0.47	0.34
Benzo(a)anthracene	0.33	0.34
Chrysene	0.80	0.34
	(1.70)	0.34
Fluoranthene	0.16	0.34
1-Methylnaphthalene	27.99	0.34
	(7.3)	(0.30)
Naphthalene	7.26	0.34
Phenanthrene	4.86	(0.31)
Pyrene	5.81	(1.21)
Benzene	3.37	0.005
Ethylbenzene	7.45	0.005
Toluene	21.42	0.005
M-Xylene	27.58	0.005
O&P Xylene	22.54	0.005
O-Cresol	2.58	0.34
M&P Cresol	12.53	0.34
Phenol	24.76	0.34
2,4-Dimethylphenol	0.02	0.34
Benzo(b)Fluoranthene	0.03	0.34
Benzol(a)Pyrene	0.02	0.34
Fluorene	1.68	1.23

TABLE 4.3 DEGRADATION COEFFICIENTS PARAMETERS

NA - Not Available
( ) - Actual Analytical Result from ZOI
Initial Conc. - Calculated
Final Conc. - Based Detection Limits

The initial concentration of each constituent was calculated by taking the mass fraction of each compound times the total mass of waste applied. The mass fraction of each compound was different for each type

of waste; see waste characterization section. It was then assumed that for any one application, waste would only be applied to about 80 percent of the land treatment area. After incorporation, the waste should be distributed over the entire depth of the zone of incorporation (ZOI). The initial concentration (Co) then is the total mass of the constituent (Mc) applied divided by 80 percent of the mass of the ZOI (Mz):

$$Co = \frac{Mc}{Mz}$$

The time duration was the interval from the date of the last waste application to the sampling date. That is, 7/21/87 to 12/21/87 or 144 days. Final concentrations were either the actual concentration detected in the core analysis or the laboratories reported detection limits. Degradation rates calculated using detection limits as the final concentration are conservative because the actual final concentration could be much less. Table 4.3 is a list of the initial and final concentrations used to determine degradation coefficients. The degradation rate is assumed to follow a first order model in that the degradation rate is proportional to the concentration of the constituent. The first order rate coefficient (K) can be calculated by:

$$K = \frac{-\ln (Ct/Co)}{t}$$

where: Ct = concentration at time (t)
Co = initial concentration
t = time

Table 4.4 is a summary of K values determined during the Giant Refinery LTD and various ranges reported in the literature. It is important to note that, the higher the K value the faster the compound will degrade.

Compound	K (Giant)	K (API Study)*	K (Published Lit.)*
Anthracene	0.002	0.013 - 0.073	0.08 - 0.019
Benzo(a)Anthracene	--	0.003 - 0.011	0.005 - 0.017
Chrysene	0.006-0.011	0.006 - 0.017	0.010 - 0.126
Fluorathene	--	0.021 - 0.047	0.003 - 0.024
1-Methylnaphthalene	0.022-0.31	0.043 - 0.058	---
Napthalene	0.021	0.013 - 0.019	0.023 - 0.087
Phenanthrene	0.019	0.016 - 0.120	0.01 - 0.03
Pyrene	0.010	0.014 - 0.022	0.007 - 0.067
Benzene*	0.010	0.013 - 0.034	---
Ethyl Benzene	0.045	0.076 - 0.083	---
Toluene	0.058	0.106 - 0.119	---
M-Xylene	0.059	0.057 - 0.087	---
O&P-Xylene	0.058	0.047 - 0.077	---
O-Cresol	0.014	---	---
M&P-Cresol	0.025	---	---
Phenol	0.030	---	---
2,4-Dimethylphenol	---		
Benzo(b)Fluorathene	---	0.003 - 0.005	0.009 - 0.05
Benzo(a)Pyrene	---	---	0.001 - 0.010
Fluorene	0.002	0.007 - 0.068	---

TABLE 4.4 SUMMARY OF DEGRADATION COEFFICIENTS
(*After API No. 4455)

Two compounds, bis(2-ethylhexyl) phthalate and fluorene were also detected during the Land Treatment Demonstration (LTD) corings but were not found during the waste characterization studies. It is assumed that these compounds are degradation products. Degradation coefficients were not determined for these compound for two reasons. First, if they are degradation products the time at which they first appear cannot be determined and, therefore, the time component of the degradation rate is not available. Second, considering they are not present in the waste when it is applied, an initial concentration cannot be determined. Indeed, if they are degradation products, their formation and decomposition would continue even after the waste is applied.

4.3 COMPOSITE WASTE

In order to determine the Rate Limiting Constituent, the Application Limiting Constituent and the Capacity Limiting Constituent, it was necessary to develop a composite waste characterization. There are four waste types which will be treated on the unit. The waste types were described and characterized earlier. Significantly different volumes of each waste type will be applied to the land treatment area (LTA). Also, each waste type has widely varying major constituents.

Loading rates calculated based on the higest concentration of each constituent would be overly conservative and would not account for the relatively small volumes of certain wastes. Conversely, however, loading rates based on the largest volume waste would be too liberal, not accounting for the high concentrations of hazardous constituents in certain wastes. To overcome these problems, a composite waste profile was developed.

The composite waste profile was determined by calculating the weighted average of each potential PHC. The weighted averages are based on the following waste volume fractions:

API Separator Sludge	72.0%
Heat Exchanger Sludge	0.5%
Slop Oil	26.5%
Leaded Tank Bottoms	1.0%

A characterization of the PHC's in the composite waste is shown in Table 4.5.

Constituent	Concentration (mg/Kg)
Ethyl Benzene	113.8
M-Xylene	424
O&P-Xylene	346
O-Cresol	32
M&P-Cresol	157
Pyrene	12.5
Phenanthrene	68.1
1-Methylnaphthalene	396
Benza(a)Pyrene	0.3
Chyrsene	11.1
Antimony	1.8
Arsenic	15.2
Barium	695
Beryllium	0.4
Cadmium	3.8
Chromium	683
Cobalt	16.8
Copper	579
Lead	435
Mercury	5.7
Nickel	78.5
Selenium	8.1
Silver	1.5
Vanadium	10.8
Zinc	1924
% Residual Solids	51.4

TABLE 4.5 COMPOSITE WASTE CHARACTERIZATION

4.4 LOADING RATES

Loading rates were determined separately for the conservative inorganic components and the degradable organic components. The organic constituent defines the rate limiting constituents (RLC) and the application limiting constituents (ALC). The metals define the capacity limiting constituents (CLC).

The degradation of the organic fraction of the waste is the principal objective of the land treatment process. The loading rates are developed from the constituent half life, which is defined as the time required to degrade the waste to one-half of the initial concentration. The half life (t 1/2) is therefore determined from the degradation coefficient (K) by:

$$t\ 1/2 = \frac{-\ln\ (1/2)}{K}$$

The loading rates are calculated based on some critical soil concentration above which the toxic effects of the constituent is unacceptable. For the compounds in question, the critical concentrations were taken from API publication No. 4455 as the concentration that shows no adverse effect on the degradation rate. For the compounds not found in this reference, we used the actual initial concentration in the LTD. These concentrations also show no adverse effect on the degradation rate and, at a minimum, are a very conservative estimate of critical concentration.

Two types of loading management plans are described in EPA SW 874 for Hazardous Waste Land Treatment (HWLT) units. For the purposes of this report, we will use the more conservative model based on a vegetative cover over the LTA as follows:

$$Cyr = \frac{1/2\ Ccrit}{t\ 1/2}$$

When the vegetative model is used, toxics exhibiting either microbial or plant toxicity may limit the loading rate. The model not used in

this study allows waste applications that exceed the phytotoxicity threshold value. The only constraints would be that the microbial toxicity threshold not be exceeded and that a final vegetative cover can be established after a given number of years.

where:

Cyr = the rate of application of the constituent of interest in the soil (lb/ac/yr)

t 1/2 = constituent half life

C crit = critical concentration of the constituent above which crop yield is affected (lb/ac)

The loading rate (LR) of raw waste is determined by:

$$LR = Cyr/Cu$$

where:

LR = Loading rate of waste (lb/ac/yr)

Cu = Concentration of the compound of interest in the waste (lb/lb)

Table 4.6 lists the critical concentration and the half life for the PHC's presented earlier.

Compound	C crit (lb/ac)	t 1/2 (yr)
Pyrene	7575	0.19
Phenanthrene	801	0.10
1-Methylnaphthalene	156	0.06
Benzo(a)Pyrene	441	0.19
Chyrsene	496	0.17
Ethylbenzene	40.6	0.04
M-Xylene	150	0.03
O&P-Xylene	123	0.03
O-Cresol	140	0.14
M&P-Cresol	680	0.08

TABLE 4.6 CRITICAL CONCENTRATION AND HALF LIFE FOR THE ORGANIC PHC's

Table 4.7 lists the compound loading rate, the constituent fraction and the waste loading rate for the organic PHC's.

Compound	Cyr (lb/ac/yr)	Cu (lb/lb)	LR (lb/ac/yr)
Pyrene	20,000	12.5×10^{-6}	1.6×10^{9}
Phenanthrene	4,000	68.1×10^{-6}	59×10^{6}
1-Methylnaphthalene	1,325	395×10^{-6}	3.4×10^{6}
Benzo(a)pyrene	1,160	0.3×10^{-6}	3.9×10^{9}
Chrysene	1,500	11.1×10^{-6}	140×10^{6}
Ethylbenzene	508	113×10^{-6}	4.5×10^{6}
M-Xylene	2,500	424×10^{-6}	5.9×10^{6}
O&P-Xylene	2,050	340×10^{-6}	5.9×10^{6}
O-Cresol	500	32×10^{-6}	15.6×10^{6}
M&P-Cresol	4,250	157×10^{-6}	27×10^{6}

TABLE 4.7 LOADING RATE ON A CONSTITUENT BASIS, ON A WASTE BASIS AND THE CONSTITUENT FRACTION OF THE WASTE

4.4.1 Rate Limiting Constituent

The rate limiting constituent (RLC) is determined from Table 4.7. The RLC is defined as the constituent which limits the annual application of waste. As shown on Table 4.7, the constituent with the lowest loading rate is 1-methylnaphthalene at 3.4×10^{6} lb/ac/yr on a composite waste basis. This load must be proportioned to the individual types of waste that make up the composite waste. Table 4.9 shows the loading rates on a specific waste basis.

4.4.2 Application Limiting Constituent

The application limiting constituent (ALC) is defined as the constituent which limits the amount of waste that may be applied in a single dose. That is to say, the resulting concentration after the single dose cannot exceed the critical concentration. This value is determined by

dividing the critical concentration by the fraction of each component in the waste. Table 4.8 shows the ALC for the organic PHC's. The ALC is M-Xylene at 354,000 lb/ac/application.

Compound	Ccrit (lb/ac)	Cu (lb/lb)	ALC lb/ac/application
Pyrene	7575	12.5×10^{-6}	610×10^{6}
Phenanthrene	801	68.1×10^{-6}	11.8×10^{6}
1-Methylnaphthalene	156	395×10^{-6}	1500×10^{6}
Chyrsene	496	11.1×10^{-6}	44.7×10^{6}
Ethylbenzene	40.6	113×10^{-6}	0.36×10^{6}
M-Xylene	150	424×10^{-6}	0.35×10^{6}
O&P-Xylene	123	346×10^{-6}	0.35×10^{6}
O-Cresol	140	32×10^{-6}	4.4×10^{6}
M&P-Cresol	680	157×10^{-6}	4.3×10^{6}

TABLE 4.8 APPLICATION LIMITING CONSTITUENTS

Type of Waste	RLC (lb/ac/yr)	ALC (lb/ac/APPLICATION)
API Sludge	2,448,000	254,880
Heat Exchanger Sludge	17,000	1,770
Slop Oil	901,000	93,810
Leaded Tank Bottoms	34,000	3,540

TABLE 4.9 LIMITING LOADING RATES ON A WASTE TYPE BASIS

4.4.3 Capacity Limiting Constituent

The metal fraction of the waste is conservative and is used to determine the capacity limiting constituents (CLC) because it is conservative i.e., non-degradation. A metals loading ratio is determined based on the metal concentration in the composite waste and an acceptable metal loading capacity. The acceptable metal loading capacity for each metal found in the waste characterization study is presented in Table 4.10. Generally, the values are from Table 6.47 of EPA SW-874. These values

are the calculated acceptable soil concentrations as published by the National Academy of Science and National Academy of Engineering at closure. For metals not found in this table, Table 6.46 of of EPA Manual SW-874 was used. This is a table of common ranges of trace metals concentrations in soils (Lindsay, 1979). Mid-range values from Table 6.46 were used.

An acceptable mercury level was not published in SW-874 Table 6.47. However, Van Loon (1974) found that the toxic effect in soil was only detected at concentrations greater than 10 mg/kg. Gracey and Stewart (1977) show no toxic effect in soil at 10 mg/kg concentrations and Beauford et.al. (1977) found no toxic effect to oats at concentration of 25 mg/kg in sand. From this data, it seems reasonable to set an acceptable mercury concentration at 10 mg/kg.

Table 4.10 also contains the metal concentration of the composite waste on a residual solids basis. The ratio of metal concentration to metal capacity is the metals loading ratio (MLR). If this ratio is less than 1, the constituent cannot increase the soil concentration above the soil capacity. The metal with the highest ratio is the capacity limiting constituent (CLC). From Table 4.10, it can be seen the zinc is the CLC.

Metal	Metal Loading (mg/kg)	Metal Capacity (mg/kg)	MLR
Sb	6 (1)	3.3	0.6
As	500	27.9	0.1
Ba	1000 (1)	1278	1.3
Be	50	0.7	0.01
Cd	3	7.0	2.3
Cr	1000	1255	1.3
Co	500	30.9	0.1
Cu	250	1065	4.3
Pb	1000	800	0.8
Hg	10 (2)	10.5	1.1
Ni	100	144	1.4
Se	3	14.9	5.0
Ag	2.5 (1)	2.8	1.1
V	500	19.9	0.04
Zn	500	3538	7.1

(1) Table 6.46 EPA SW-874
(2) See Text

TABLE 4.10 METAL LOADING RATIO

The capacity of the soil on an applied waste basis is shown in Table 4.11. Again, the capacity limiting constituent is Zn at 0.17×10^9 lb of waste or 35.4×10^6 lb/ac.

Compound	Soil Capacity (mg/kg)	Metal Conc. Wet Basis (mg/kg)	Total Mass of Waste (lb)
Ba	1000	695	0.92×10^9
Cd	3	3.8	0.50×10^9
Cr	1000	683	0.93×10^9
Cu	250	579	0.28×10^9
Hg	10	5.7	1.12×10^9
Ni	100	78.5	0.81×10^9
Se	3	8.1	0.24×10^9
Ag	2.5	1.5	1.06×10^9
Zn	500	1924	0.17×10^9

TABLE 4.11 TOTAL METAL CAPACITY OF THE SOIL ON A WASTE BASIS

4.5 CONSTITUENT MIGRATION

A principal concern involved in the land treatment of petroleum refinery wastes is the potential for the migration of hazardous waste constituents beyond the treatment zone. Extensive data from petroleum waste land treatment sites (Linkenheil 1985) indicate that inorganics are essentially immobile provided proper management techniques are practiced. The migration of inorganics will be discussed later. Of greater concern to the migration question is the leaching of organics beyond the treatment zone.

4.5.1 Organics

In order to evaluate the migration potential of the organics, a screening model is employed. Waste, site and operational factors are the input data to a screening model. Using known and estimated organic carbon partition coefficients (Koc) site specific partition coefficients (Kp) can be estimated for the constituents present in the waste. Appendix E contains a tabular listing of the Kp's for the site constituents. Degradation coefficients, discussed elsewhere, are also presented in this appendix.

The screening model requires that the degradation time (td) and the migration time (tm) be determined using the coefficients (see Appendix E). If td is less than tm then the constituent will degrade before it moves beyond the treatment zone and no further evaluation is necessary. If td is greater than tm, then the compound may not be completely degraded before migration beyond the treatment zone and further evaluation is needed.

The t-test statistics show that metal concentrations in the BTZ for the post demonstration sampling event are equal to or less than the metal concentrations found in the BTZ for the predemonstration sampling event. When the final sampling event is compared to the background BTZ samples, the results also show that the metals concentrations in the BTZ for both treatment plots are equal to or less than the background plot, with one exception. The exception is the vanadium concentration in Plot 2. The Plot 2 vanadium concentration of 14.8 mg/kg shows a statistically significant increase over the background concentration of 12.6, however, this is due to the small standard deviation of the Plot 2 vanadium data of 1.46. In actuality, the percentage difference between these two valves is less than 18 percent. These facts lead to the conclusion that although monitoring of this metal concentration should continue, no migration of this metal out of the treatment zone has occurred.

4.6 UNIT LIFE

With the capacity limiting constituent defined, the unit life can be determined. Based on the composite waste and the capacity limiting constituent, the land treatment area can accept maximum of 35.4×10^6 lb/ac of waste. The mass of waste applied per year at current production rate, to the land treatment area during the demonstration period was 1.3×10^6 lb/yr. The annual loading rate is 3.4×10^6 lb/ac/yr based on the RLC. To be conservative, the unit life will be calculated using the annual loading rate.

$$UL = \frac{LCAP}{LR_{RLC}}$$

where:

UL = Unit Life (yr)

LCAP = The waste loading capacity which will not exceed the CLC (35.4×10^6 lb/ac).

LR_{RLC} = Loading rate based on RLC (3.4×10^6 lb/ac/yr)

From the expression above, the land treatment area is estimated to have a unit life of 10 years.

4.7 OPERATIONAL EXPERIENCE

The Giant Refining land treatment facility has been in operation for several years with no detrimental effects to the site. Good records of application rates are available for the site. There is no evidence of groundwater contamination or leachate migration from the unit.

A yearly summary of operational data is presented in Table 4.12 for the years 1984 through 1987. Total waste loading has remained constant during this four year period at between 220,000 lb/ac/yr and 270,000 lb/ac/yr. The oil fraction of the waste is between 6 and 10 percent oil, which gives an oil loading rate of 12,800 lb/ac/yr to 24,600 lb/ac/yr.

Year	Waste Type	Waste Loading Rate (lb/ac/yr)	Oil Loading Rate (lb/ac/yr)
1984	Slop Oil	102,000	17,500
	API Sludge	125,000	7,100
1985	Slop Oil	5,600	960
	API Sludge	264,000	15,000
	Heat Exchanger Sludge	1,500	320
1986	Slop Oil	330	60
	API SLudge	220,000	12,500
	Heat Exchanger Sludge	800	170
1987	Slop Oil	59,000	10,100
	API Sludge	212,500	4,300
	Heat Exchanger Sludge	1,400	300

TABLE 4.12 SUMMARY OF GIANT REFINING LAND TREATMENT UNIT APPLICATION RATES 1984 THROUGH 1987

Table 4.13 is a list of typical land treatment facility's oil application rates at full scale refineries. From this data, it can be seen that the oil application rate at the Giant Refining land treatment facility is at the extreme low end of the typical range. Also, the annual waste application rates are an order of magnitude less than the RLC show in section 4.4.1.

Location	Annual LR BBL/AC	Annual LR (lb/ac/yr)
Montana	70	21,300
California	1900	581,000
New Jersey	650	199,000
Illinois	100	30,500
Mississippi	840	257,000
Louisiana	380	116,000
Washington	650	199,000
Washington	280	85,800
Texas	220	67,300
Texas	680	208,000
Texas	400	122,000
Oklahoma	500	152,000
Oklahoma	110	33,500
Giant	51*	17,100*

TABLE 4.13 TYPICAL OIL APPLICATION RATES FOR LAND TREATMENT UNITS AT FULL SCALE REFINERIES (API, Land Treatment Practices in the Petroleum Industry, June, 1983)
*Four Year Average

5.0 CONCLUSION

The demonstration of treatment at the Giant Refinery land treatment facility was a full-scale field study. Table 4.12 shows that, during the one-year demonstration period, the Land Treatment Area (LTA) treated a typical amount of yearly waste. This is based on operating data from the last four years and considers both waste loading and oil loading.

Degradation studies confirm the degradation or transformation of all the applied wastes. The degradation coefficient and half life values determined from the field study agreed very well with values reported by the American Petroleum Institute and in the literature. From the data produced during this portion of the field study, it can be demonstrated that the facility can efficiently treat waste at and above the current loading rate. In fact, the LTA can treat twice the amount of waste annually applied and still have a facility life of 10 years.

All data obtained during this demonstration confirms that there is no detectable constituent migration from this unit.

From data available to date, the proposed operating parameters are presented in Table 4.14.

Loading Rates

Application	lb/ac/application
API Separator Sludge	254,880
Heat Exchanger Sludge	1,770
Slop Oil	93,810
Leaded Tank Bottoms	3,540
Total Waste	354,000

Annual	lb/ac/yr
API Separator Sludge	2,448,000
Heat Exchanger Sludge	17,000
Slop Oil	901,000
Leaded Tank Bottom	34,000
Total Waste	3,400,000

Facility Capacity 35,400,000 lb/ac

Facility Life* - 10 years

* Based on twice the present annual application rate to data.

TABLE 4.14 PROPOSED OPERATING PARAMETERS

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Appendix E

APPENDIX E

POST CLOSURE MONITORING PLAN

ZONE OF INCORPORATION
TREATMENT ZONE
CHINLE SLOPE
SONSELA AQUIFER

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ACRONYMS AND ABBREVIATIONS

%C	numerical expression of the completeness
%R	percent recovery
BFB	4-bromofluorobenzene
BTZ	below treatment zone
Ciniza	Ciniza Refinery
COC	chain of custody
DMP	Detection Monitoring Plan
DOT	U.S. Department of Transportation
DQO	data quality objective
EDP	Early Detection Plan
EDS	Early detection system
EM	environmental manger
EPA	U.S. Environmental Protection Agency
Giant	Giant Refining Company
LCS	laboratory control sample
LTD	land treatment demonstration
LTU	land treatment unit
MDL	method detection limit
MW	monitoring well
NMED/HRMB	New Mexico Environmental Department/Hazardous and Radioactive Materials Bureau
PHC	principal hazardous constituent
PID	photo ionization detector
PPE	personal protective equipment
QA	quality assurance
QA/QC	quality assurance/quality control
QC	quality control
RCRA	Resource Conservation Recovery Act
RFA	RCRA Facility Assessment
RPD	relative percent differences
SAL	screening action level
SOP	standard operating procedure
SMW	shallow monitoring well
SVOC	semi-volatile organic compound
TZ	treatment zone
TEGD	RCRA Ground Water Monitoring Technical Enforcement Guidance Document (EPA 1986)
VOA	volatile organic analyte
VOC	volatile organic compound
ZOI	zone of incorporation

1.0 INTRODUCTION

1.1 Overview

During the post closure care period Gallup Refinery proposes a Post Closure Monitoring Program that encompasses two monitoring sequences; the early detection monitoring for monitoring subsurface conditions to "determine whether hazardous constituents have migrated out of the treatment zone" as required by 20 NMAC 4.1, subpart V, §264.278 and detection monitoring for monitoring groundwater to protect human health and environment as required by 20 NMAC 4.1, subpart V, §264.97. The early detection monitoring works in concert with the detection monitoring for protection of the groundwater resources at the Gallup Refinery.

The combination of early detection monitoring and detection monitoring provide the procedures necessary to: define monitoring team responsibilities, define sampling and analytical techniques, specify sample identity, and establish precision and accuracy of reported data.

It is essential to ensure that data generated from these monitoring programs are valid. For data to be valid, they must be supported by documented procedures so that they can be used with confidence to support and defend regulatory decisions. The overall objective for the Land Treatment Unite (LTU) monitoring plan, during the post closure care period, is to collect accurate and defensible data sufficient to assess the concentrations, if any, of subsurface constituents below the LTU.

1.2 Purpose

This appendix provides instruction for sample collection, water level monitoring, data management, and reporting of annual data; identifies analytical parameters selected for assessing the quality of soil and groundwater; and establishes personnel responsibilities for the LTU soil and groundwater monitoring program. Because quality assurance (QA) is an integral component of the soil and groundwater sampling, analysis, and reporting

process, quality assurance/quality control (QA/QC) elements and associated data acceptance criteria are provided to the laboratory(s) performing sample analysis.

Detailed instructions for performing field activities that will be conducted in conjunction with the post closure monitoring plan are provide in field operating procedures maintained by the Gallup Refinery's Environmental Manager (EM). Detailed procedures are provided for each aspect of the soil and groundwater sampling process, including water-level measurement, sampling equipment operation, field water-quality measurements and sample collection. These procedures are intended to support proper field sampling expertise. Samples will be taken under the supervision and direction of qualified engineers, scientists, or other technical personnel.

1.3 Site Location

Gallup Refinery is a crude oil refining facility located in McKinley County, New Mexico at Township 15 North, Range 15 West, Sections 28 and 33. The Gallup Refinery is just north of Interstate 40 (I-40) and approximately 17 miles east of Gallup, New Mexico.

The LTU is located within the Gallup Refinery property boundary. The LTU consists of three 480 feet x 240 feet sections. Each section is diked and contains 2.6 acres (1.0 hectare) of surface. The LTU treatment zone of soil extends 5 feet deep from the original soil surface. This depth is shallow enough to ensure the treatment zone is more than 3 feet above the seasonal high water table. The zone of incorporation (ZOI) within the treatment zone is the volume of soil to which the waste is directly applied. The ZOI is the top 12 inches of the treatment zone. The LTU was designed and constructed with a continuous berm, which surrounds the LTU at an elevation of approximately 3 feet above the natural grade.

1.4 Geological and Hydrologic Characteristics

The Gallup Refinery is located on a layered geologic formation, which slopes gently to the northwest. Surface soils consist of varied fluvial and alluvial deposits (clay, silt, sand) and imported fill. Below is the Chinle formation, which consists of very low-

permeability clays and shale's, and effectively serves as an aquiclude, or confinement layer that lies directly above the Sonsela sandstone. The Sonsela sandstone is a water saturated unit and represents the uppermost aquifer in the region (Figure 1-1). The clay and shale of the Chinle aquiclude have a hydraulic conductivity of 10 (-9) centimeters per second.

Just above the Chinle aquiclude is a zone of water bearing, weathered alluvium known as the Chinle slope wash. Based on hydrologic investigations performed at the site, it has been determined that the Chinle slope wash is hydraulically interconnected with water located in shallow, localized sand lenses (Precision Engineering 1996) located between the Chinle slope wash and the ground surface. Unlike the shallow, localized sand lenses, the Chinle slope wash is continuous and saturated throughout the region underneath the LTU. However, the Chinle slope wash does not meet the regulatory definition of the uppermost aquifer. The water table above the aquiclude slopes to the northwest at a gradient of 0.01 ft/ft. Chinle slope wash flow direction is depicted in Figure 1-2. The rate of water movement in these clay stones is estimated to be less than 1 foot per year (Hazardous Waste Facility Permit).

The Sonsela aquifer is considered to be the uppermost aquifer even though it does not meet the water quality standards for drinking water. The Sonsela aquifer potentiometric surface is shown in Figure 1-2. The Sonsela aquifer is a bed of fine to medium grained sandstone, 12 to 15 feet thick, within the upper most of the Chinle formation. The top of the unit is at 100 to 112 feet and it is overlain by reddish-brown, weathered clay stones and sandy clays tones. Groundwater in the uppermost aquifer is under artesian confinement in the vicinity of the LTU. The potentiometric surface for groundwater in the aquifer is 70 to 100 feet above the top of the aquifer, or 9 to 31 feet below the surface. The direction of flow in the Sonsela aquifer is northwest and the potentiometric gradient is approximately 0.01 ft/ft directly beneath the Ciniza Refinery. The average linear velocity for water in the uppermost aquifer beneath the LTU is 8.2 feet per year (Giant Refining Company 1984)

The Sonsela sandstone bed is separated from lower aquifers by a thick sequence of mudstones and siltstones, with a few beds of sandstone and conglomerate. There appears to be no significant hydraulic connection between the Sonsela aquifer from the lower aquifers (Shinarump Member of the Chinle Formation, the Moendopi Formation, and the Permian-age San Andres Limestone-Glorieta Sandstone aquifer). The lower aquifers lie at depths greater than 700 feet. Figure I-1 of the Ciniza Part B Post Closure Permit Application depicts the stratigraphy beneath the LTU.

2.0 POST CLOSURE MONITORING PLAN OVERVIEW

2.1 Scope

Ciniza developed the post closure monitoring plan to monitor subsurface conditions to "determine whether hazardous constituents have migrated out of the treatment zone", as required by 20 NMAC 4.1, subpart V, §264.278. The post closure monitoring plan is comprised of early detection monitoring and detection monitoring. This appendix addresses monitoring of soils and liquids which lie beneath the LTU, including the Sonsela aquifer. The Sonsela is the uppermost aquifer beneath the LTU and is monitored in accordance with detection monitoring procedures. Early detection monitoring involves monitoring the ZOI, and treatment zone, and works in concert with detection monitoring to employ a multi-tiered approach that confirms, at a high level of certainty, the integrity of the LTU.

Early detection monitoring involves sampling the ZOI, treatment zone, and the Chinle slope wash. The Chinle slope wash is contiguous beneath the LTU and may provide a potential pathway for any releases to move beyond the point of compliance. Therefore, in order to be fully protective of human health and the environment, Ciniza developed an early detection monitoring sequence to monitor the Chinle slope wash.

The detection monitoring for the Sonsela aquifer consists of four monitoring wells (MWs). These well include one MW located up gradient of the LTU to measure background, and three additional MWs located at the point of compliance at the down gradient edge of the LTU. These MWs will be sampled to determine whether the LTU

has released hazardous constituents below the treatment zone (BTZ). This monitoring plan provides economical feasibility and environmental protection while ensuring the technical adequacy of the approach.

2.2 Background Values

2.2.1 Background Soil Samples

Background soil samples were collected in 1981 from the LTU, prior to any waste application, as part of Ciniza's Groundwater Monitoring Program. In 1987, Ciniza was issued a Short term Land Treatment Demonstration permit to conduct a hazardous waste land treatment demonstration (LTD). The LTD included sampling of both ZOI and BTZ soils. In 1988, Ciniza was issued a Hazardous Waste Facility Permit (NMED 1988). Sampling of ZOI and BTZ soils was established as a condition of the permit. Permitted sampling provides ten years of LTU soil data. No hazardous waste has been applied to Cell 3 of the LTU has been routinely sampled during this time. Data from the 1981 sampling and Cell 3 sampling has been used historically as the background. Samples obtained from Cell 3 (analyzed in accordance with the early detection monitoring) will be used as the background for determining statistically significant increases in hazardous constituents as required by 20 NMAC 4.1, subpart V, §264.278 (f). Background values for Chinle slope wash samples are not established. Detection of any constituents from Table 2A through 2D may generate additional sampling in consultation with NMED.

2.2.2 Background Sonsela Groundwater Samples

Samples obtained from MW-4 and analyzed in accordance with the detection monitoring will be used as background for determining statistically significant increases in hazardous constituents in the Sonsela aquifer as required by 20 NMAC 4.1, subpart V,§264.97 (a). MW-4 is located between the LTU and the evaporation ponds directly to the south of the LTU. Using MW-4 as background will ensure that any potential impacts from the evaporation ponds can be identified and evaluated in comparison to the other MW sampling data.

2.3 Monitoring Wells

To ensure that post closure monitoring will provide the best quality data in the future, Ciniza will utilize shallow monitoring well (SMW-4) to sample the Chinle slope wash. MW-1, MW-2, MW-4 and MW-5 to sample the Sonsela. MW-4 is located up gradient of the LTU to provide background values. Wells MW-1, MW-2 and MW-5 are located down gradient of the LTU at the point of compliance. The well locations ensure detection of any release from the LTU. All well locations are based on current potentiometric surfaces (Figures 2-1a and 2-1b).

2.3.1 Well Siting

The wells are sited following guidance in the U.S. Environmental Protection Agency (EPA) Groundwater Monitoring Technical Enforcement Guidance Document, and the groundwater flow characteristics at the site. In September 1985, shallow monitoring wells were installed around the LTU perimeter as part of the early detection monitoring. The shallow monitoring wells were installed in pockets of sand above the Chinle formation that exists as thin lenses above the Chinle shale between the ground surface and the top of the Sonsela sandstone. The shallow monitoring wells SMW-1, SMW-2, SMW-3, SMW-5 and SMW-6 have performed poorly because it has been discovered that they were completed within different sand lenses, which does not allow them to produce consistent data applicable to the LTU. MW-1, MW-2, MW-5 are completed in the Sonsela aquifer and are located directly down gradient of the LTU. Figure 1-1 shows the direction of groundwater flow. The locations of the three down gradient wells were selected to intercept the groundwater flow moving beneath the LTU. The up gradient well, MW-4 completed in the Sonsela, is also located based on groundwater flow vectors derived using the potentiometric surface across the site.

2.3.2 Well Construction Specification

SMW-4 was completed using mud rotary drilling techniques following established well construction guidance from RCRA Groundwater Monitoring Technical Enforcement Guidance Document (EPA 1986) (TEGD). The well is drilled into the Chinle slope wash and screened across the water bearing zone within the unit. The well was logged during

drilling and completed using an appropriately sized gravel pack and screen slot size. The screened interval is isolated from the remainder of the well using a low permeability annular seal to prevent cross contamination.

Four MWs were installed and completed in October 1981, pursuant to 40 Code of Federal Regulations Part 265. Construction of the LTU monitoring wells began in October 1981, and was completed in April 1984.

Current flow patterns in the Sonsela aquifer suggest the configuration of the LTU monitoring well system will provide sound, defensible data throughout the post closure monitoring period.

3.0 RESPONSIBILITIES

3.1 Responsibilities

The importance of defining responsibilities for the implementation of the procedures must be stressed. All individuals involved with the monitoring program must clearly understand their responsibilities so the procedure detailed in this plan will be conducted successfully and efficiently.

3.2 Environmental Manager

The EM is responsible for the overall design and implementation of this post closure monitoring plan. The EM develops and approves specific procedures for the conduct of all post closure monitoring plan activities, and reviews and approves reports. The EM oversees interactions between the Gallup Refinery and the New Mexico Environment Department/Hazardous and Radioactive Material Bureau (NMED/HRMB) regarding environmental monitoring of the LTU. The EM appoints a post closure monitoring plan team leader and field team, assigning responsibilities as described below.

3.3 Team Leader

The team leader, either the EM or a designee, will coordinate and oversee field sampling activities, ensuring that sampling and associated procedures are followed and that quality

assurance/quality control (QA/QC) and safety guidelines are met. The team leader reviews and evaluates sample data, prepares and reviews LTU reports, and assures that appropriate samples are collected and analyzed.

3.4 Field Team

The LTU field team consists of one or more scientists, engineers, or technicians, who are responsible for sample collection, handling, shipping, and preparation and maintenance of appropriate data sheets, and completion of sample tracking documentation under the direction of the team leader, in accordance with this post closure monitoring plan and associated Gallup Refinery field procedures. The field team will inspect, maintain, and ensure proper calibration of equipment prior to use at the LTU, while ensuring that site health and safety requirements are met at all times. The field team will communicate any problems or project changes to the team leader.

3.5 Analytical Laboratory

The contract laboratory used for sample analysis is responsible for supplying sample collection containers and sample shipping containers to the field team. Sample collection containers supplied by the laboratory will be certified as clean by either the laboratory or their supplier. The contract laboratory is responsible for performing analysis in accordance with this post closure monitoring plan and the data are supported by adequate documentation that meet NMED and U.S. Environmental Protection Agency (EPA) requirements. The laboratory will maintain documentation of sample handling and custody, analytical results, and internal QC data. Additionally, the laboratory will analyze QC samples in accordance with this plan and its own internal QC program for indicators of analytical accuracy and precision. Data generated outside laboratory acceptance limits will trigger an inquiry and, if appropriate, corrective action, as directed by the EM. The laboratory will report the result of the environmental sample and QC sample analyses and any necessary corrective actions that were performed. In the event that more than one contract laboratory is used (e.g., for different analyses), each one has the responsibilities described above.

4.0 QUALITY ASSURANCE/QUALITY CONTROL

4.1 Overview

The Gallup Refinery developed this QA/QC program to ensure that data integrity and quality are maintained for all samples collected and that equipment and records are maintained in accordance with NMED/HRMB guidance. The QA/QC program identifies data quality objectives (DQOs), processes for assuring sample quality, and processes for generating and maintaining quality records. Detailed QA/QC parameters are described in Tables 1A and 1B.

4.1.1 Data Quality Objectives

DQOs are qualitative and quantitative statements that specify the quality of data required supporting post closure care decisions. DQOs are established to ensure that the data collected are of a sufficient and known quality for their intended uses. The overall DQO for the post closure care of the LTU is to collect accurate and defensible data of known quality that are sufficient to assess the concentrations of constituents in the groundwater underlying the LTU.

4.2 Quality Assurance Objectives

The analytical data generated during the post closure care period will be specified in terms of accuracy, precision, completeness, representativeness, and comparability. This data will support decisions regarding identification, if any, of hazardous constituent concentrations found BTZ, changes in the monitoring system, and development of characterization and remediation activities as necessary to protect human health and the environment. Each QA/QC objective of the Ciniza QA plan is described below.

4.2.1 Accuracy

Accuracy is the closeness of agreement between a measurement and an accepted reference value. Measurements of accuracy for laboratory activities will include analysis of calibration standards, laboratory control samples (LCSs), matrix spike samples, and

surrogate spike samples. The bias component of accuracy is expressed as percent recovery (%R). Percent recovery is expressed as follows:

$$\%R = \frac{Measured\ sample\ concentration}{True\ concentration} x100 \qquad (4\text{-}1)$$

4.2.1.1 Accuracy Objectives for Field Sampling Activities.

For field sampling activities, accuracy will be measured through the use of equipment and trip blanks. Equipment blanks will be analyzed to check for contamination due to improper/insufficient decontamination procedures. These blanks will be used for non-dedicated boring and sampling equipment.

To ensure equipment has been sufficiently decontaminated, de-ionized water will be poured over and through the sampling equipment, caught in a clean stainless steel bowl, and poured into the sample bottles. One equipment blank will be taken randomly during each monitoring event involving non-dedicated equipment.

One trip blank will be used for each monitoring event involving analysis for volatile organic compounds (VOCs). The trip blank will be prepared and labeled by the laboratory. One 40ml septum vial will be filled with reagent grade water, transported to the site with the empty sample bottles, carried with the sample bottles during all sampling and shipping activities, and returned to the laboratory for analysis. The trip blank shall not be opened at any time prior to analysis.

4.2.1.2 Accuracy Objectives for Laboratory Measurements.

Analytical system accuracy will be quantified using the following laboratory accuracy QC checks: calibration standards, LCSs, laboratory blanks, matrix and surrogate spike samples. Single LCSs and matrix spike and surrogate spike sample analysis will be expressed as %R. Laboratory analytical accuracy is parameter dependent and is prescribed in appropriate laboratory standard operating procedures (SOPs).

4.2.2 Precision

Precision is the agreement among a set of replicate measurements without assumption or knowledge of true value. Precision of data will be derived from duplicate field and laboratory measurements.

4.2.2.1 Precision Objectives for Field Sampling Activities.

To measure the precision of field sampling activities, duplicate samples will be collected and analyzed. Duplicates will be collected at a frequency of one duplicate sample for each sampling event. Duplicates will be analyzed for all parameters.

In order to evaluate the precision of the analysis, it is necessary to calculate the relative percent difference (RPD) between the two results of the duplicate analysis. The RPD calculation is as follows:

$$RPD = \frac{(S1 - S2)}{(S1 + S2)/2} x100 \qquad (4\text{-}2)$$

Where: S1 = Sample Result 1
S2 = Sample Result 2

RPD should be less than or equal to 10 percent for values five times greater than the method detection limit (MDL) and plus or minus the detection limit for values less than five times the MDL.

4.2.2.2 Precision Objectives for Laboratory Measurements.

Precision of laboratory analyses will be assessed by performing the analyses of two aliquots extracted from one sample or on a matrix spike and matrix spike duplicate with each analytical batch assessed at a minimum frequency of 1 to 20 samples. The laboratory will determine analytical precision control limits by performing replicate analyses of control samples. Precision measurements will be expressed as RPD. Laboratory analytical precision is also parameter dependent and is prescribed in laboratory SOPs.

4.2.2.3 Contamination.

In addition to measurements of accuracy and precision, QC checks for contamination will be performed. QC samples including trip blanks, equipment blanks, field blanks, calibration and method blank will be analyzed to assess and document contamination attributable to sample collection equipment, sample handling and shipping, and laboratory reagents, glassware, and equipment. Trip blanks are used to assess VOC sample contamination during shipment and handling and will be collected and analyzed at a frequency of one sample per sample shipment. Field blanks are used to assess field sample collection methods and will be collected and analyzed at a frequency of one per 20 samples (five percent of the samples collected). Method blanks are used to assess contamination resulting from the analytical process and will be analyzed at a frequency of each preparation batch or every 20 samples, whichever is more frequent. Sample blanks will be evaluated following EPA National Functional Guidelines for Organic Data Review (EPA 1991) and Functional Guidelines for Evaluating Inorganic Analyses (EPA 1988). Only method blanks will be analyzed by classical chemistry methods. The criteria for evaluating method blanks will be established as follows. If method blank results exceed specified detection limits, then that value will become the detection limit for the sample batch. Detection of analytes of interest in blank samples may be used to disqualify some samples, requiring re-sampling and additional analyses on a case by case basis.

4.2.3 Completeness.

Completeness is the degree to which sample analyses accurately and precisely represent the media they are intended to represent. Data representativeness for post closure monitoring will be accomplished through implementing approved sampling procedures and the use of validated analytical methods.

Occurrences that reduce the amount of data collected include sample container breakage in the laboratory and data generated while the laboratory was operating outside prescribed QC limits. All attempts will be made to minimize data loss and to recover lost

data whenever possible. The completeness objective for non-critical measurements (i.e., field measurement) is 90 percent and 100 percent for critical measurements (i.e., compliance data). If completeness objective is not met, the Ciniza EM will determine the need for re-sampling on a case by case basis. Numerical expression of the completeness (%C) of data is as follows:

$$\%C = \frac{\text{number of samples with valid results}}{\text{total number of samples taken}} x100 \qquad (4\text{-}3)$$

4.2.4 Representativeness.

Representativeness is the degree to which sample analyses accurately and precisely represent the media they are intended to represent. Data representativeness for this early detection monitoring will be accomplished through implementing approved sampling procedures and the use of validated analytical methods. Sampling procedures are designed to minimize factors affecting the integrity of the samples. Groundwater samples will only be collected after well purging criteria have been met. The analytical methods selected are those that will most accurately and precisely represent the true concentration of analytes of interest.

4.2.5 Comparability

Comparability is the extent to which one set of data can be compared to another. Comparability will be achieved through reporting data in consistent units and collection and analysis of samples using consistent methodology. Aqueous samples will consistently be reported in units of measure dictated by the analytical method. Units of measure include:

- Milligrams per liter (mg/L) for alkalinity, inorganic compounds and metals.
- Micrograms per liter (μ/L) for VOCs and Semi-VOCs (SVOCs)

4.3 Design Control

The monitoring system is designed to meet requirements in 20 NMAC 4.1, subpart V, §264.97 and §264.278. The specific components are described in Section 5.0.

4.4 Instructions, Procedures, and Drawings.

Provisions and responsibilities for the preparation and use of instructions and procedures during the post closure care period of the LTU are detailed in Ciniza Refinery LTU Implementing Procedures, Sample Control, and Quality Assurance Requirements (Ciniza 1998). Quality affecting activities performed by or on behalf of Ciniza for monitoring are required to be performed in accordance with documented and approved procedures which meet the intent of 20 NMAC 4.1, subpart V, §264.97 for groundwater and 20 NMAC 4.1, subpart V, §264.278 for soils.

Technical procedures developed for the pre-detection monitoring activities at the LTU are maintained by the Environmental Department at the Gallup Refinery. The procedures are sufficiently detailed and include, when applicable, quantitative or qualitative acceptance criteria.

4.5. Document Control

Document control of procedures, used in performing soil and groundwater monitoring functions, is maintained by the Environmental Department at the Gallup Refinery. This control ensures that the latest approved version of procedures is used during monitoring and maintenance activities at the LTU.

4.6 Monitoring and Data collection Equipment

Data collection equipment is controlled and calibrated to ensure continued accuracy of monitoring data. Results of calibrations, maintenance, and repair are documented. Calibration records identify the reference standard and the relationship to national standards or nationally accepted measurement system. Records are maintained to track uses of monitoring and data collection equipment. If the equipment is found to be out of tolerance, the equipment is tagged and it is not used until corrections are made.

4.7 Quality Assurance Records

The EM at the Gallup Refinery outlines the policy regarding identification, preparation, collection, storage, maintenance, disposition, and permanent storage of QA records.

QA and Resource Conservation and Recovery Act (RCRA) records document the results of the early detection monitoring implementing procedures and are sufficient to demonstrate that all quality related aspects are valid. The records will be identifiable, legible, and retrievable in accordance with the Gallup Refinery Records Management Plan.

5.0 POST CLOSURE MONITONG PLAN –DESCRIPTION

The monitoring plan is designed to meet the monitoring requirements of 20 NMAC 4.1, subpart V, §264.90 through §264.101 and 20 NMAC 4.1, subpart V, §264.278. Monitoring locations will be selected in order to adequately determine if hazardous constituents have migrated out of the LTU. The number and depth of samples in this plan have been selected to adequately detect potential migration of hazardous constituents and determine successful treatment, degradation, and immobilization in the treatment zone.

5.1 Pre-Sampling Operations

Gallup Refinery will notify NMED/HRMB a minimum of two weeks prior to a monitoring event so that they may allocate the personnel and equipment necessary to meet the demands of the sample analyses. The lab should specify and provide the adequate materials, (i.e., coolers, bottles, custody seals, chain of custody {COC} forms, trip blanks) for the monitoring event. Field team personnel should review the field checklists (Attachment 1) to assure that all equipment is available and operational.

5.2 Early Detection: Soil Monitoring

The purpose of monitoring the ZOI and treatment zone is to detect potential migration of hazardous constituents and to ensure that treatment of hazardous constituents with the treatment zone has been successfully completed.

5.2.1 Soil Monitoring Locations

Sampling accuracy will be achieved by randomly selecting six soil monitoring locations over Cell 1 and Cell 2 of the LTU. The locations will be randomly selected each time soil samples are collected. Prior to each sampling time, the six locations are selected as follows:

- Grid the sample area into 6 feet squares and establish the coordinate at the southeast corner of the LTU.
- Using a random number table or generator, select four sampling locations taking care to locate at least one location in each cell

At least 6 inches of topsoil will be added to the LTU surface during closure activities. ZOI samples will be taken from the 12 inches below the topsoil-ZOI surface. The treatment zone is identified as the top 5 feet of soil and is defined as the environmental control level. Both ZOI and treatment zone samples will be taken from the boring. Sample volumes required by analytical protocol will be collected, taking care not to sample beyond the defined sampling depths.

5.2.2 Soil Monitoring Frequency

The frequency for the monitoring of LTU soils will be conducted as described in Volume 1, Section E.0.

5.2.3 Number of Soil Samples

For each monitoring event at total of two samples will be taken from each boring; one sample from the ZOI and one sample from the treatment zone. A sample is defined as the amount of soil necessary to secure analyses for all of the parameters identified in Section 5.2.2. This results in a total of 12 LTU samples per event. This total does not include QC samples required in Section 4.0. Samples will not be composited for analysis. The samples will be analyzed for Modified Skinner List and TPH as GRO and DRO.

5.3 Early Detection: Chinle Slope Wash Monitoring

The purpose of sampling the SMW-4, completed in the Chinle slope wash, is to detect the migration of hazardous constituents before they reach the point of compliance.

5.3.1 Groundwater Monitoring Locations

Groundwater samples will be collected from SMW-4. SMW-4 is screened only in the Chinle slope wash. Figure 2-1 shows the location of SMW-4 in relation to the LTU. Sample volume will be determined based on analytical protocols specified by the contract laboratory.

5.3.2 Groundwater Monitoring Frequency

The Chinle slope wash sampling frequency is parallel with the detection monitoring of the Sonsela aquifer. The sampling frequency for the Chinle slope wash is summarized in Volume I, Section E.0. Samples will be analyzed for the parameters listed in the modified Skinner List, Table 2A and 2B.

If any sampling event indicates that there has been a statistical increase in the hazardous constituents, then sampling frequency may be modified after consultation with NMED. If a statistically significant increase is indicated and confirmed, appropriate notification to NMED will be provided and a permit modification may be required for further characterization. The characterization, if required, will include all organics and metals in the modified Skinner List. The sampling frequency for the Chinle slope wash is summarized in Volume I, Figure 5.1.

5.4 Sonsela Groundwater Monitoring

Gallup Refinery will sample the MWs completed in the Sonsela aquifer to detect the migration of hazardous constituents if they reach the point of compliance.

5.4.1 Groundwater Monitoring Locations

Groundwater samples will be collected from the four MWs completed in the Sonsela aquifer. Figure 2-1 shows the location of the MWs in relation to the LTU. Sample volume will be determined based on analytical protocols specified by the contract laboratory.

5.4.2 Groundwater Monitoring Frequency

The Sonsela aquifer will be sampled based on the frequency described in Volume I, Figure E-1. Samples will be analyzed for both organics and metals in the modified Skinner List shown in Table 2A thru 2B.

If any sampling event indicates that there has been a statistical increase in the hazardous constituents, then sampling frequency may be modified after consultation with NMED. If a statistically significant increase is indicated and confirmed, appropriate notification to NMED will be provided and a permit modification may be required for further characterization of the Sonsela aquifer. The characterization, if required, will include all organics and metals in the modified Skinner List. The Gallup Refinery will establish a compliance monitoring program in the Sonsela aquifer in accordance with 20 NMAC 4.1, subpart V, §264.99. The sampling frequency for the Sonsela aquifer is summarized in Volume I, Figure E.1.

5.4.3 Number of Groundwater Samples

One sample will be collected from each MW per sampling event. This results in four groundwater samples per event for the detection monitoring program. This number does not include the QC samples required in Section 4.0.

5.5 Analytical Parameters

Selection of analytical parameters is based on the contaminants expected to be present in the waste and their associated degradation products. Tables 2A through 2D contain the parameters that will be analyzed for during the various phases of sampling operations.

5.6 Sample Collection

Groundwater samples will be collected following the groundwater procedures presented in Section 7.0. These samples will be sent to contract laboratories and analyzed for metals and constituents of concern identified in Table 2A through 2D. These hazardous constituents are specific to the waste applied to the LTU from 1988 to 1990 during its operational phase.

5.7 Laboratory Analysis

Samples will be analyzed by a commercial laboratory that participates in EPA's Contract Laboratory Program. Methods are specified in Ciniza procurement documents and are selected to be consistent with EPA recommended procedures in Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (EPA 1997) (SW-846). Data analysis is to provide an objective and reliable means for interpreting data in relation to the objectives of the data collection program. For these monitoring programs, the principal goal of data analysis is the comparison of a data point or data set to a fixed standard or to equivalent data collected at another location and time (such as during operational phase of the LTU, background data, or data collected at a control location). Additional detail on analytical techniques and methods are given in laboratory SOPs.

5.8 Statistical Evaluation of Laboratory Data

As required by 20 NMAC 4.1, subpart V, §264.97 and §264.98, data collected during monitoring will be evaluated using appropriate statistical techniques. Ciniza has been evaluating the groundwater monitoring data using Cochran's approximation to the Behrens-Fisher Student's T-test for its existing groundwater monitoring program. Ciniza plans to use this methodology to evaluate soil and groundwater monitoring data during the post closure period. Cochran's approximation to the Behrens-Fisher Student's T-test is shown below:

$$t^* = \frac{X_a - X_b}{\sqrt{\frac{S_m^2}{N_m} + \frac{S_b^2}{N_b}}}$$

(5-1)

Where: t^* = t star

X_a = mean of the sample

X_b = mean of the background

S_m^2 = variance of the sample

S_b^2 = variance of the background

N_m = number of samples

N_b = number of backgrounds

$$t_c = \frac{W_b t_b + W_m t_m}{w_b + w} \qquad (5\text{-}2)$$

Where: t_c = comparison t-star

W_b = variance/number of backgrounds

t_b = t-table with (N_b-1) degrees of freedom at the 0.05 level of significance

W_m = variance/number of samples

t_m = t-table with ((N_m-1) degrees of freedom at the 0.05 level of significance

The t-star (t*) is compared to the comparison t-star t_c using the following decision rule.

- If t* is equal to or larger than t_c then conclude that there most likely has been a significant increase in this parameter.
- If t* is less than t_c then conclude that there most likely has not been a change in this parameter.

6.0 SAMPLE DOCUMENTATION AND CUSTODY

The integrity of samples from the time of collection through reporting date, sample collection, handling, and custody must be documented. Standardized forms used to document sample management include identification numbers, sample labels, custody tape, the sample tracking logbooks, and the COC form. The forms are briefly defined in the following subsections. All sample documentation will be completed for each sample and reviewed by the team leader for completeness and accuracy.

6.1 Sample Numbers and Labels

A unique sample identification number will be assigned to each sample sent to the laboratory for analysis. The team leader will assign the numbers prior to sample collection. The sample identification numbers are used to track the sample from the time of collection through data reporting. Every sample container sent to the laboratory will

be identified with a label affixed to it. Sample label information will be completed in permanent, indelible ink and will contain the following information: sample identification number with sample matrix type; sample location; analysis requested; time and date of collection; preservative(s), if any; and the sampler's name or initials.

6.1.1 Sample Identification Numbering System

The sample identification numbering system is used to identify individual samples. Sample numbers may include a code number or letter attached to the end to identify the type of sample.

Samples for a typical sampling event would be labeled as:

EQUATION

(1)	ZOI	=	Zone of Incorporation
	TZ	=	Treatment Zone
	MW1	=	Monitoring Well #1
(2)	234	=	Grid cell number (enter 000 for well sample)
(3)	1	=	Monitoring event number (for the year)
(4)	98	=	Year (1998)
(5)	D	=	Duplicate
	E	=	Equipment Blank
	B	=	Trip Blank

If no letter appears here, it is the original sample.

6.2 Custody Seals

Custody seals are used to detect sample tampering from collection through analysis. The custody seals are adhesive backed strips that are destroyed when removed or when the container is opened. The seal is affixed to the sample container lid in such a manner that it is necessary to break the seal to open the container. Seals are affixed to sample containers in the field immediately after collection. Upon receipt at the laboratory, the laboratory custodian will inspect the seal for integrity; a broken seal invalidates the sample.

6.3 Sample Log Book Record

Field team personnel will record critical information in the sample log book for each sample collected. The information recorded will include:

- Sample location (well number or boring location)
- Sample identification number
- Date and time of sampling
- Sampling personnel
- Sample collection method
- Field measurements
- COC number
- Date sample(s) were sent to the lab
- Comments and observations

It is important that specific observations be recorded concerning site conditions. These include:

- Weather conditions
- Physical surrounding (water, plant growth)
- Evidence of contamination
- Odors or color abnormalities

Sample log book information is completed in the field by the sampling team and checked by the team leader. When samples are shipped, the information remains in the custody of the EM for sample tracking purposes.

6.4 Chain of Custody

A COC form will be completed during or immediately following sample collection and will accompany the sample through analysis and disposal. The COC form is signed and dated each time the sample custody is transferred. A sample is considered to be in a person's custody if: the sample in his/her physical possession; a sample is in his/her obstructed view, and/or the sample is placed, by the last person in possession of it, in a secured area with restricted access. During shipment, the carrier's bill number serves as

custody verification. Upon receipt of the samples at the laboratory, the laboratory sample custodian acknowledges possession of the samples by signing and dating the COC. The completed COC is returned to the team leader with the laboratory analytical report and becomes part of the permanent record of the sampling event. The COC also may contain specific instructions to the laboratory for sample analysis, potential hazards, and disposal information.

The COC shall include the following information:

- Facility name
- Type and number of samples
- Sample location and ID
- Collection dates/times
- Analysis required
- Number of containers for each sample
- Additional remarks or comments as needed
- Sampler's signature
- Signatures of all individuals in the chain of possession
- Inclusive dates and time of possession

The original COC must accompany the samples. One copy of the COC form will be kept in the project files.

7.0 FIELD OPERAIONS

This section describes equipment and supplies; and provides general instructions for sample collection, preservation, packaging, and shipping; decontamination; and documentation. By following these instructions sampling personnel will ensure that the sample collected is representative of the soil and groundwater, thus providing scientifically valid and legally defensible analytical data.

The ZOI, treatment zone, Chinle slope wash and the Sonsela aquifer are routinely sampled and monitored. These activities are detailed in Section 7.1 and 7.2. Monitoring related activities include soil collection, litho logic logging, borehole filling, static water level measurements; equipment calibration; field water quality analyses; and sample handling, shipping, and management. A typical sampling event is depicted on Figure 7-1.

7.1 Soil Procedures

7.1.1 Borehole/Core Sampling

Boreholes for sampling will be advanced by a drilling rig employing hollow-stem augers. There will be no compositing of soil samples. Core samplers are used in conjunction with hollow-stem augers to collect soil samples. A five feet, 2.5 inches diameter, split core barrel will be placed in the lead auger. The tube is pushed into the soil at the same drilling rate as the auger. After the tube is pulled from the soil, it is detached from the drill rod and opened to remove the soil core. The sample must be transferred to the sample container in a timely manner in order to maintain the integrity of the sample and to prevent the potential loss of VOCs if present. Only after the sample has been collected should field observations and measurements (such as photo ionization detector [PID] readings) be completed. Split core barrels will be used for obtaining samples of consolidated soil and to penetrate some types of rock.

7.1.2 Soil Screening

Should visual inspection or detection of odors warrant its use, a PID will be used to screen for volatiles. Since prior sampling has not shown significant contamination, the use of a PID is not expected. If the PID is used, all readings will be recorded in the log book.

7.1.3 Litho logic Logging

Detailed logs will be maintained for each boring. Listed below is a general description of terms to be used to describe the soil characteristics for each boring.

- Litho logy
- Color (i.e., light, dark, mottled, mixed)
- Size (fine, medium, coarse)
- Moisture (dry, moist, wet)
- Odor (or no odor)
- Other Descriptive terms:
    - Lens <1 inch
    - Layer >1 inch
    - Interbedded
    - Slickenside – soils having inclined planes of weakness, glossy in appearance.

Litho logic logs of the entire core shall be used. Samples for VOCs shall be obtained before logging to preclude potential loss of VOCs.

7.1.4 Disposition of Soils

All drill cuttings generated by borehole advancement for soil samples will be spread within the LTU.

7.1.5 Backfill of borings

All boring shall be backfilled with bentonite clay to prevent migration from the treatment zone.

7.1.6 Soil Sample Collection

To ensure that soil samples obtained for monitoring of LTU post closure are of a consistently high quality, the following procedure will be used for their collection.

- Use an amber glass bottle to protect the sample from ultraviolet light.
- When sampling wet soils, leave enough headspace in the bottle to allow for expansion.

- Take extreme care to avoid contaminating the bottles or caps. Remove the cap just before filling and replace it as soon as possible after filling. Avoid touching the inside of the bottle or cap. See Section 7.3 for specific guidelines for organic analytes in soil.

7.1.7 Soil Sample Preservation

Appropriate preservation of collected samples is critical for ensuring analytical results are not impacted during transportation and handling before analyses. To ensure that LTU samples are properly preserved the following procedure will be followed:

- If required by analytical protocol, place the container in a cooler. Maintain the samples at or below 4^{0}C.
- Do not expose the sample to extreme hot or cold temperatures or intense sunlight, even if no specific preservation is recommended.
- Deliver the samples to the contract laboratory as soon as practicable.

7.2 Groundwater Procedures

Gallup Refinery sampling personnel will follow the guidelines outlined below for collecting groundwater samples. These samples consist of both field measurements and samples to be sent to the contract laboratory.

7.2.1 Groundwater Level Monitoring

The static groundwater level elevation will be measured in each well prior to well excavation. This will be accomplished through the use of a steel tape, acoustic well probe or other approved methodology.

7.2.2. Well Purging

The wells will be purged prior to the collection of any groundwater samples, to ensure that a representative sample of the groundwater can be collected. This will be accomplished using a sufficiently low flow rate to minimize the possibility of stripping VOCs from the groundwater recharging the well. To eliminate the possibility of cross-

contamination between wells, a dedicated pump for each well will be used to complete the well purging.

One of two methods will be used to complete the well purging. The first method is to remove three well volumes prior to sampling. The well volumes will be calculated based on the measured water level elevation and the size of well bore and gravel pack used during well construction. Because the wells are hydraulically low-yield wells, alternative sampling methods and reporting requirements exist. If sampling results indicate that SMW-4 is dry, this result will be recorded and reported to NMED. Other well water samples will be field measured for pH, temperature, and specific conductance to establish the conditions within the well bore. Then, the necessary samples will be collected and containerized in the order of the parameters volatilization sensitivity. Once the necessary samples have been collected, the conditions within the well bore will be rechecked for stability by additional field measurements of pH, temperature, and specific conductance. If the field measurements show that conditions have not remained stable within the well bore during the sampling event, additional samples will be collected and the same process of field measurements will be conducted.

7.2.3 Groundwater Sample Collection

To ensure that LTU groundwater samples are of a consistently high quality, the following procedure will be used for their collection:

- Take extreme care to avoid contaminating the sample container or caps. Remove the cap just before filling and replace it as soon as possible after filling. Avoid touching the inside of the bottle or cap.
- Do not filter the sample unless specified by analytical personnel.
- Do not rinse the sample container.
- Slowly fill each container almost full, except volatile organic analyte (VOA) vials. See Section 7.3 for sampling guidelines for organic analytes.

7.2.4 Groundwater Sample Preservation

Appropriate preservation of collected samples is critical for ensuring analytical results are not impacted during transportation and handling before analyses. To ensure that LTU samples are properly preserved the following procedure will be followed

- If directed by analytical personnel, add the prescribed preservative. After adding preservative, slowly invert the vial to mix.
- If required by protocol, place the sample in a cooler. Maintain the organic samples and solid metal samples at or below 4^{0}C with frozen Blue Ice. Avoid freezing the sample by packing it with vermiculite to prevent contact between the coolant and the sample container. Aqueous metal samples must not be cooled. Refer to Tables 2A through 2D for preservation methods.
- Do not expose the sample to extreme hot or cold temperatures and intense sunlight, even if no specific preservation is recommended.
- Deliver the samples to the contract laboratory as soon as practicable.

7.3 Specific Sampling Guidelines for Organic Analytes in Aqueous or Solid Matrices

Special precautions must be taken to maintain sample integrity when analyzing for VOCs or semi-VOCs. In addition to the general sampling guidelines described for aqueous and solids in Sections 7.1.6, 7.1.7, 7.2.3 and 7.2.4 of this Appendix, sampling personnel follow the guidelines outlined below for collecting aqueous or solid matrix samples to be analyzed for organic analytes:

7.3.1 Volatile Organic Compound Sampling

- To monitor possible contamination, prepare a trip blank from organic free reagent water before leaving for the sampling site. Carry the trip blank throughout sampling, storing, and transportation.
- Do not collect or store samples in the presence of exhaust fumes from vehicles, equipment or machinery.
- Collect only grab samples. Compositing samples pose an unknown safety risk: do not composite samples of unknown wastes with suspect organic components.

- Liquids. Use standard 40ml glass, screw cap VOA vials with Teflon-lined silicone septa for liquid samples. Introduce liquids into the vials gently to reduce agitation that might drive off volatile compounds. Pour aqueous samples into the VOA vial without introducing any air bubbles within the vial as it is being filled. If bubbling occurs, discard the sample and collect another sample in a new VOA vial. Each VOA vial should be filled until a meniscus is over the lip of the vial. The vials should be completely filled at the time of sampling so that when the septum cap is fitting and sealed (Teflon side toward the sample) and the vial is inverted, no headspace is visible. If there are any air bubbles, recollect the sample.

- Solids. Use standard 40ml glass screw-cap VOA vials with Teflon-lined silicone septa for samples with solid or semi-solid matrices. Introduce the solids into the vials gently to reduce agitation that might drive off VOCs. VOA vials should be completely filled. The VOA vials should be tapped slightly as they are filled to eliminate free air space.

- Seal each VOA vial in a separate plastic bag to prevent cross contamination between samples, particularly if the sampled waste is suspected of containing high levels of volatile organics. VOA samples may also be contaminated by diffusion of VOCs through the septum during transportation and storage at the Ciniza facility.

7.3.2 Semi-volatile Organic Compound Sampling

- Do not collect or store samples in the presence of exhaust fumes from vehicles, equipment or machinery.
- Collect only grab samples. Compositing of samples pose an unknown safety risk; do not composite samples of unknown, suspect organic analytes.

- Containers used to collect SVOC samples should be specially cleaned with a soap and water wash followed by methanol or iso-propanol rinsing. The sample container should be glass or Teflon and have screw-caps with Teflon-lined septa. Plastic containers or lids may NOT be used. To avoid any possible contamination, sample containers should be filled with care to prevent any portion of the collected sample coming in contact with the sampler's glove.

7.4 Calibration

Proper calibration of equipment used to obtain samples and date for this early detection monitoring is critical for ensuring accuracy and precision of results. Due to changes in

technology and sub contractors used for early detection monitoring activities, Gallup Refinery will rely on manufacturer's specifications and instructions for proper calibration of equipment.

7.4.1 Sampling and Monitoring Equipment and Calibration

The equipment used to collect data for this monitoring plan is to be calibrated in accordance with manufacturers' specifications before use. The team leader is responsible for calibrating needed equipment on schedule, in accordance with specifications. The team leader is also responsible for maintaining current calibration records for each piece of equipment. Calibration records will include manufacturers' specifications and instructions for each piece of equipment used in sampling and monitoring.

7.5 Decontamination

The following procedures are applicable to decontamination of drilling equipment and vehicles and sampling equipment.

7.5.1 Drilling Equipment and Vehicles

Decontamination of large drilling equipment and vehicles is required to prevent cross contamination of boreholes from which samples will be retrieved for chemical analysis. This procedure also provides for the protection of personnel subsequent to demobilization form the LTU.

- Wash and mechanically clean augers and split spoon with biodegradable soap and brush. Rinse with potable water.
- Steam augers and split spoon.
- Protect equipment, if necessary, when transporting drilling equipment between boreholes, by covering or shielding.

During decontamination of drilling equipment and accessories, it is especially critical to clean the inside of hollow-stem auger flights, drill rods, and bits. Decontamination can be limited to those parts that may come into direct contact with soil sample surfaces.

7.5.2 Sampling Equipment

Sampling equipment includes all sampling devices and containers that are used to collect or contain a sample prior to final sample analysis. Before its use, all sampling equipment that may contribute to the contamination of a sample must be thoroughly cleaned.

Sampling equipment can generally be cleaned by hand. The following procedure will be used for sampling equipment.

- Scrub with biodegradable soap and potable water.
- Rinse with de-ionized water followed by iso-propanol
- Allow to air dry
- Protect, if necessary, to prevent contamination while transporting from borehole to borehole by covering or shielding.

8.0 ANALYTICAL PROCEDURES

8.1 Methods

To adequately evaluate analytical data, EPA-approved methods have been selected and are listed in Tables 2A through 2D.

8.2 Detection Limits

It is imperative that the analytical procedures chosen have detection limits that are less than appropriate clean up standards or action levels. Clean up standards for this plan are included in Tables 2A through 2D.

8.3 Sample Container, Preservation and Holding Times

Sample container selection, preservation techniques, and holding times must be addressed for every sampling activity to ensure that the sample does not deteriorate or become contaminated. Sample deterioration can occur through biological degradation or chemical precipitation. Sample contamination can occur through absorption, adsorption,

or leaching effects due to the interaction of the sample and the container material. Sample container selection, preservation techniques, and holding times are listed in Tables 2A through 2D.

8.4 Sample preparation

Proper sample preparation is an integral part of any analytical program. Sample preparation should be confirmed with the EM.

8.5 Laboratory QA/QC

A copy of the laboratory's QA/QC program as submitted to the Gallup Refinery is kept on file. The recommended QA/QC program submitted to the Gallup Refinery by the NMED is provided as Attachment 2. If necessary, Gallup Refinery will request that the laboratory's QA/QC program be modified to conform to the NMED QA/QC program.

9.0 REPORTING

9.1 Laboratory Data Reports

Laboratory data are provided as hard copy reports to the Gallup Refinery as well as an electronic copy. Laboratory data reports will be maintained by the Gallup Refinery and contain the following information for each analytical report.

- A brief narrative summarizing laboratory analyses performed, date of issue, deviations from the analytical method, technical problems affecting data quality, laboratory quality checks, corrective actions (if any), and the project manager's signature approving issuance of the data report.
- Headed information for each analytical data summary sheet including: sample number and corresponding laboratory identification number, sample matrix; dates of collection, receipt, preparation and analysis; and analyst's name.
- Results of QC sample analyses for all concurrently analyzed QC samples.
- Lab reports will be submitted to NMED as part of the reporting requirements.

10.0 RECORDS MANAGEMENT

Records generated during early detection monitoring events will be maintained in the Gallup Refinery's project files. Project records include, but are not limited to:

- Sampling and Analysis Plans
- Operating Procedures
- COC Records
- Contract Analytical Laboratory Data Reports
- Instrument Maintenance and Calibration Records
- Control Charts and Calculations
- Raw Analytical Results
- Field Log Books/Notes

11.0 REFERENCES

20 NMAC 4.1, Subpart V. Title 20, New Mexico Administrative Code, Chapter 4, Part 1, Subpart V, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities," Santa Fe, New Mexico, New Mexico Environmental Improvement Board.

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Table 1A. Summary of Laboratory Quality Control Procedures for Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)[a]

Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
BFB Tune	Before each initial calibration and calibration verification (every 12 hours).	Method 8260B, Table 4 acceptance criteria	Perform necessary instrument maintenance/repair and re-analyze.
Instrument calibration (minimum 5 standards)	Initially and as needed (calibration standards to contain all analytes and surrogates)	Not applicable	Not applicable.
System Performance Check Compounds (SPCCs)	Initial calibration: Immediately after calibration and before sample analysis	RFs: Chloromethane ≥ 0.10 1,1-Dichloromethane ≥ 0.10 Bromoform ≥0.10 Chlorobenzene ≥ 0.30 1,1,2,2-Tetrachloroethane ≥ 0.30	Evaluate analytical system and perform corrective maintenance/repair as necessary. Recalibrate instrument.
	Calibration verification: At the beginning of each 12 hour analytical shift	As for initial calibration	Evaluate analytical system and perform corrective action. Re-analyze and recalibrate if necessary.
Calibration Check Compounds (CCCs)	Initial calibration: After calibration and before sample analysis	RSDs for CCCs ≤ 30% RSDs for target analytes ≤ 15%	Evaluate analytical system and perform corrective maintenance/repair as necessary. Recalibrate instrument.
	Calibration verification: At the beginning of each 12 hour analytical	% difference or % drift ≤ 20% for CCCs and all target analytes	Evaluate analytical system and perform corrective action. Re-analyze and recalibrate if necessary.
Linearity of target analytes	After calibration and before sample analysis	RSD ≤ 15%	Recalibrate or use alternate calibration options provided in SW-846, Method 8000.
Retention Time (RT) windows	Initially, establish an absolute retention time for each analyte and surrogate compound according to established and documented procedures	Not applicable	Not applicable.
	Assess the retention times of target analytes in each calibration standard	± 0.06 relative retention times (RRT)	Evaluate analytical system and perform corrective maintenance/repair as necessary. Recalibrate instrument.

Table 1A. Summary of Laboratory Quality Control Procedures for Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)[a] (continued)

Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
	The center of the retention time window for analytes and surrogates is established from the calibration verification standard	Not applicable	Not applicable.
	Assess retention time of internal standards in the calibration verification standard	Within 30 secs of RT in the mid-point initial calibration standard	Investigate analytical system and apply corrective actions as necessary. Re-analyze samples processed while malfunction was in operation. Recalibrate as necessary.
Internal Standards (IS)	Assess IS response in the calibration verification standard	EICP area ≥ -50% or ≤ + 100% of most recent initial calibration	Investigate analytical system and apply corrective actions as necessary. Re-analyze samples processed while malfunction was in operation. Recalibrate as necessary.
Calibration Verification	At the beginning of each 12 hour analytical shift	See acceptance criteria for DFTPP, SPCCs, CCCs, method blank. RTs, IS	Evaluate analytical system, perform corrective action, re-calibrate as necessary.
Surrogates	Each field sample, blank, and QC sample	Laboratory established acceptance limits	Review surrogate recoveries in comparison with other QC sample results (MS/MSD, LCS). Re-extract and/or re-analyze samples, flag data.
Method blank (MB)	Immediately after the calibration verification standardWith every analytical batch (once per 20 samples prepared using the same procedures at the same time)	≤ 5% of the regulatory/contract required limit for the analytes. If no regulatory/contract limit applies, ≤ 3 x MDL	Identify and reduce the source of contamination. Re-extract/re-analyze samples associated with a contaminated blank. Recalibrate as necessary.
Matrix spike (pre-digestion) (MS) [c]	One per batch per matrix or every 20 samples, whichever is more frequent	± 30% of spiked value [b]	Flag data.
Matrix spike duplicate (pre-digestion) (MSD) [c]	One per batch per matrix or every 20 samples, whichever is more frequent	± 30% of spiked value [b] 0-20% RPD [b]	Flag data.

Table 1A. Summary of Laboratory Quality Control Procedures for Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)[a] (continued)

Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
Duplicates (D) [c]	One per batch per matrix or every 20 samples, whichever is more frequent	0-20% RPD [b]	Flag data.
Surrogates	Each field sample, blank, and QC sample	Laboratory established acceptance limits for % recovery (R)	Review surrogate recoveries in comparison with other QC sample results (MS/MSD, LCS). Re-extract and/or re-analyze samples, flag data.
Laboratory Control Sample (LCS)	Once per analytical batch or every 20 samples whichever is more frequent	70-130% recovery (R)[b]	Identify and correct problem. Re-analyze all samples associated with failed LCS.
Method Detection Limit (MDL)	Annually, at a minimum.	≤ 5% regulatory/contract required detection limit	Review analytical protocol, rerun MDL samples, select an alternative method of analysis.

[a] U.S. Environmental Protection Agency, 1986 and all approved updates, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," *SW-846*, Method 8260B and Method 8000B

[b] Laboratory developed in-house control limits must be used if available

[c] Requirement for analysis of duplicate/MS or MS/MSD is sample dependent; if samples are not expected to contain target analytes, MS/MSD should be used.

Table 1B. Summary of Laboratory Quality Control Procedures for Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)[a]

Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
DFTPP Tune	Before initial each calibration and calibration verification (every 12 hours).	Method 8270C, Table 3	Perform necessary instrument maintenance/repair and re-analyze.
Column performance and injection port inertness	Before each initial calibration and calibration verification (every 12 hours).	DDT → DDE and DDD ≤ 20%	Perform necessary instrument maintenance/repair and re-analyze.
Instrument calibration (minimum 5 standards)	Initially and as needed (calibration standards to contain all analytes and surrogates)	Not applicable	Not applicable.
System Performance Check Compounds (SPCCs)	Initial calibration: Immediately after calibration and before sample analysis	RFs for SPCCs ≥ 0.050	Evaluate analytical system and perform corrective maintenance/repair as necessary. Recalibrate instrument.
	Calibration verification: Before sample analysis and once every following 12 hour analytical shift	RFs for SPCCs ≥ 0.050	Evaluate analytical system and perform corrective action. Re-analyze and recalibrate if necessary.
Calibration Check Compounds (CCCs)	Initial calibration: After calibration and before sample analysis	%RSD for CCCs ≤ 30% % RSD for all target analytes ≤ 15%	Evaluate analytical system and perform corrective maintenance/repair. Re-analyze and recalibrate if necessary.
	Calibration verification: Before sample analysis and once every following 12 hour analytical shift	% difference or % drift ≤ 20% for CCCs and all target analytes	Evaluate analytical system and perform corrective maintenance/repair. Re-analyze and recalibrate if necessary.
Linearity of target analytes	After calibration and before sample analysis	RSD ≤ 15%	Recalibrate or use alternate calibration options provided in SW-846, Method 8000.
Retention Time (RT) windows	Initially, establish an absolute retention time for each analyte and surrogate compound according to established and documented procedures	Not applicable	Not applicable.
	Assess the retention times of target analytes in each calibration standard	± 0.06 relative retention times (RRT)	Evaluate analytical system and perform corrective maintenance/repair as necessary. Recalibrate instrument.

Table 1B. Summary of Laboratory Quality Control Procedures for Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)[a] (continued)

Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
	The center of the retention time window for analytes and surrogates is established from the calibration verification standard	Not applicable	Not applicable.
	Assess retention time of internal standards in the calibration verification standard	Within 30 secs of RT in the mid-point initial calibration standard	Investigate analytical system and apply corrective actions as necessary. Re-analyze samples processed while malfunction was in operation. Re-calibrate as necessary.
Internal Standards (IS)	Assess IS response in the calibration verification standard	EICP area >≥ -50% or ≤ + 100% of most recent initial calibration	Investigate analytical system and apply corrective actions as necessary. Re-analyze samples processed while malfunction was in operation. Recalibrate as necessary.
Calibration Verification	At the beginning of each 12 hour analytical shift	See acceptance criteria for DFTPP, SPCCs, CCCs, method blank. RTs, IS	Evaluate analytical system, perform corrective action. Re-calibrate as necessary.
Method blank (MB)	Immediately after the calibration verification standard With every analytical batch (once per 20 samples prepared using the same procedures at the same time)	≤ 5% of the regulatory/contract required limit for the analytes. If no regulatory/contract limit applies, ≤ 3 x MDL	Identify and reduce the source of contamination. Re-extract/re-analyze samples associated with a contaminated blank. Recalibrate as necessary.
Matrix spike (pre-digestion) (MS) [c]	One per batch per matrix or every 20 samples, whichever is more frequent	± 30% of spiked value [b]	Flag data.
Matrix spike duplicate (pre-digestion) (MSD) [c]	One per batch per matrix or every 20 samples, whichever is more frequent	± 30% of spiked value [b] 0-20% RPD [b]	Flag data.
Duplicates (D) [c]	One per batch per matrix or every 20 samples, whichever is more frequent	0-20% RPD [b]	Flag data.

Table 1B. Summary of Laboratory Quality Control Procedures for Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)[a] (continued)

Quality Control Check	Frequency	Acceptance Criteria	Corrective Action
Surrogates	Each field sample, blank, and QC sample	Laboratory established acceptance limits for % recovery (R)	Review surrogate recoveries with regard to other QC sample results (MS/MSD, LCS). Re-extract and/or re-analyze samples, flag data.
Laboratory Control Sample (LCS)	Once per analytical batch or every 20 samples, whichever is more frequent	70-130% recovery (R)[b]	Identify and correct problem. Re-analyze all samples associated with failed LCS.
Method Detection Limit (MDL)	Annually, at a minimum.	≤ 5% regulatory/contract required detection limit	Review analytical protocol, rerun MDL samples, select an alternative method of analysis.

[a] U.S. Environmental Protection Agency, 1986 and all approved updates, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," *SW-846*, Method 8270C and Method 8000B.

[b] Laboratory developed in-house control limits must be used if available.

[c] Requirement for analysis of duplicate/MS or MS/MSD is sample dependent; if samples are not expected to contain target analytes, MS/MSD should be used.

Table 2A. Modified Skinner List 8260 Volatile Organics and PHCs[a]

Parameter	EPA Method SW-846	Description	Containers	Preservative	Holding Time/Days	Liquid Reporting[c] Limit (µg/L)	Soil Reporting[c] Limit (mg/kg)
Benzene	8260	GC/MS	G	4°C	14	5	0.67
2-Butanone (MEK)	8260	GC/MS	G	4°C	14	1900	7000
Carbon Disulfide	8260	GC/MS	G	4°C	14	1000	350
Chlorobenzene	8260	GC/MS	G	4°C	14	39	54
Chloroform	8260	GC/MS	G	4°C	14	0.16	0.24
Chloromethane	8260	GC/MS	G	4°C	14	1.5	1.2
1,1 Dichloroethane	8260	GC/MS	G	4°C	14	25	580
1,2 Dichloroethane	8260	GC/MS	G	4°C	14	5	0.34
1,1 Dichloroethene	8260	GC/MS	G	4°C	14	5.0	0.053
trans-1,2-Dichloroethene	8260	GC/MS	G	4°C	14	100	63
1,4-Dioxane	8260	GC/MS	G	4°C	14	6.1	44
Ethylbenzene[a]	8260	GC/MS	G	4°C	14	700	230
Methylene Chloride	8260	GC/MS	G	4°C	14	4.3	8.6
Styrene	8260	GC/MS	G	4°C	14	100	1700
1,1,2,2-Tetrachloroethane[b]	8260	GC/MS	G	4°C	14	0.055	0.37
Tetrachloroethene[b]	8260	GC/MS	G	4°C	14	5	4.9
Toluene	8260	GC/MS	G	4°C	14	750	1000
1,1,1-Trichloroethane	8260	GC/MS	G	4°C	14	60	200
Trichloroethene	8260	GC/MS	G	4°C	14	5	2.7
Total Xylene[a, d]	8260	GC/MS	G	4°C	14	620	860
Ethylene Dibromide[b]	8260	GC/MS	G	4°C	14	0.1	0.005
Acetone	8260	GC/MS	G	4°C	14	610	1500

[a]Principal hazardous constituent identified in Ciniza Hazardous Waste Facility Permit.
[b]Additional constituents.
[c]Based on EPA Region 6, Human Health Medium-Specific Screening Levels (1999) and NM WQCC Regulations (1996). Analytical detection limits are required to be lower than reporting limits.
[d]Regulatory limits for individual isomers combined into a 'total' limit for these compounds.

mg/kg = milligrams per kilogram
µg/L = microgram per liter
G = glass with Teflon-lined lid
GC/MS = gas chromatography/mass spectrometry

Table 2B. Modified Skinner List 8270 Semivolatile Organics Including TPH and PHCs[a]

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Liquid Reporting Limit (µg/L)[c]	Soil Reporting Limit (mg/kg)[c]
Anthracene	8270	GC/MS	G	4°C	14	1800	16000
Acenaphthene	8270	GC/MS	G	4°C	14	370	2800
Benzo(a)Anthracene	8270	GC/MS	G	4°C	14	0.09	0.62
Benzo(b)Fluoranthene	8270	GC/MS	G	4°C	14	0.09	0.62
Benzo(k)Fluoranthene	8270	GC/MS	G	4°C	14	0.9	6.2
Benzo(a)Pyrene[a]	8270	GC/MS	G	4°C	14	0.0007	0.062
Butyl Benzyl Phthalate	8270	GC/MS	G	4°C	14	7300	240
Chrysene[a]	8270	GC/MS	G	4°C	14	9.2	62
Diethyl Phthalate	8270	GC/MS	G	4°C	14	29000	49000
7,12-Dimethylbenz(a)-Anthracene	8270	GC/MS	G	4°C	14	[e]	[e]
Dimethyl Phthalate	8270	GC/MS	G	4°C	14	370000	100000
Di-n-Octyl Phthalate	8270	GC/MS	G	4°C	14	730	1200
Fluoranthene	8270	GC/MS	G	4°C	14	1500	2300
Fluorene	8270	GC/MS	G	4°C	14	240	2000
Indeno(1,2,3-cd)Pyrene	8270	GC/MS	G	4°C	14	0.09	0.62
2-Methylnaphthalene[a]	8270	GC/MS	G	4°C	14	30	660
2-Methylphenol (Cresol)	8270	GC/MS	G	4°C	14	1800	3000
3/4-Methylphenol (Cresol)	8270	GC/MS	G	4°C	14	1980	3300
Naphthalene[g]	8270	GC/MS	G	4°C	14	30	55
Nitrobenzene	8270	GC/MS	G	4°C	14	3.4	17
4-Nitrophenol	8270	GC/MS	G	4°C	14	2300	3800
Phenanthrene[a]	8270	GC/MS	G	4°C	14	[e]	[e]
Pyrene[a]	8270	GC/MS	G	4°C	14	180	1700
Pyridine	8270	GC/MS	G	4°C	14	37	61
Quinoline	8270	GC/MS	G	4°C	14	0.0056	0.04
Benzenethiole	8270	GC/MS	G	4°C	14	[e]	[e]
Phenol	8270	GC/MS	G	4°C	14	5	36000
Bis(2-Ethylhexyl)phthalate[b]	8270	GC/MS	G	4°C	14	6.0	35
Dibenz(a,j)acridine[b]	8270	GC/MS	G	4°C	14	[e]	[e]
Dibenz(a,h)-anthracene	8270	GC/MS	G	4°C	14	0.0092	0.062
Dichlorobenzene[b, f]	8270	GC/MS	G	4°C	14	675	410
Methyl Naphthalene	8270	GC/MS	G	4°C	14	30	[e]
2,4-Dimethylphenol	8270	GC/MS	G	4°C	14	730	1200
2,4-Dinitrotoluene	8270	GC/MS	G	4°C	14	73	120

Table 2B. Modified Skinner List 8270 Semivolatile Organics Including TPH and PHCs[a] (Continued)

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Liquid Reporting Limit (µg/L)[c]	Soil Reporting Limit (mg/kg)[c]
2,4-Dinitrophenol[b]	8270	GC/MS	G	4°C	14	73	120
Benzo(j)Fluoranthene	8270	GC/MS	G	4°C	14	[e]	[e]
2-Chlorophenol	8270	GC/MS	G	4°C	14	30	61
2,4,6-Trichlorophenol	8270	GC/MS	G	4°C	14	6.1	44
Di-n-Butyl Phthalate	8270	GC/MS	G	4°C	14	3700	6100
Benzyl Alcohol[b]	8270	GC/MS	G	4°C	14	11000	18000
Methyl Chrysene	8270	GC/MS	G	4°C	14	[e]	[e]
Total Cresol[a, f]	8270	GC/MS	G	4°C	14	3780	6300
TPH[h]	8015m	GS	G	4°C	7	—	1000

[a]Principal hazardous constituent identified in Ciniza Hazardous Waste Facility Permit.
[b]Additional constituents.
[c]Based on EPA Region 6, Human Health Medium-Specific Screening Levels (1999) and NM WQCC Regulations (1996). Analytical detection limits are required to be lower than reporting limits.
[e]No regulatory limit provided. Laboratory detection limit will be used.
[f]Regulatory limits for individual isomers combined into a 'total' limit for these compounds.
[g]Total naphthalene plus monomethylnaphthalenes regulatory limit is < 30µg/L for aqueous samples.
[h]Total Petroleum Hydrocarbon as Gasoline Range Organics and Diesel Range Organics

µg/L = microgram per liter
mg/kg = milligram per kilogram
G = glass with Teflon-lined lid
GC/MS = gas chromatography/mass spectrometry
GC = gas chromatography

Table 2C. Modified Skinner List Metals and PHCs[a]

Parameter	EPA Method SW-846	Description	Container	Preservative [b]	Holding Time/Days	Aqueous Reporting Limit (µg/L)[c]	Soil Reporting Limit (mg/kg)[c]
Antimony	7060(aq), 6010	GFAA/ICP	P or G	4°C	180	6.0	31
Arsenic	6010	ICP-AES	P or G	4°C	180	50	22
Barium	6010	ICP-AES	P or G	4°C	180	2000	5400
Beryllium	6010	ICP-AES	P or G	4°C	180	4.0	150
Cadmium	6010	ICP-AES	P or G	4°C	180	5.0	39
Chromium[a]	6010	ICP-AES	P or G	4°C	180	50	210
Cobalt	6010	ICP-AES	P or G	4°C	180	50	3400
Lead[a]	6010	ICP-AES	P or G	4°C	180	15	400
Nickel	6010	ICP-AES	P or G	4°C	180	100	1600
Selenium	6010	ICP-AES	P or G	4°C	180	50	390
Silver	6010	ICP-AES	P or G	4°C	180	50	390
Vanadium	6010	ICP-AES	P or G	4°C	180	260	550
Zinc	6010	ICP-AES	P or G	4°C	180	10000	23000

[a]Principal hazardous constituent identified in Ciniza Hazardous Waste Facility Permit.
[b]Aqueous samples are field acidified to pH < 2 with HNO_3 and must not be refrigerated. Non-aqueous samples are cooled to 4°C.
[c]Based on EPA Region 6, Human Health Medium-Specific Screening Levels (1999) and NM WQCC Regulations (1996). Analytical detection limits are required to be lower than reporting limits.

µg/l = microgram per liter
mg/kg = milligram per kilogram
ICP-AES = Inductively Coupled Plasma - Atomic Emission Spectroscopy
G = glass
P = linear polyethylene, polypropylene, or Teflon

Table 2D. Mercury[a] and Cyanide

Parameter	EPA Method SW-846	Description	Container	Preservative	Holding Time/Days	Aqueous Reporting Limit (µg/L)[c]	Soil Reporting Limit (mg/kg)[c]
Mercury[a]	7470/7471	CVAA	P or G	4°C[b]	28	2.0	23.
Cyanide	335.3/ 9010, 9014	Colorimetry	P or G	4°C[d]	14	200	1200

[a]Principal hazardous constituent identified in Ciniza Hazardous Waste Facility Permit.

[b]Aqueous samples are field acidified to pH < 2 with HNO_3 and must not be refrigerated. Non-aqueous samples are cooled to 4°C.

[c]Based on EPA Region 6, Human Health Medium-Specific Screening Levels and NM WQCC Regulations (1996). Analytical detection limits are required to be lower than reporting limits.

[d]Aqueous samples are field adjusted to pH >12 with NaOH and refrigerated. Non-aqueous samples are cooled to 4°C.

µg/l = microgram per liter
mg/kg = milligram per kilogram
CVAA = cold vapor atomic absorption
G = glass
P = linear polyethylene, polypropylene, or Teflon

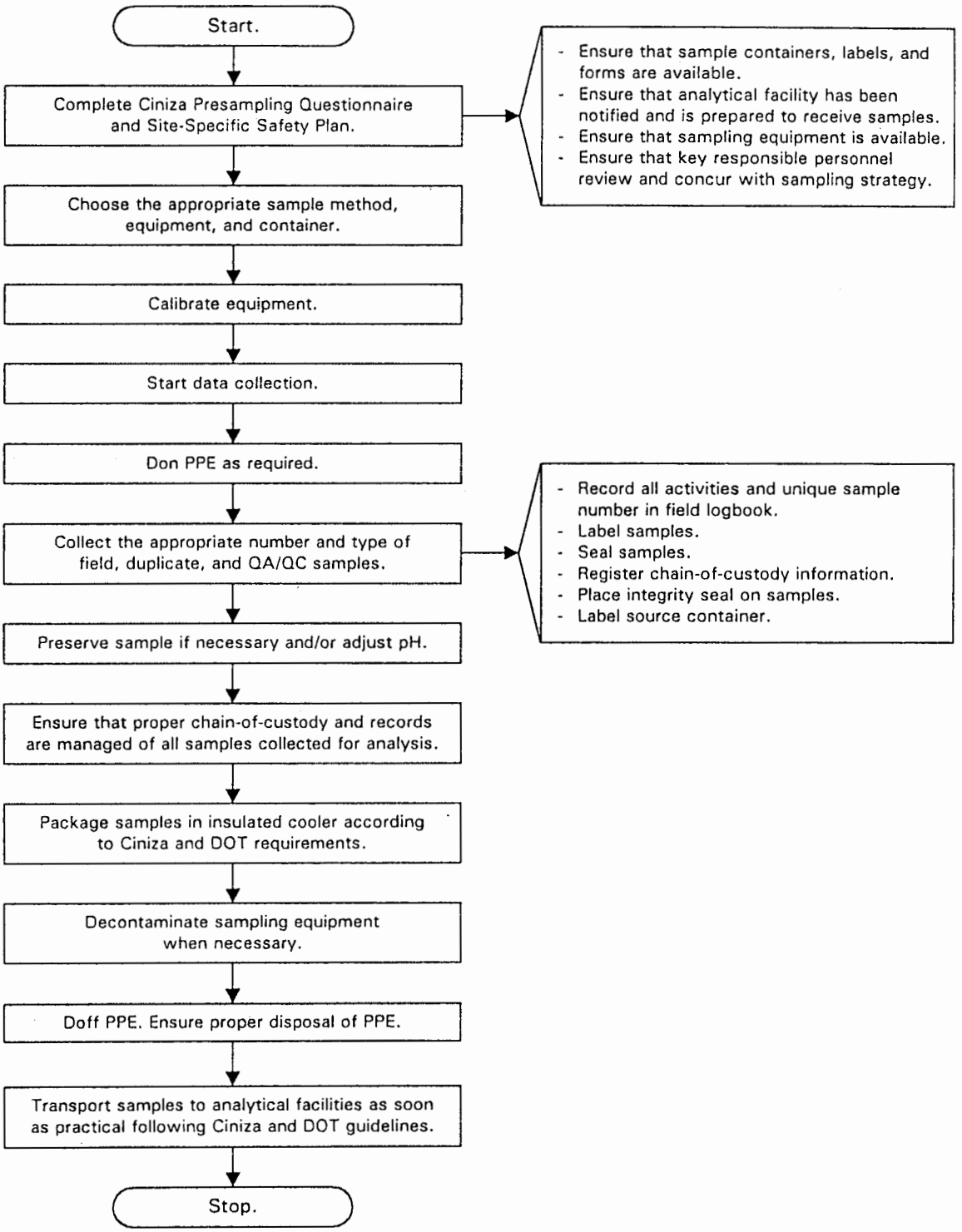

Figure 7-1. Sampling Event

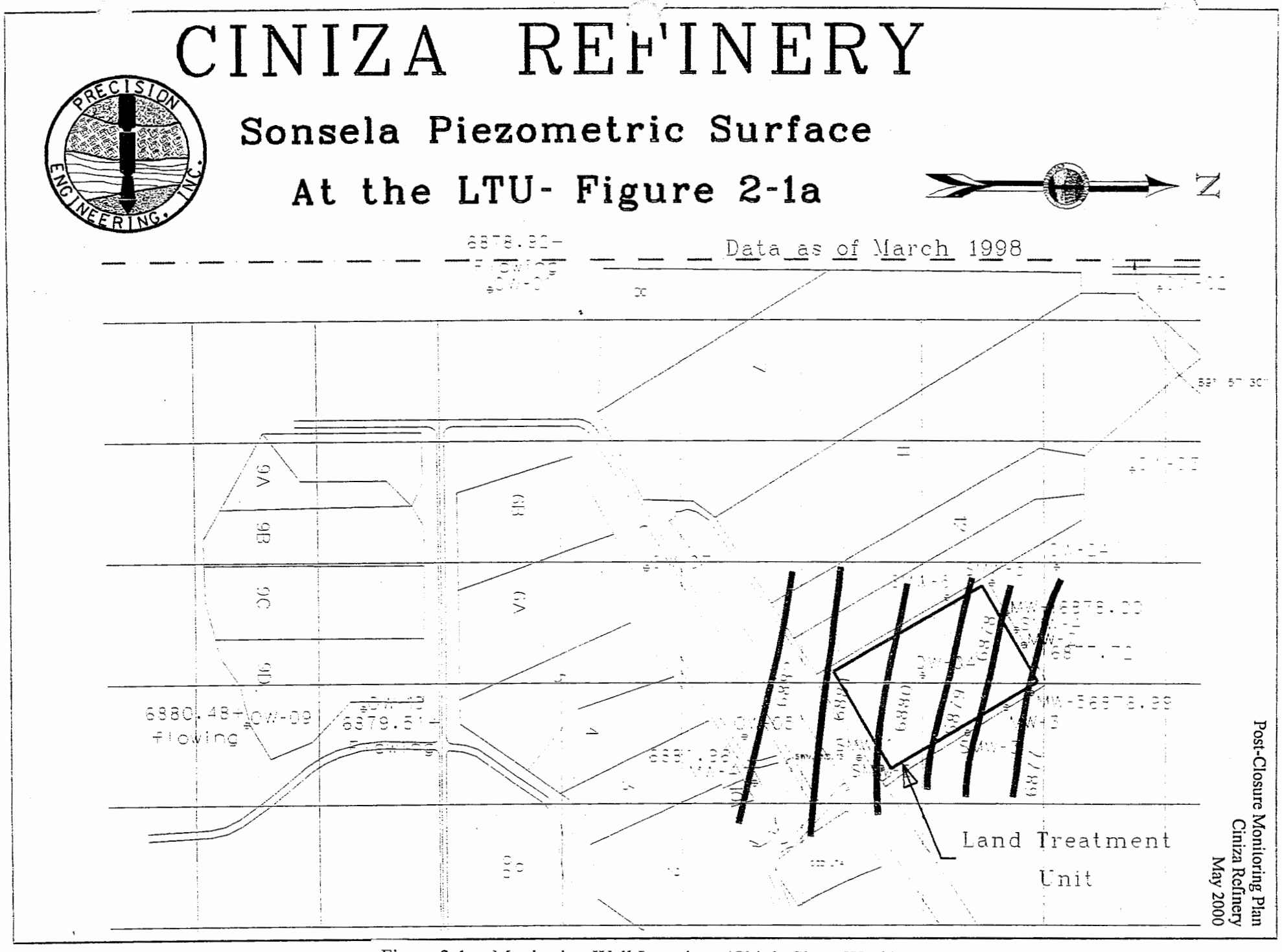

Figure 2-1a. Monitoring Well Locations (Chinle Slope Wash)

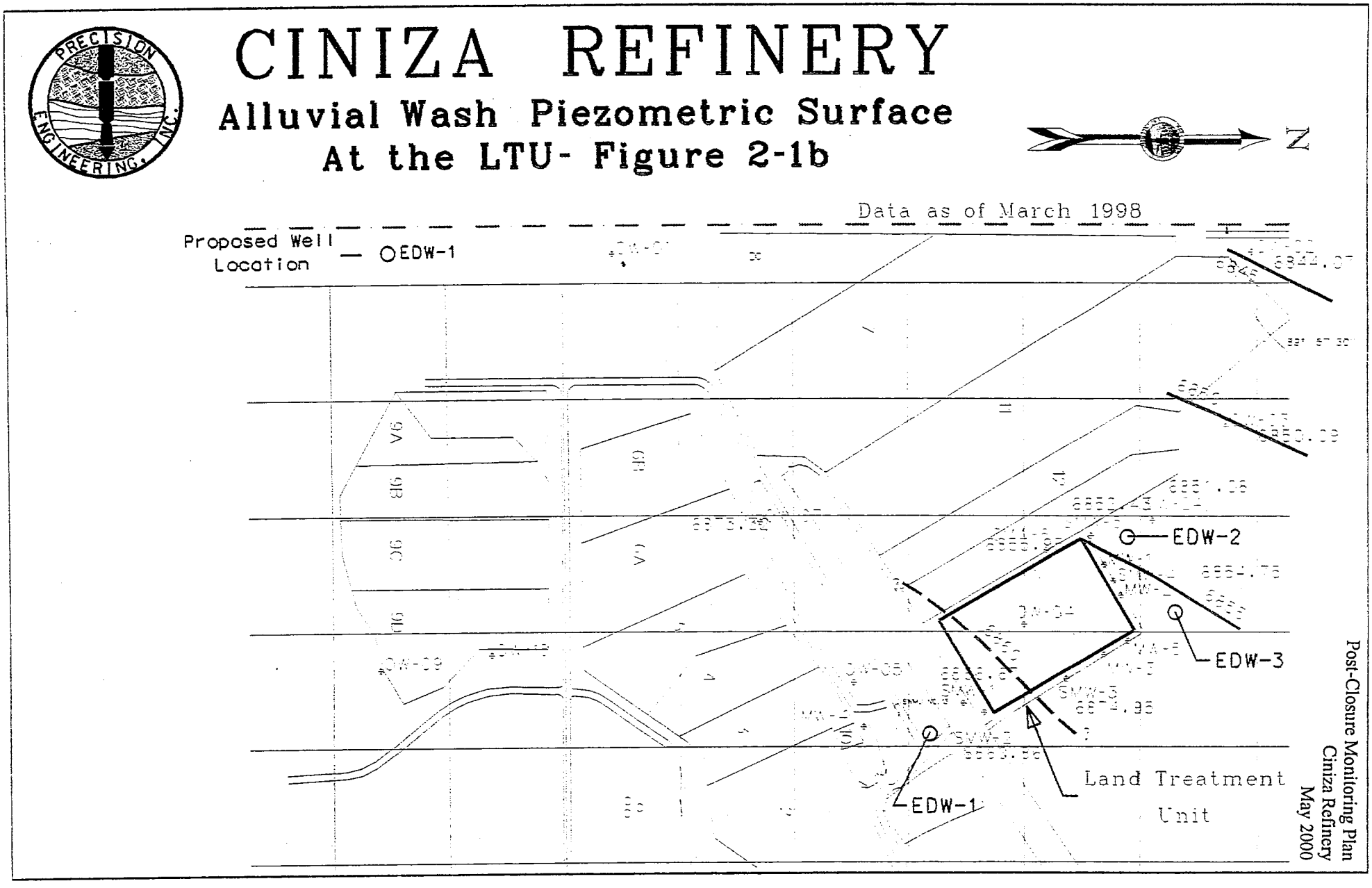

Figure 2-1b. Monitoring Well Locations (Chinle Slope Wash Potentiometric Surface)

Appendix F

APPENDIX F

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Appendix G

APPENDIX G

Well Construction Logs

MONITORING WELL MW-1

SURFACE ELEVATION: 6876 FEET
(Unsurveyed)

DEPTH IN FEET	LABORATORY TEST DATA: TESTS REPORTED ELSEWHERE	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	STRENGTH TEST DATA: TYPE OF TEST	STRENGTH TEST DATA: NORMAL OR CONFINING PRESSURE (PSF)	STRENGTH TEST DATA: SHEAR STRENGTH (PSF)	STRENGTH TEST DATA: DEVIATOR STRESS (PSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	BLOWS/FT. SAMPLES
0										
10										
20										
30										
40										
50										
60										
70										
80										
90										
100										
110										
120										
130										
140										
150										
160										

SYMBOLS	DESCRIPTION
CL	REDDISH-BROWN SILTY CLAY, TRACE OF MEDIUM TO COARSE SAND AS BLEBS AND THIN INTERBEDS
	WATER LEVEL 14.1 FEET B.G. 10/18/81
SC	PINKISH-PURPLE, SLIGHTLY SANDY (FINE) CLAY
SH	VARIEGATED SILTY SHALE, REDDISH BROWN GRADING TO GREEN AND LIGHT PURPLE
CL	REDDISH-BROWN SILTY CLAY, FIRM
LS/SH	VARIEGATED LIGHT GREEN AND DARK RED LIMESTONE INTERBEDDED WITH SHALE
SH	REDDISH-ORANGE SHALE
LS	LIGHT-GREEN LIMESTONE DENSE, HARD
SS	LIGHT GREENISH-GRAY, MEDIUM TO FINE, LOOSELY CEMENTED SANDSTONE INTERBEDDED WITH LIGHT GRAY, LOOSE CLAY
SH	REDDISH-PURPLE SHALE

BORING COMPLETED AT 130.4 FEET ON 10/14/81.

SCREENED INTERVAL

FIGURE 30.2-1

MONITORING WELL MW-2

SURFACE ELEVATION: 6877 FEET
(Unsurveyed)

LABORATORY TEST DATA

DEPTH IN FEET	TESTS REPORTED ELSEWHERE	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	STRENGTH TEST DATA: TYPE OF TEST	STRENGTH TEST DATA: NORMAL OR CONFINING PRESSURE (PSI)	STRENGTH TEST DATA: SHEAR STRENGTH (PSI)	STRENGTH TEST DATA: DEVIATOR STRESS (PSI)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	BLOWS/FT.	SAMPLES
0											
10											
20											
30											
40											
50											
60											
70											
80											
90											
100											
110											
120											
130											
140											
150											
160											

SYMBOLS	DESCRIPTION
CL	REDDISH-BROWN SILTY CLAY, TRACE MEDIUM TO COARSE SAND AS LOOSE TO FIRM BLEBS
	WATER LEVEL 9.1 FEET B.G. 10/18/81
SC	PINKISH-PURPLE, SLIGHTLY SANDY (FINE) CLAY
SH	VARIEGATED REDDISH-BROWN, GREEN AND LIGHT PURPLE, SANDY TO SILTY SHALE
CL	REDDISH-BROWN SILTY CLAY, FIRM
LS/SH	LIGHT GREEN TO DARK RED LIMESTONE INTERBEDDED WITH SHALE
LS	LIGHT GREEN LIMESTONE, HARD
SS	WHITE TO LIGHT-GRAY, FINE TO MEDIUM SAND; SOME CLAY; GRADES GREENISH GRAY TO PINK, COARSE TO MEDIUM SAND
SH	DEEP PURPLE SHALE, FIRM

BORING COMPLETED AT 138.0 FEET ON 10/15/81.

SCREENED INTERVAL

FIGURE 30.2-2

MONITORING WELL MW-4

SURFACE ELEVATION: 6883 FEET
(Unsurveyed)

DEPTH IN FEET	LABORATORY TEST DATA: TESTS REPORTED ELSEWHERE	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	STRENGTH TEST DATA: TYPE OF TEST	STRENGTH TEST DATA: NORMAL OR CONFINING PRESSURE (PSF)	STRENGTH TEST DATA: SHEAR STRENGTH (PSF)	STRENGTH TEST DATA: DEVIATOR STRESS (PSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	BLOWS/FT. SAMPLES	SYMBOLS	DESCRIPTION
0											CL	REDDISH-BROWN SILTY CLAY, LOOSE
											CL	REDDISH-BROWN CLAY, FIRM WATER LEVEL 8.7 FEET B.G. 10/18/81
10												
20												GRADES SILTY AND SANDY (COARSE) 20-25 FEET
30												
40												
50												
60											SH	VARIEGATED REDDISH-BROWN, GREEN AND LIGHT PURPLE SILTY SHALE GRADES REDDISH-BROWN TO RED-ORANGE, 65-70 FEET
70												
80											SH/LS	VARIEGATED LIGHT GREEN TO DARK RED SHALE AND THIN LIMESTONE BED
											SH	REDDISH-ORANGE, SLIGHTLY SANDY SHALE
90											SS	WHITE TO LIGHT GRAY, CLAYEY SANDSTONE
100											SH	PURPLE SANDY SHALE
											SS	WHITE TO LIGHT GRAY SANDSTONE, HARD
110												
120											SH	PURPLE SHALE WITH THIN LENSES OF CLAYEY SAND
130												
140												
150												
160												

BORING COMPLETED AT 120.0 FEET ON 10/16/81.

SCREENED INTERVAL

FIGURE 30.2-4

ECL

WELL LOGGING FO

Client Giant Well Number MW-5

1/4 1/4 1/4 1/4 S T R State New Mexico

County Contractor Stewart Bros.

Spud Date 7/23/86 Completion Date 7/28/86

Logs Run Lithology Logged By Selke

Elevation Spud In (Fm.) Chinle Formation

Remarks Drilled w/failing F-10 rig - hollow stem auger to 65' and rotary core to 135'. Rig and all tools steam cleaned prior to drilling split spoon and cutting samples w/auger - core w/rotary

DEPTH | LITHO. | RECOV.

RUN	FROM	TO	SAMPLE DEPTH	REMARKS
1	0	3.5	0.0 3.5	0-30.0 Reddish-brown, silty clay w/minor sandy lenses.
2	3.5	8.5	8.5-10.0 38 blows	
3	8.5	13.5	13.5	
4	13.5	18.5	18.5-20 90 blows	
5	18.5	23.5	23.5	
6	23.5	28.5	28.5-30.0 26 blows	
7	28.5	30.0	30.0-31.5	
8	30.0	31.5	31.5-33.0	30.0-35.0 fn-med grained grading to slightly clayey silt to fn sand w/minor clay lenses
9	31.5	33.0	33.0-34.5	
10	33.0	34.5	34.5-36.0	
11	34.5	36.0	36.0-37.5	35.0-50 Reddish-brown clay w/locally minor silt and silty clay
12	36.0	37.5	37.5-39.0	
13	37.5	40.0	40.0-41.5	
14	40.0	42.5	42.5-44.0	

GCL

WELL LOGGING F. M

Client Giant Well Number MW-5

1/4 1/4 1/4 1/4 S T R State New Mexico

County Contractor Stewart Bros.

Spud Date 7/23/86 Completion Date 7/29/86

Logs Run Lithology Logged By Selke

Elevation Spud In (Fm.) Chinle Formation

Remarks

DEPTH	LITHO.	RECOV.	RUN	FROM	TO	SAMPLE DEPTH	REMARKS
45							
			15	42.5	45.0	45.0-46.5	
			16	45.0	47.5	47.5-49.8 57 blows	
50			17	47.5	50.0	50.0-51.5 43 blows	
			18	50.0	52.5	52.5-54.0 53 blows	50-53 Reddish-brown clay w/minor sand/gravel lenses
55			19	52.5	55.0	55.0-56.5 54 blows	
			20	55.0	57.5	57.5-59.0 100 blows	53-97 Reddish to purple shale and/or clay w/greenish colored blebs
60			21	57.5	60.0	60.0-61.5	
			22	60.0	68.5		
65			23	68.5	77	68.5-77	
70							
75							
80			24	77	87	77-87	
85							
90							

GCL

WELL LOGGING FL .

Client Giant Well Number MW-5

1/4 1/4 1/4 1/4 S T R State New Mexico

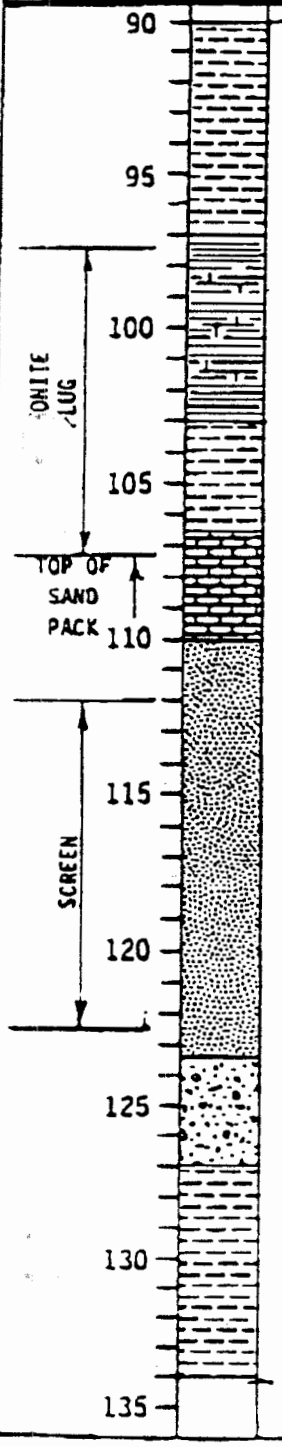
County Contractor Stewart Bros

Spud Date 7/23/86 Completion Date 7/29/86

Logs Run Lithology Logged By Selke

Elevation 6961.8 Spud In (Fm.) Chinle Formation

Remarks TOC

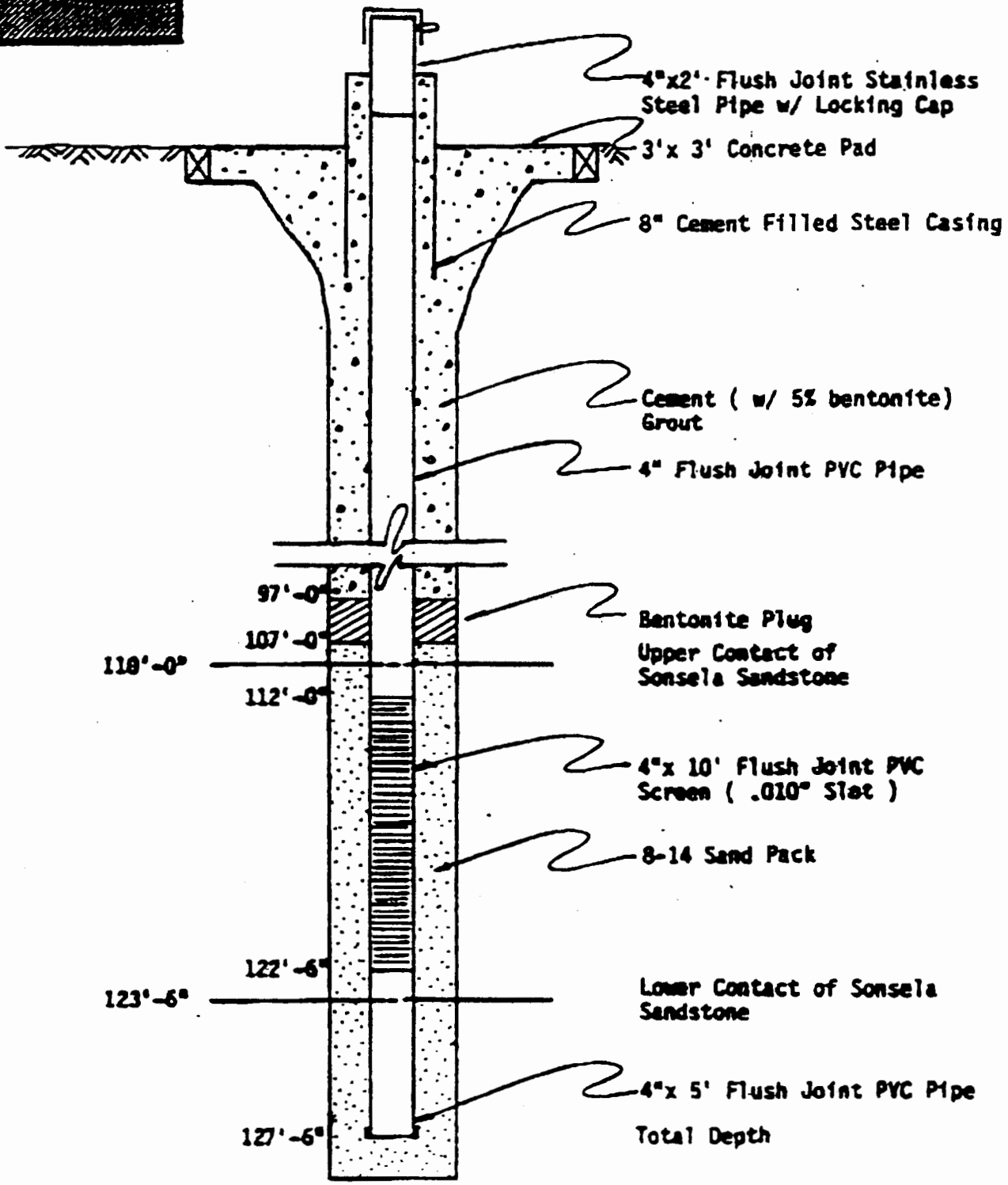


RUN	FROM	TO	SAMPLE DEPTH	REMARKS
25	97	107	97-107	97-103 Reddish shale w/limestone stringers
				103-106.5 red shale/clay
25	107	117	107-117	106.5-110 reddish colored limestone w/greenish white blebs
				110-123.5 grayish to reddish (?) colored, fine to medium grained, subrounded to rounded, moderately well sorted, moderately well indurated, quartz sandstone. Bedding planes dipping approx. 15°.
27	117	125	117.0-125.0	
				123.5-127 Basal conglomerate is similar colored to above sandstone but less consolidated than sandstone.
28	125	134	125.0-134	
				127-134 dk red clay/shale

GCL

COMPLETION DIAGRAM

MW-5



MAJOR DIVISIONS			GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL SAND-CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

UNIFIED SOIL CLASSIFICATION SYSTEM

FIGURE 30.2-5

MONITORING WELL IDENTIFICATION REPORT

ENVIRONMENTAL IMPROVEMENT DIVISION
HAZARDOUS WASTE SECTION
1190 ST. FRANCIS DR./HAROLD RUNNELS BLDG.
SANTA FE, NEW MEXICO 87503

FACILITY NAME Giant Refining Company

EPA I.D. NUMBER NMD000333211-2

COUNTY McKinley

WELL NUMBER SMW-2

WELL LOCATION (LONGITUDE) ° ' "

WELL LOCATION (LATITUDE) ° ' "

AQUIFER NAME Ciniza Sand

AQUIFER CONFINED X UNCONFINED

WELL INSTALLATION DATE 9-26-85

DRILLING METHOD HLWAG

INNER CASING DIAMETER 2.0"

BOREHOLE DIAMETER 6.5"

CASING MATERIAL SS304

METHOD OF DEVELOPMENT COMPR

ELEV BOTTOM OF BOREHOLE 6826.73

ELEV BOTTOM OF WELL CASING 6827.13

ELEV BOTTOM OF SCREENED INT 6830.13

ELEVATION OF SCREENED INT 6850.13

SURVEYED ELEV OF CASING TOP 6881.73

DATE OF REPORT Jan. 28, 1991 SIGNATURE Claud C. Rosendale

NAME (TYPED) Claud C. Rosendale

b:wellid/bas

MONITORING WELL IDENTIFICATION REPORT

ENVIRONMENTAL IMPROVEMENT DIVISION
HAZARDOUS WASTE SECTION
1190 ST. FRANCIS DRIVE/HAROLD RUNNELS BLDG.
SANTA FE, NEW MEXICO 87503

FACILITY NAME GIANT REFINING COMPANY

EPA I.D. NUMBER NMD000333211-2

COUNTY McKinley

WELL NUMBER SMW-2

WELL LOCATION (LONGITUDE) _____

WELL LOCATION (LATITUDE) _____

NEW MEXICO STATE PLANE (X) 321,542.80

(Y) 1.635,592.65

AQUIFER NAME Ciniza Sand

AQUIFER CONFINED X UNCONFINED _____

WELL INSTALLATION DATE 9-26-85

DRILLING METHOD HLWAG

INNER CASING DIAMETER 2.0"

BOREHOLE DIAMETER 6.5"

CASING MATERIAL SS304

METHOD OF DEVELOPMENT COMPR

ELEV BOTTOM OF BOREHOLE 6826.73

ELEV BOTTOM OF WELL CASING 6827.13

ELEV BOTTOM OF SCREENED INT 6830.13

ELEVATION OF SCREENED INT 6850.13

SURVEYED ELEV OF CASING TOP 6884.44

DATE OF REPORT 11-1-91. SIGNATURE [illegible]

NAME (TYPED) [illegible]

Geoscience Consultants, Ltd.

WELL LOGGING FORM

Page ____ of ____

Client GIANT REFINING COMPANY Well Number SMX-2

___ ¼ ___ ¼ ___ ¼ ___ ¼ S ___ T 15 N R 15 W State New Mexico

County McKinley Contractor Fox

Spud Date 9-26-85 Completion Date

Logs Run Lith from Cores Logged By J.C. Hunter

Elevation 6883 Spud In (Fm.) Chinle

Remarks Drilled w/Hollow Stem Auger & Continuous Sampler. Collected samples @ 2.5 and 5.0' intervals for %H_2O. Comp. as SS monitor Well

Depth | Litho | recov

RUN	From	To	Sample#/Ft	Lith/Remarks
				~ 81' N62E FROM MW-4
			850926	
1	0	5	1015/2.5 1016/5.0	0-2.5' soil light-brn silty clay calcification root'l cons
2	5	10	1018/7.5 1019/10.0	
3	10	15	1023/12.5 1024/15.0	2.5'-9.0' clay red slightly moist very cohesive
4	15	20	1050/17.5 1051/20.0	9.0'-9.1 sand buff fine-med gr unconsolidated
5	20	25	1059/22.5 1100/25.0	dry 9.1'-~17.0' CLAY; red, slightly moist, plastic
6	25	30	1112/27.5 1113/30.0	~17.0'-~23.0' SAND (WET) fn-med gr
				23'-30' CLAY: red, slightly moist, plastic
				WATER LEVEL 15'-7" . 1150

Depth: 0, 5, 10, 15, 20, 25, 30

Sand ~17'

23'

Geoscience Consultants, Ltd.

WELL LOGGING FORM

Page ____ of ____

Client GIANT REFINING COMPANY Well Number SMW-2

___ ¼ ___ ¼ ___ ¼ ___ ¼ S ___ T 15 N R 15 W State New Mexico

County McKinley Contractor Fox

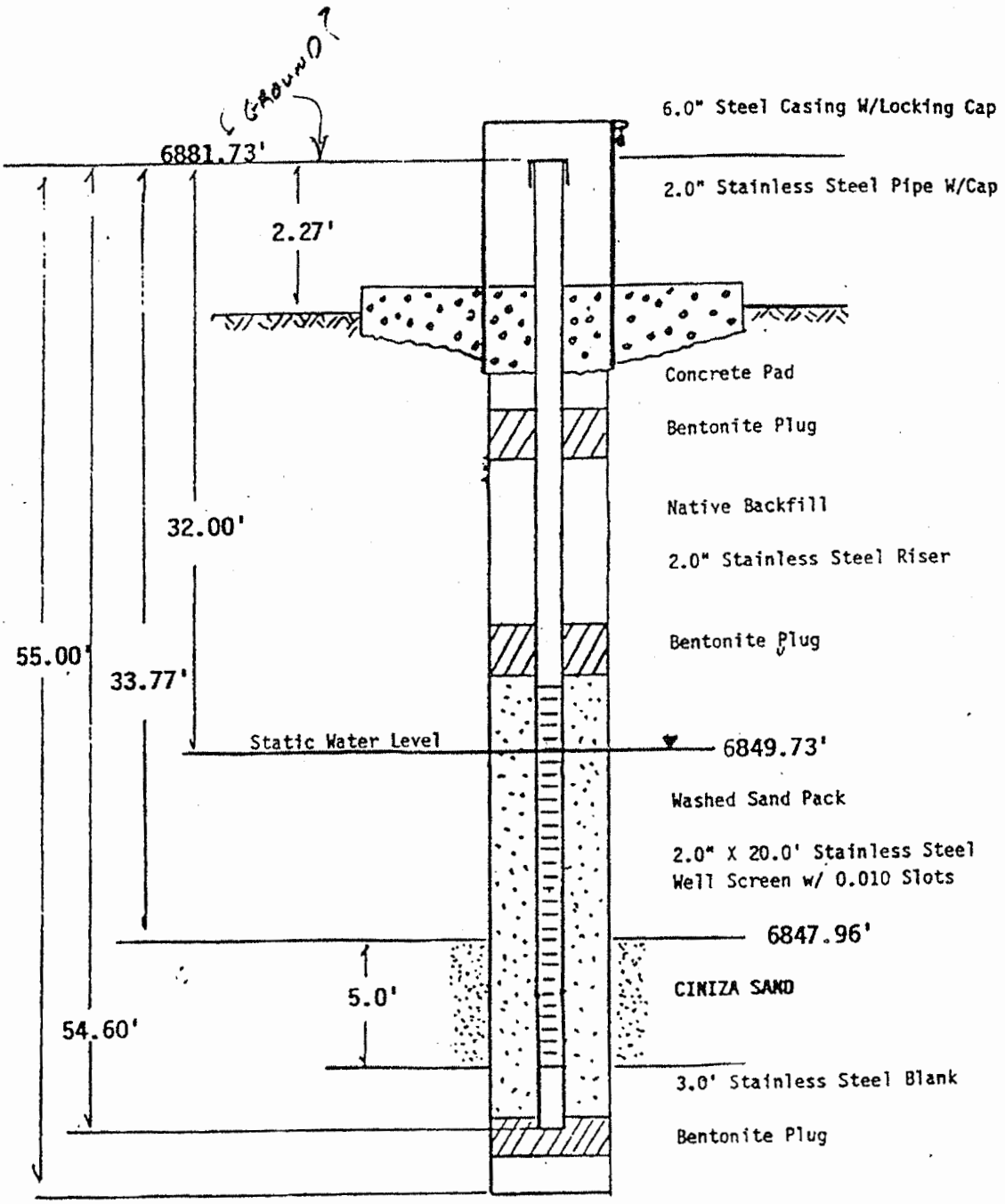
Spud Date 9/26/95 Completion Date

Logs Run Lith from Cores Logged By J.C. Hunter

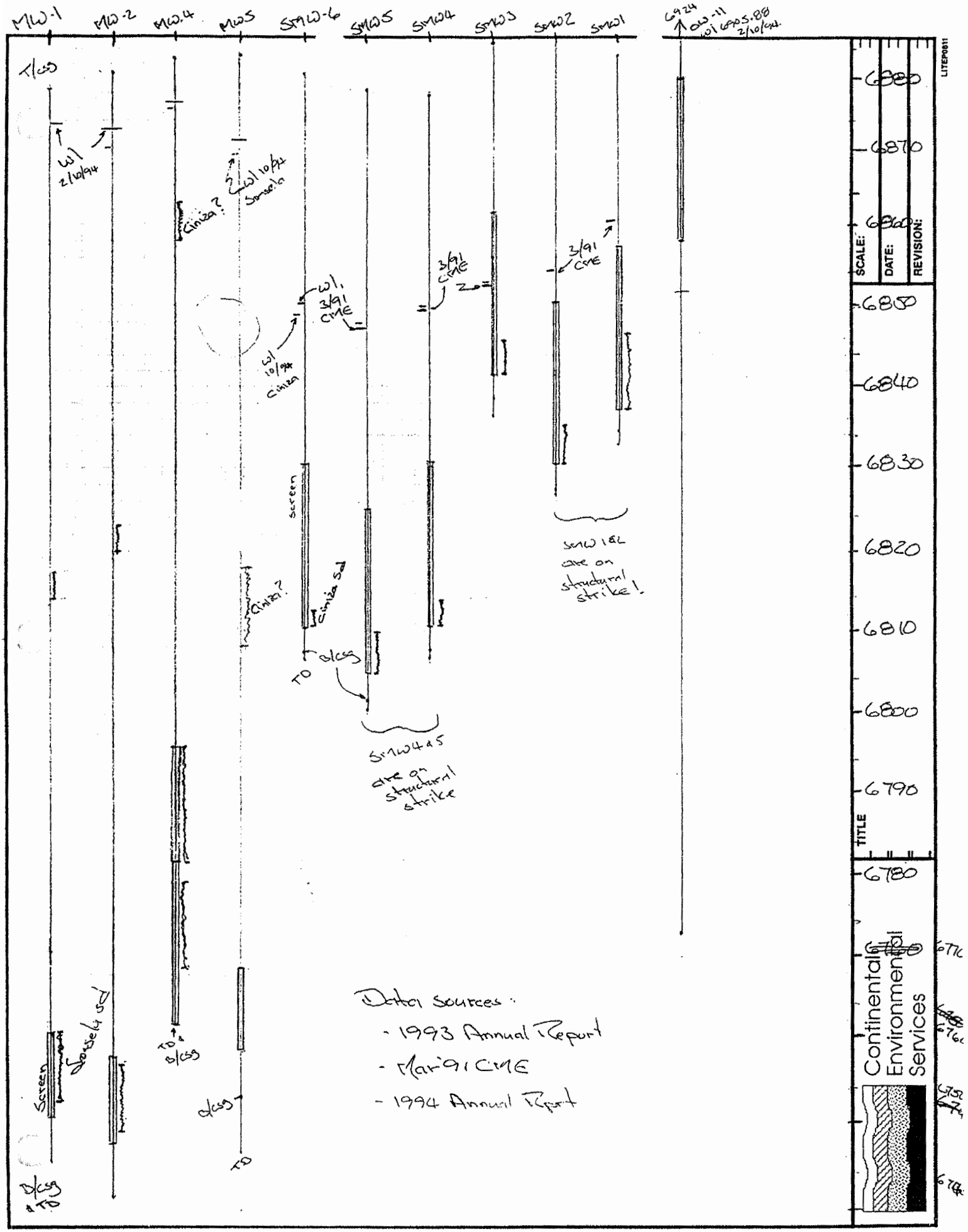
Elevation 6882.83 Spud In (Fm.) Chinle

Remarks Drilled w/Hollow Stem Auger & Continuous Sampler. Collected samples @ 2.5 and 5.0' intervals for %H_2O. Comp. as SS monitor Well

Depth	Litho	Recov	RUN	From	To	Sample#/Ft	Lith/Remarks
							SE corner of LTA Times should be 15xx, not 14xx etc
						850925	
0							
			ϕ	0	5	1415/4.0 SDY CLY	0-1.5 SOIL
5			2	5	10	1420/10.0 CLY SD	
10			3	10	15	1426/15' CLY	1.5-4.0 CLAY
15			4	15	20	1432/20' SD	
20			5	20	25	1438/25' CLY	4.0-19.0 SANDY CLAY
25			6	25	30	1445/27.5 SD 1446/30.0 CLY SD	
30			7	30	35	1452/32.5 CLY 1453 35.0 SD	19.0-24 SAND; gr rd (5R4/2); med gr,
35			8	35	40	1458/37.5 1459/40.0	poor sort, qty & lic ca frag
40							
							24-25 CLAY
							25-28 SAND, as above
							28-33 CLAYEY SAND & CLAY
						5'	33-38 SAND (WET) med rd brn (10R4/1)
							med gr, mod sort, qty, rnd
							38-40 CLAY
							9/27/95 H_2O level 29'7" 9:40
							N 120° to SMW 2
							pH 7.1 #850926 1445



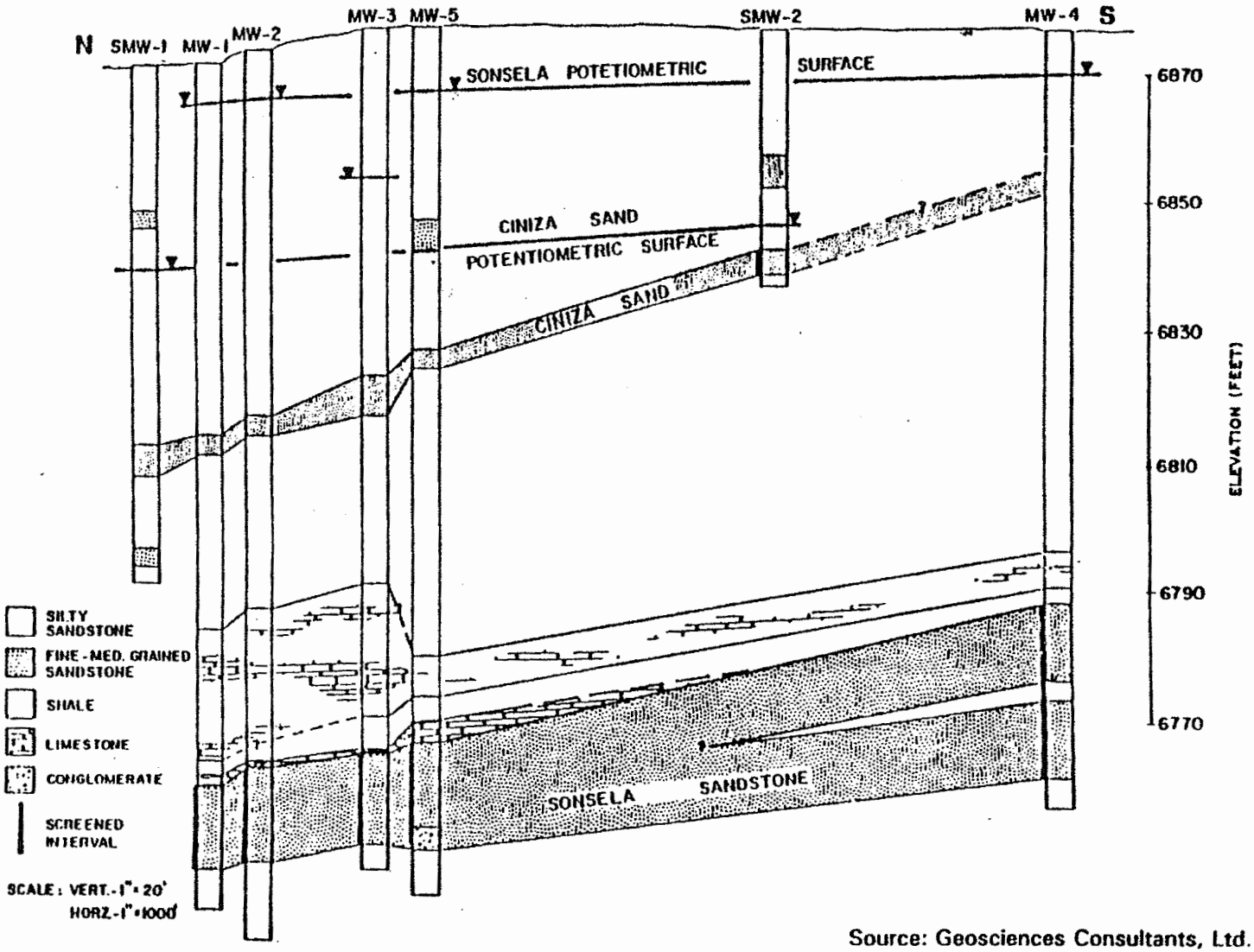
COMPLETION DIAGRAM FOR WELL SMW-2



Data sources:

- 1993 Annual Report
- Mar 91 CME
- 1994 Annual Report

CHECKED BY | APPROVED BY | DRAWN BY



Source: Geosciences Consultants, Ltd. 1986

SEC DONOHUE
Environment & Infrastructure

FIGURE 3
GEOLOGIC CROSS SECTION

CINIZA REFINERY
GIANT REFINING COMPANY
GALLUP, NEW MEXICO

MONITORING WELL IDENTIFICATION REPORT

NEW MEXICO ENVIRONMENT DEPARTMENT
HAZARDOUS WASTE SECTION
P.O. BOX 26110
SANTA FE, NEW MEXICO 87502

FACILITY NAME	Giant Refining Co. - Ciniza
EPA I.D. NUMBER	NMD000333211-2
COUNTY	McKinley
WELL NUMBER	SMW-4
WELL LOCATION (LONGITUDE)	108 26' 01"
WELL LOCATION (LATITUDE)	35 29' 44"
NEW MEXICO STATE PLANE	(X) 321,397.90 (Y) 1,635,948.75
AQUIFER NAME	Ciniza Sand
AQUIFER CONFINED? xx	UNCONFINED?
WELL INSTALLATION DATE	9-25-85
DRILLING METHOD	HLWAG
INNER CASING DIAMETER	2.0"
BOREHOLE DIAMETER	6.5"
CASING MATERIAL	SS304
METHOD OF DEVELOPMENT	Compr
ELEV. BOTTOM OF BOREHOLE	6806.74
ELEV. BOTTOM OF WELL CASING	6807.84
ELEV. BOTTOM OF SCREENED INT.	6810.84
ELEVATION OF SCREENED INTERVAL	6830.84
SURVEYED ELEVATION OF CASING TOP	6880.08

DATE OF REPORT 2-22-96

SIGNATURE Dorinda Mancini
NAME (TYPED) Dorinda Mancini

Consultants, Ltd

Page SMW-4 of

Client GIANT REFINING COMPANY Well Number SMW-4

___ ¼ ___ ¼ ___ ¼ ___ ¼ S ___ T 15 N R 15 W State New Mexico

County McKinley Contractor Fox

Spud Date 9/25/85 Completion Date 9/25/85

Logs Run Lith from Cores Logged By J.C. Hunter

Elevation 6878.84 Spud In (Fm.) Chinle

Remarks Drilled w/Hollow Stem Auger & Continuous Sampler. Collected samples @ 2.5 and 5.0' intervals for %H_2O. Comp. as SS monitor Well

Depth	Litho	Recov	RUN	From	To	Sample#/Ft	Lith/Remarks
							Between MW1- & MW-2 Depths from top
							of auger, ~1.5' AGL (typical)
0							
TTR 0830 5			1	0	5	850925: cl 0840/4.0	0-1.5' (1.5) SOIL; gry rd (10R 4/2); silty cly
10			2	5	10	0847 cl /10.0	w/ minor sd; roots & org matter
15			3	10	15	0852 cl /15'	1.5-9.0 (7.5') CLAY; gry rd (5R4/2) - dk rd
20			4	15	20	0859 cl /20'	brn (10R 3/4); dense, plastic, 1-5% silt
25			5	20	25	0906 sd /25'	9.0-16.0 (6.0') SANDY CLAY; gry rd (10R 4/2)
30			6	25	30	0913/27.5 cl 0914/30.0 snt	- dsky rd (5R 3/4); cly w/ 15-20% me
35			7	30	35	0917/32.5 cl 0920/35.0 cl	cly Drilling 36') gr-cr gr sd, loca f grvl, poor sort
40			8	35	40	0927/37.5 cl 0928/40.0 cl	
45			9	40	45	0936/42.5 cl 0937/45.0 cl	2nd cutting - 44')
50			10	45	50	0940/42.5 snt cly 0951/50.0 cly	16.0-23.0 (7.0) CLAY; gry rd (5R 4/2),
TD 1000 55			11	50	55	0954/52.5 snt cly 0000/55.0 cly	loc. sandy, 5-10% sd
			12	55	60	850926 1215/57.5' cly 1216/60.0 snt	23.0-24.0 (1.0) SAND; pale rd brn (10R 5/4) - me
More 10 20			14	60	65	1241/62.5 1242/65.0	rd brn (10R 4/2); f g, mod srt, loose,
Restarted 9/30/85 @ 1100			15	65	69	1255/67.5 1259/69.0	qtz ± K-spar
							24.0-33.0 (9.0) SILTY CLAY; mod rd (5R 5/4)
							cly w/ 10-20% slt, loc f g sand
							33.0-~~55.0~~ 59 (26) CLAY; mod rd brn (10R 4/6)
							loc silty-sandy
							57.5-59.5
							59-61 (2') Sand (wet) mod rd brn
							(10R 4/6); fg, mod sort
							61-69 Silty Sandstone (dry) pale red (10R 6/2)
							loc [illegible]

Geoscience Consultants, Ltd.

WELL LOGGING FORM

Page ____ of ____

Client GIANT REFINING COMPANY Well Number SMX-4

___ ¼ ___ ¼ ___ ¼ ___ ¼ S ___ T 15 N R 15 W State New Mexico

County McKinley Contractor Fox

Spud Date 9-26-85 Completion Date

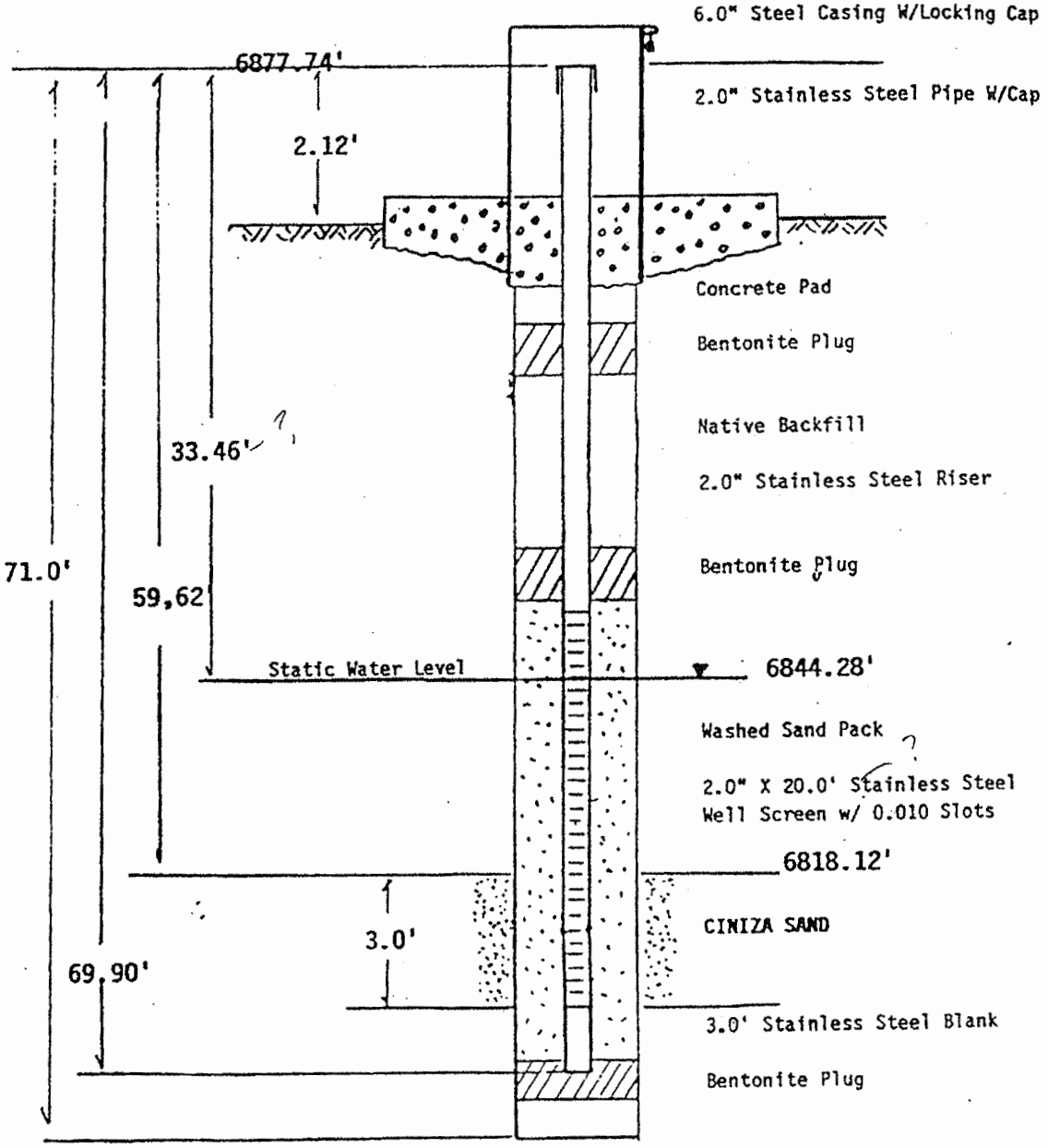
Logs Run Lith from Cores Logged By J.C. Hunter

Elevation Spud In (Fm.) Chinle

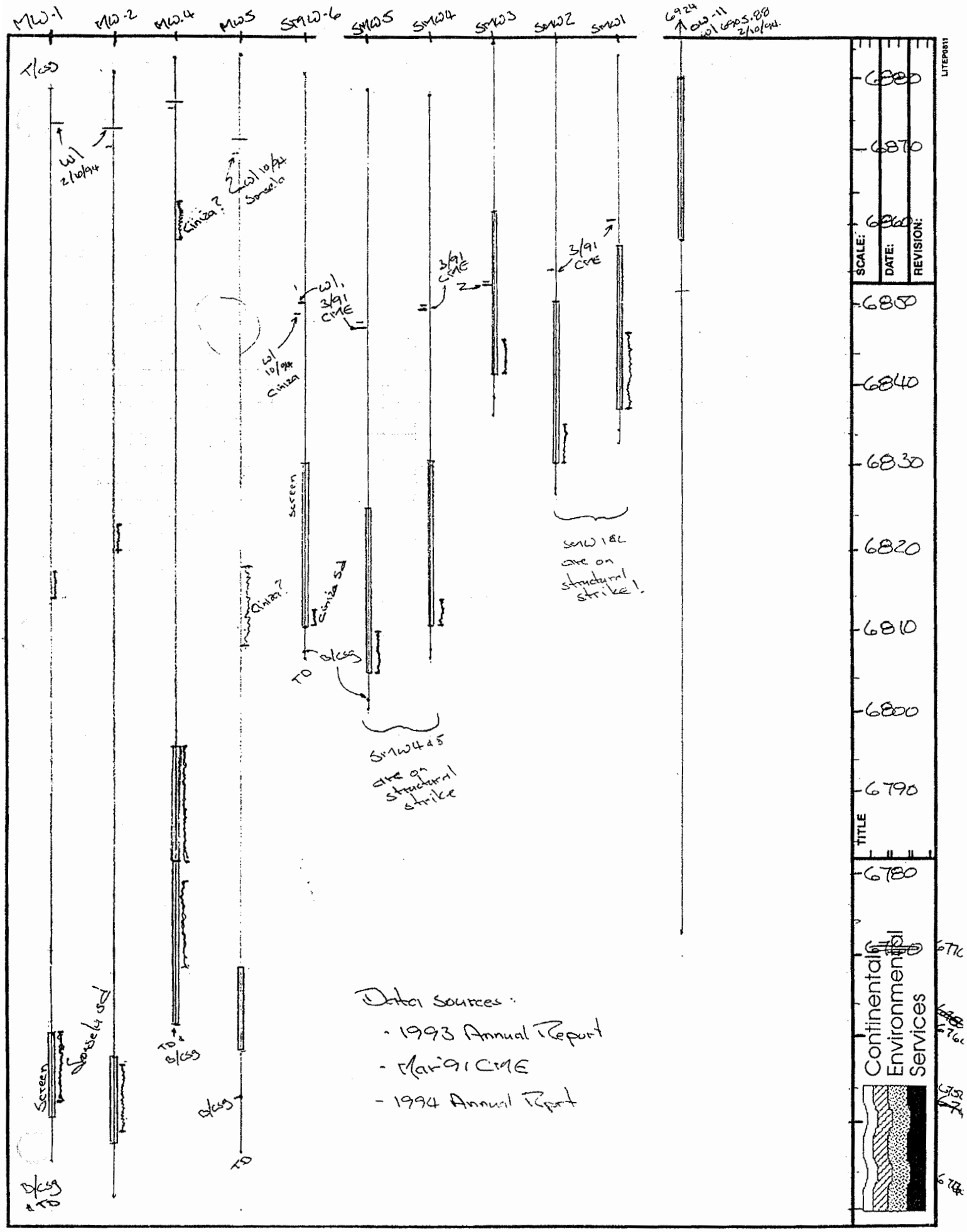
Remarks Drilled w/Hollow Stem Auger & Continuous Sampler. Collected samples @ 2.5 and 5.0' intervals for %H_2O. Comp. as SS monitor Well

Depth | Litho | Recov

RUN	From	To	Sample#/Ft	Lith/Remarks
			850926	
1	0	5	1325/0.0 1326/2.5 1327/5.0	0-10 shale/clay red slightly moist cohesive
2	5	10	1330/7.5 1331/10.0	
3	10	15	1335/12.5 1336/15.0	10-15 sand encountered at 10' dry coarse-fine gr low density
4	15	20	1345/17.5 1346/20.0	water level 15'5"
5	20	25	1354/22.5 1355/25.0	18-20 clayey sand (saturated) brn, fn-med gr w/ abundant clay
6	25	30	1402/27.5 1403/30.0	W.L. 26'-10 #850926 1+10
				22-24 sand; brn, fn-gr (saturated) w/ v. minor clay
				24-25 sandy clay; brn (saturated) w/ silt & fn sand
				25-27.5 sand; fn-med gr (saturated) v. minor clay
				27.5-27 sandy clay (moist) silt & fn sand
				29-30+ silty clay; (dry) reddish brn w/ greenish reduction nodules
				pH 7.4
				Conductance 4850



COMPLETION DIAGRAM FOR WELL SMW-4


MW-1
MW-2
MW-4
MW-5
SMW-6
SMW5
SMW4
SMW3
SMW2
SMW1
6924
MW-11
6905.88
2/10/94
T/CSG
wl 2/10/94
Cinza?
wl 10/94 Sonsela
3/91 CME
wl, 3/91 CME
wl 10/94 Cinza
Screen
Cinza?
TD
B/CSG
SMW 1&2 are on structural strike!
SMW 4&5 are on structural strike
Sonsela sd
Data sources:
- 1993 Annual Report
- Mar'91 CME
- 1994 Annual Report
6880
6870
6860
6850
6840
6830
6820
6810
6800
6790
6780
SCALE:
DATE:
REVISION:
TITLE
Continental Environmental Services
LITEP0811

Appendix H

APPENDIX H

Financial Test and Corporate Guarantee (Closure and Post-Closure)

BILL RICHARDSON
Governor

DIANE DENISH
Lieutenant Governor

NEW MEXICO ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Phone (505) 476-6000 Fax (505) 476-6030
www.nmenv.state.nm.us

RON CURRY
Secretary

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

February 4, 2010

Ms. Leslie Ann Allen
Senior Vice President
Health, Safety, Environment and Regulatory Affairs
Western Refining Company
123 W. Mills Avenue, Suite 200
El Paso, TX 79901

RE: NOTICE OF DISAPPROVAL
FINANCIAL ASSURANCE FOR THE
GALLUP REFINERY EPA ID# NMD000333211 AND THE
BLOOMFIELD REFINERY EPA ID # NMD 089416416
WESTERN REFINING SOUTHWEST, INC.
HWB-GRCC-MISC AND HWB-GRCB-MISC

Dear Ms. Allen:

The New Mexico Environment Department (NMED) has reviewed Western Refining, Southwest, Inc. (Western)'s December 30, 2009 letter concerning Western's annual financial assurance submittal for RCRA closure and post-closure. NMED, in consultation with the U.S. Environmental Protection Agency (EPA), has determined that Western may not apply the non-cash charge of $61,005,000.00 when calculating Alternative I of the financial test per 20.4.1.500 NMAC (incorporating 40 C.F.R. §§ 264.143(f)(1)(i) & 264.145(f)(1)(i)). Because Western is unable to use Alternative 2 of the financial test, as its bond rating with both Moody's and Standard and Poor's does not meet the minimum required ratings threshold required under 40 C.F.R. §§ 264.143(f)(1)(ii) & 264.145(f)(1)(ii), Western does not pass either alternative of the financial test.

Western states in its December 30, 2009 letter that "EPA Region 3 agreed and accepted Western's position that the lower-of-cost or market write-down of inventory was of such a nature that it was appropriate to include it as an adjustment to period of net income. The amount is clearly not related to depreciation or amortization, but has been in this adjustment as there are no other appropriate points within the prescribed financial test format to include such an adjustment."

NMED has determined that Region 3's allowance of the $61,005,000.00 lower-of-cost or market write-down of inventory when calculating the financial test was a specific circumstance related to the specific corrective action at the Yorktown. NMED does not agree that it is appropriate to allow the $61,005,000.00 to be used when calculating Ratio 2 (net income divided by total liabilities) of Alternative 1 of the financial test, 40 C.F.R. § 264.143(f)(1)(i)(A), for the Gallup and Bloomfield refineries because the application is not appropriate and does not comply with the regulations for RCRA closure and post closure. As discussed in NMED's December 4, 2009 letter, 40 C.F.R. § 264.143(f)(1)(i)(A) allows a company to add back the sum of depreciation, depletion, and amortization to net income when calculating Ratio 2, but the regulations do not allow for the adding back of other non-cash accounting line items, including inventory write-downs, which also do not fall within the accounting definitions. Specifically, depreciation, depletion, and amortization are defined in terms of financial accounting as "the accounting procedure used to allocate the cost of an asset, which will benefit a business enterprise for more than a year, over the asset's service life; the accounting procedure used to allocate the cost of acquiring and developing natural resources; and the process of expense allocation applied to the cost expiration of intangible assets," respectively. These definitions do not include inventory write-downs (LYN FRASER & AILEEN ORMISTON, UNDERSTANDING FINANCIAL STATEMENTS 261-63 (8th ed. 2007)).

Notwithstanding, in light of Western's current financial standing (Quarter 1 – Quarter 3), Western will not be able to utilize the financial test for its 2010 RCRA financial assurance submission. Accordingly, Western must submit financial assurance submission under a mechanism other than the financial test and corporate guarantee found in 40 C.F.R. §§ 264.143 & 264.145.

Finally, upon Western's indefinite suspension of the refining operations at the Bloomfield Refinery, NMED has reevaluated the closure and post-closure cost estimate for the surface impoundments of $1,264,704 and determined that Western must add an additional one million one hundred thousand dollars ($1,100,000) to the total cost estimate for closure and post closure activities to $2, 364,704. The additional cost is based on complete removal of the surface impoundments for clean closure (e.g., cost to remove the surface impoundments, characterization of soil and groundwater beneath the impoundments, soil removal costs, transportation costs, waste profiling and disposal costs and the costs for reporting and record keeping, and long term monitoring).

Western must submit a new financial assurance mechanism to NMED on or before March 4, 2010. If you have any questions regarding this letter, please contact Hope Monzeglio of my staff at 505-476-6045.

Sincerely,

James P. Bearzi
Chief
Hazardous Waste Bureau

cc: J. Kieling, NMED HWB
D. Cobrain, NMED HWB
H. Monzeglio, NMED HWB
L. King EPA Region 6 (6PD-N)
A. Hains, Western
R. Schmaltz, Western Bloomfield
E. Riege, Western Gallup
Reading File and GRCB 2010 and GRCC 2010

GIANT
INDUSTRIES, INC.

23733 NORTH
SCOTTSDALE ROAD
SCOTTSDALE
ARIZONA 85255

P. O. BOX 12999
SCOTTSDALE
ARIZONA 85267

PHONE
480-585-8888
INTERNET
WWW.GIANT.COM

March 22, 2000

Mr. James Bearzi
New Mexico Environment Department
Hazardous & Radioactive Material Bureau
P.O. Box 26110
Santa Fe, New Mexico 87502

Re: Financial Assurance for Giant Industries Arizona, Inc. and San Juan Refining Company

Dear Mr. Chacone:

I am the Financial Officer of Giant Industries Inc. This letter is in support of this firm's use of the financial test to demonstrate financial assurance for closure and post-closure costs, as specified in subpart H of 40 CFR parts 264 and 265.

1. This firm is the owner or operator of the following facilities for which financial assurance for closure care 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:

Giant Refining Company - Ciniza Refinery
EPA ID Number: NMD 000333211
Exit 39, East Interstate Highway 40
Gallup, New Mexico 87301

Closure cost estimate -	$
Post-closure cost estimate -	$
Total closure/post-closure cost estimate-	$371,756

San Juan Refining Company - Bloomfield Refinery
EPA ID Number: NMD 089416416

#50 County Road 4990
Bloomfield, New Mexico 87413

Closure cost estimate -	$ 24,954
Post-closure cost estimate -	$
Total closure/post-closure cost estimate-	$ 24,954

2. This firm guarantees, through the guarantee specified in subpart H of 40 CFR parts 264 and 265, the closure or post-closure care of the following facility owned or operated by the guaranteed party. The current cost estimates for the closure or post-closure so guaranteed are shown for each facility:

Giant Refining Company - Ciniza Refinery
EPA ID Number: NMD 000333211
Exit 39, East Interstate Highway 40
Gallup, New Mexico 87301
Closure cost estimate - $371,756

San Juan Refining Company - Bloomfield Refinery
EPA ID Number: NMD 089416416
#50 County Road 4990
Bloomfield, New Mexico 87413
Closure cost estimate - $24,954

The firm identified above (Giant Industries Inc.) is the direct or higher-tier parent corporation of the owner or operator (San Juan Refining Company and Giant Refining Company).

3. In States where EPA is not administering the financial requirements of subpart H of 40 CFR parts 264 or 265, this firm, as owner or operator or guarantor, 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 and/or post-closure cost estimates covered by such a test are shown for this facility:

None

4. 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 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 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:

None

The firm is 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 of 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, 1999.

1.	Sum of current closure and post-closure cost estimate:	$396,710
*2.	Total liabilities:	$414,336,000
*3.	Tangible net worth:	$132,462,000
*4.	Net worth:	$132,462,000
*5.	Current assets:	$171,983,000
*6.	Current liabilities:	$122,587,000
7.	Net working capital (line 5 minus line 6)	$ 49,396,000
*8.	The sum of net income plus depreciation, depletion, and amortization:	$41,907,000
*9.	Total assets in U.S. (required only if less than 90% of firm's assets are located in the U.S.):	Not required
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 the firm's assets located in the U.S.? If not, complete line 14.	Yes
14.	Is line 9 at least 6 times line 1?	Not required
15.	Is line 2 divided by line 4 less than 2.0?	No
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 substantially identical to the wording specified in 40 CFR 264.151 (f) as such regulations were constituted on the date shown immediately below.

Mark B. Cox
Financial Officer

4/15/00
Date

cc: Sarah Allen

RCRA PART A AND PART B
POST CLOSURE
PERMIT APPLICATION

LAND TREATMENT UNIT
WESTERN REFINING COMPANY
GALLUP REFINERY

VOLUME III
APPENDICES I-1 THROUGH I-14

APPENDICES

Appendix

I-1 Aeration Basin – SWMU No. 1 Summary

I-2 Evaporation Ponds, SWMU No. 2 Summary

I-3 Empty Container Storage Area – SWMU No. 3 Summary

I-4 Old Burn Pit – SWMU No. 4 Summary

I-5 Landfill Areas – SWMU No. 5 Closure Certification

I-6 Tank Farm-Leaded Gasoline Tanks – SWMU No. 6 Summary

I-7 Fire Training Area – SWMU No. 7 Summary

I-8 Railroad Rack Lagoon and Fan Out Area – SWMU No. 8 Summary

1-8A Updated Summary of On-Going Work Plan on SWMU #8 – Fan Out Area

I-9 Drainage Ditch and the Inactive Land Farm – SWMU No. 9 and No. 14 Summary

I-10 Sludge Pits – SWMU No. 10 Summary

I-11 Secondary Oil Skimmer – SWMU No. 11 Summary

I-12 Contact Wastewater Collection System – SWMU No. 12 Summary

I-13 Drainage Ditch Between API Evaporation Ponds and Neutralization Tank Evaporation Ponds – SWMU No. 13 Summaries

I-14 Old API Separator – SWMU No. 14 Summary

Appendix I-1

APPENDIX I-1

Aeration Basin - SWMU No. 1 Summary

SWMU # 1 Summary Report

Aeration Basins

Ciniza Refinery
McKinley County, New Mexico

Prepared for:

Ciniza Refinery
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

Prepared by:

Practical Environmental Services, Inc.
1444 Wazee Street, Suite 225
Denver, Colorado 80202

Job No. 98-205-03

April 23, 1998

1.0 EXECUTIVE SUMMARY

Practical Environmental Services, Inc. (PES) has been retained by Giant-Ciniza Refinery (Ciniza) to perform a visual inspection, data evaluation, and status assessment for the aeration basins located within the Ciniza Refinery, in McKinley County, New Mexico.

The aeration basins site was identified as a Solid Waste Management Unit (SWMU), and designated as SWMU #1, during a RCRA Facility Investigation conducted at the refinery in the early 1990's. This investigation included soil sampling and analysis, determined that no significant impact had occurred, and recommended no further action (NFA).

In 1994, the Environmental Protection Agency Region VI Office (EPA) concurred in this finding, approved cessation of the investigative process, but requested ongoing soil monitoring. Monitoring samples were collected and analyzed in 1996, and the results confirmed that no significant impact has occurred.

This summary report for SWMU #1 has been prepared in conjunction with submittal of a Resource Conservation and Recovery Act (RCRA) Part B permit application covering post closure care of the Ciniza Refinery Land Treatment Unit. All investigative activities for SWMU #1 have been completed. This assessment is summarized as follows.

- ⇒ The aeration basins continue in active service treating wastewater at the refinery and are functioning normally.
- ⇒ Containment berms and basin sidewalls have been inspected and are intact and stable.
- ⇒ Local soil underlying the basins predominantly consists of bentonitic clays and silts having a very low hydraulic conductivity.
- ⇒ Soil sampling and analysis was conducted during an initial site investigation and subsequent monitoring assessment. Trace organic contaminants were detected below corrective action levels. The site was recommended for NFA and approved by the EPA.
- ⇒ SWMU #1 has been characterized in accordance with current applicable state and federal regulations, and the available data indicate that no significant environmental impact or migration has occurred.

2.0 BACKGROUND

During 1987, a RCRA Facility Assessment was conducted at the Ciniza Refinery. This assessment identified various "units of concern" and recommended further evaluation. A RCRA Facility Investigation (RFI) was subsequently conducted and the aeration basins site was identified as SWMU #1.

Applied Earth Sciences (AES) investigated the aeration basins site during the early 1990s. Soil samples were collected and analyzed. No organic contaminants were detected in any sample. Trace metals were detected in all samples; of which, a few samples indicated levels slightly above ambient background concentration.

As a result of the investigation, AES recommended no further action for this SWMU. Results and recommendations were reported to the EPA in 1991. The EPA approved the NFA finding in 1994, with the added provision that soil monitoring be performed every five years.

3.0 SITE LOCATION AND DESCRIPTION

SWMU #1 is located within the Ciniza Refinery's property boundary. This refinery is located on the north side of Interstate 40, approximately 17 miles east of Gallup, New Mexico. Within the refinery, SWMU #1 is located west of the tank farm, northwest of the flare, and adjacent to the API separator. See Figure No. 1 for location details.

The aeration basins are a component of the refinery wastewater treatment system. Effluent water from the API separator is directed to an air stripper for removal of VOCs and then passed on to the aeration basins for oxygenation and biological stimulation prior to evaporation.

SWMU #1 consists of three man-made earthen basins connected in series. The first two basins are equipped with aeration pumps which are used to oxygenate the water. The last basin serves as a holding pond upstream of the evaporation ponds. The three basins are located adjacent to each other on a site measuring approximately 500 feet by 450 feet. Total hydraulic holding capacity is approximately 2 million gallons.

The aeration basins were constructed in 1987 and have been in continuous operation since that time.

4.0 SITE INSPECTION

During the week of March 23, 1998, an on-site inspection was performed. Photographs are included in the appendix to this report. Observations are noted as follows:

- The aeration basins were observed in active service treating effluent wastewater from the air strippers. Aeration pumps were observed running and the system was functioning normally.

- Berms and sidewalls were visually inspected on all three basins. All were found to be intact and stable. No erosion, damage, or sign of containment failure was observed. A dark mineral dust coating was observed around the interior perimeter of the basins.

- Native shrubs and grasses were observed growing around the perimeter of all basins. Downwind vegetation was also discolored by the dark mineral dust, but otherwise was not found to be distressed.

- Local soil in the vicinity of the aeration basins presented as bentonitic clays and silts. Similar soil strata from a neighboring SWMU exhibited a hydraulic conductivity of less than 10^{-7} cm/sec.

5.0 DATA REVIEW

Soil samples from around the perimeter of the aeration basin site were collected and analyzed during the initial site investigation and a subsequent monitoring assessment. Samples were collected at multiple depths and at both upgradient and downgradient locations. Several borings were angled to collect samples from beneath the basins.

In 1991, the initial site investigation collected samples from six locations and four depths ranging from 4 to 16 feet below ground surface. Analysis found no detection of VOCs or SVOCs in any sample. Trace metals were detected in all samples; of which, six samples indicated levels slightly above ambient background concentration.

In 1996, monitoring samples were collected and analyzed. Six locations were sampled at depths ranging from 4 to 20 feet below ground surface. Analysis again found no detection of VOCs and SVOCs in 25 of the samples. However, two samples collected adjacent to the inlet aeration basin at a depth of 4 feet detected trace quantities of BTEX; of which, xylenes at 2.2 mg/kg was the highest detection. Confirmatory samples were subsequently collected and analyzed. One resample showed non-detect and the other detected trace ethylbenzene at 0.61 mg/kg.

State of New Mexico corrective action levels for BTEX in soil is 50 mg/kg total and 10 mg/kg of benzene. Three of 53 samples indicated trace BTEX, the highest of which was less than 5 mg/kg total; well below the 50 mg/kg action level.

6.0 ASSESSMENT

Based on the site inspection and data review, the aeration basins site is assessed as follows.

- The aeration basins are in active service, functioning normally, and performing the necessary task of oxygenating wastewater and stimulating biological activity.

- The aeration basins are properly designed and located in an appropriate geologic setting in which the underlying bentonitic soil has a very low hydraulic conductivity which effectively serves as an aquiclude.

- Trace detection of BTEX constituents near the sidewalls of the inlet aeration basin is common and predictable for this service. The absence of BTEX at depth and at all other locations is confirmatory of the highly impermeable characteristic of the confining soil. This location and low level of detection are indicative of no significant impact or migration.

- Trace detection of metals at levels slightly above ambient background concentration is likely due to normal soil variation.

- The no further action finding that was recommended by AES and approved by the EPA is appropriate for this site.

- The next soil monitoring event is scheduled for 2001. If this sampling and analysis confirms previous findings, further monitoring is unnecessary and should be discontinued.

7.0 PROFESSIONAL ENGINEER'S CERTIFICATION

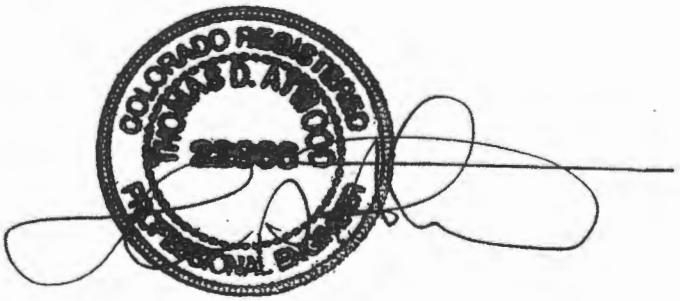
This summary report for SWMU #1 has been prepared under the direct supervision and control of a Registered Professional Engineer.

Client: Ciniza Refinery
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

Job No.: 98-205-03

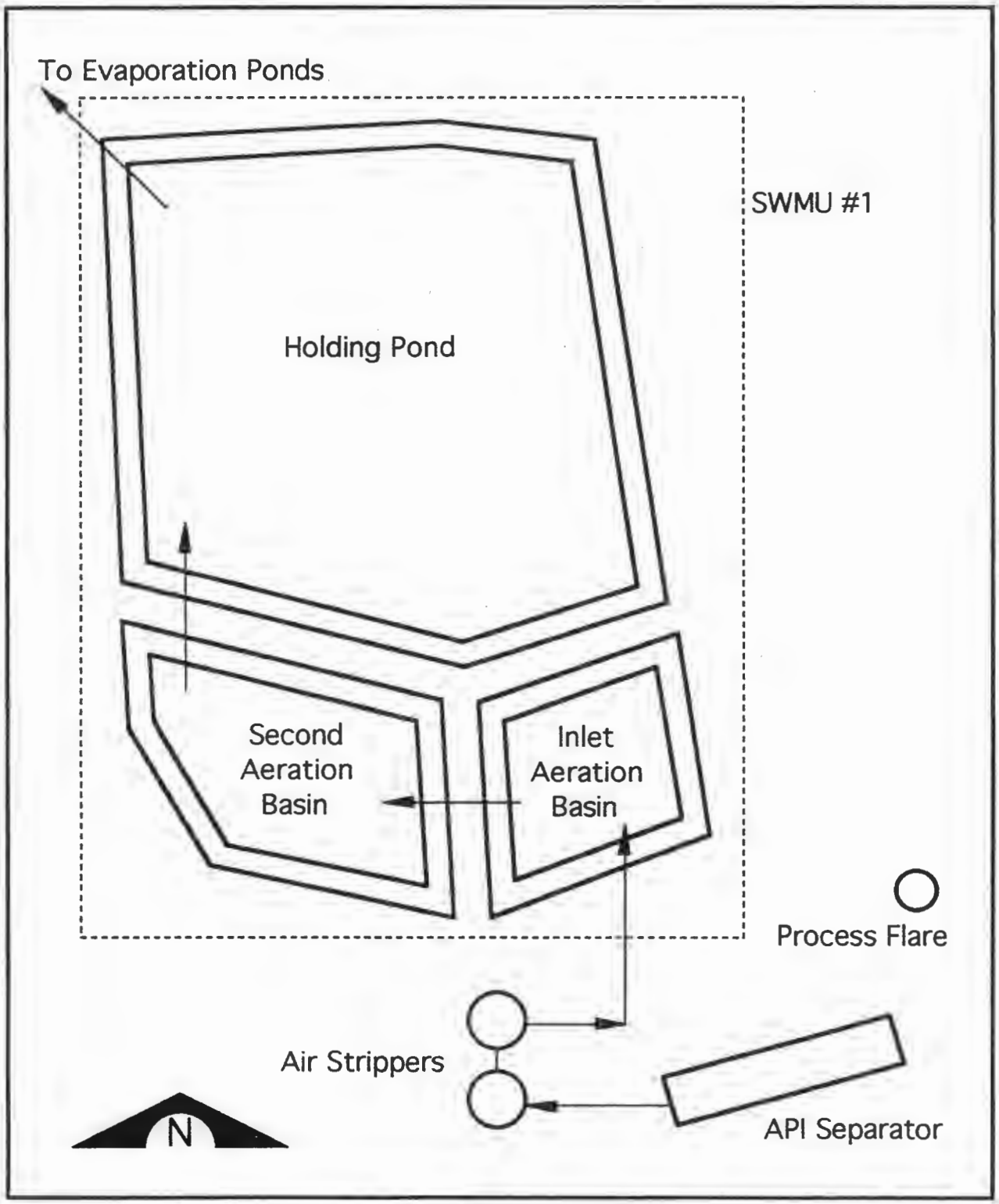
Date: April 23, 1998

Prepared and Certified by:



Thomas D. Atwood, P.E.
Colorado Registration No. 22866

Figure No. 1
Aeration Basin Site



View of Aeration Basin

Close-up of Aeration Pumps

Appendix I-2

APPENDIX I-2

Evaporation Ponds - SWMU No. 2 Summary

SWMU #2 Summary Report

Evaporation Ponds
Ciniza Refinery
McKinley County, New Mexico

Prepared for:

Ciniza Refinery
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

Prepared by:

Practical Environmental Services, Inc.
1444 Wazee Street, Suite 225
Denver, Colorado 80202

Job No. 98-205-03

April 23, 1998

1.0 EXECUTIVE SUMMARY

Practical Environmental Services, Inc. (PES) has been retained by Giant-Ciniza Refinery (Ciniza) to perform a visual inspection, data evaluation, and status assessment for the evaporation ponds located within the Ciniza Refinery, in McKinley County, New Mexico.

The evaporation pond area was identified as a Solid Waste Management Unit (SWMU), and designated as SWMU #2, during a RCRA Facility Investigation (RFI) conducted at the refinery in the early 1990's. This investigation included both soil and groundwater sampling and analysis, determined that no significant impact had occurred, and recommended no further action (NFA).

In 1994, the Environmental Protection Agency Region VI Office (EPA) concurred in this finding, approved cessation of the investigative process, and requested follow-up monitoring at seven groundwater wells. Monitoring samples are scheduled to be collected and analyzed during May 1998.

This summary report for SWMU #2 has been prepared in conjunction with submittal of a Resource Conservation and Recovery Act (RCRA) Part B permit application covering post closure care of the Ciniza Refinery Land Treatment Unit. All investigative activities for SWMU #2 have been completed. This assessment is summarized as follows.

- ⇒ The evaporation ponds continue in active service evaporating waste-water at the refinery and are functioning normally.
- ⇒ Containment berms and basin sidewalls have been inspected and are intact and stable.
- ⇒ Local soil underlying the ponds predominantly consists of bentonitic clays and silts having a very low hydraulic conductivity.
- ⇒ Soil and groundwater sampling and analysis was conducted during an initial site investigation. Trace organic contaminants were detected below corrective action levels. The site was recommended for NFA and approved by the EPA.
- ⇒ SWMU #2 has been characterized in accordance with current applicable state and federal regulations, and the available data indicate that no significant environmental impact or migration has occurred.

2.0 BACKGROUND

During 1987, a RCRA Facility Assessment was conducted at the Ciniza Refinery. This assessment identified various "Solid Waste Management Units" and recommended further evaluation. A RCRA Facility Investigation was subsequently conducted and the evaporation ponds site was identified as SWMU #2.

Applied Earth Sciences (AES) investigated the evaporation pond area during the early 1990s. Soil and groundwater samples were collected and analyzed. No organic contaminants were detected in any groundwater sample. Similarly, most soil samples indicated no detection of organics; however, trace amounts of toluene were detected in a few samples.

Trace metals were detected in both soil and groundwater samples; of which, a few samples indicated levels slightly above ambient background concentration.

As a result of the investigation, AES recommended no further action for this SWMU. Results and recommendations were reported to the EPA in 1991. The EPA approved the NFA finding in 1994, with the provision that on-going groundwater monitoring be performed every five years.

3.0 SITE LOCATION AND DESCRIPTION

SWMU #2 is located within the Ciniza Refinery's property boundary. This refinery is located on the north side of Interstate 40, approximately 17 miles east of Gallup, New Mexico. Within the refinery, SWMU #2 is located to the west of the process unit and tankfarm area on a lower flat plain. See Figure No. 1 for location details.

The evaporation ponds are part of the refinery wastewater treatment system. Effluent water from the aeration basins is directed to these ponds and allowed to evaporate.

There are 15 ponds of varying size having a total surface area of approximately 110 acres. All are man-made earthen basins with bermed sidewalls. Water depth typically ranges from 2 to 4 feet, with an average of 3 feet. Total hydraulic holding capacity is approximately 100 million gallons. Some berms incorporate a perimeter road.

The initial evaporation ponds were constructed in the late 1950's. Additional ponds were constructed at various times thereafter. The evaporation ponds have been in continuous service since initial construction.

4.0 SITE INSPECTION

During the week of March 23, 1998, an on-site inspection was performed. Photographs are included in the appendix to this report. Observations are noted as follows:

- The evaporation ponds were observed in active service treating effluent wastewater from the aeration basins. All 15 ponds contained water. Freeboard space was evident on all ponds.

- Containment berms and sidewalls were visually inspected on all ponds. All were found to be intact and stable. No erosion, damage, or sign of containment failure was observed.

- No soil staining or distressed vegetation was observed at or in the vicinity of any pond. No discoloration or hydrocarbon sheen was evident on any of the ponds.

- Local soil in the vicinity of the evaporation ponds presents as bentonitic clays and silts. Similar soil strata from a neighboring SWMU exhibited a hydraulic conductivity of less than 10^{-7} cm/sec.

- Perimeter roads are located on the berms surrounding several of the ponds. These roads are used for access and inspection.

5.0 DATA REVIEW

Soil samples from around the perimeter of the evaporation ponds were collected and analyzed during the initial site investigation. Samples were collected at multiple depths and at both upgradient and downgradient locations. Several borings were angled to collect samples from beneath the ponds.

The initial site investigation found no detection of VOCs or SVOCs in 46 of the 54 soil samples collected. Trace amounts of toluene were detected in eight samples; of which, 5 mg/kg is the highest reported detection and the remaining seven samples detected less than 0.5 mg/kg. Trace butylbenzylphthalate was also detected in one sample at a concentration of 0.3 mg/kg.

State of New Mexico corrective action levels for BTEX in soil is 50 mg/kg total and 10 mg/kg of benzene. Eight of 54 samples indicated trace BTEX, the highest of which was 5 mg/kg total; well below the 50 mg/kg action level.

Trace metals were also detected in all soil samples; of which, most tested within the range of normal background concentration. A few samples indicated slightly elevated levels of chromium and nickel.

Groundwater samples were collected from seven monitoring wells in the vicinity of the evaporation ponds. Sampling points included upgradient and downgradient locations.

The initial site investigation found no detection of VOCs or SVOCs in any of the groundwater samples collected.

Trace metals were detected in all groundwater samples. A few samples indicated slightly elevated levels of cadmium and selenium.

Per EPA request, groundwater monitoring samples are scheduled to be collected and analyzed during May 1998.

6.0 ASSESSMENT

Based on the site inspection and data review, the evaporation pond area is assessed as follows.

- The evaporation ponds are in active service, functioning normally, and performing the necessary task of evaporating wastewater.

- The evaporation ponds are properly designed and located in an appropriate geologic setting in which the underlying bentonitic soil has a very low hydraulic conductivity which effectively serves as an aquiclude.

- Trace detection of toluene and butylbenzylphthalate in various soil samples presents no logical or consistent pattern of release, is well is below action levels, and may represent anomalous data. This low level of contaminant detection is indicative of no significant impact or migration.

- Trace detection of metals at levels slightly above ambient background concentration is likely due to normal soil variation.

- The absence of organic contaminants in underlying groundwater is confirmatory of the highly impermeable characteristic of the confining soil.

- The no further action finding that was recommended by AES and approved by the EPA is appropriate for this site.

- The next groundwater monitoring event is scheduled for 2003. If this sampling and analysis confirms previous findings, further monitoring is unnecessary and should be discontinued.

7.0 PROFESSIONAL ENGINEER'S CERTIFICATION

This summary report for SWMU #2 has been prepared under the direct supervision and control of a Registered Professional Engineer.

Client: Ciniza Refinery
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

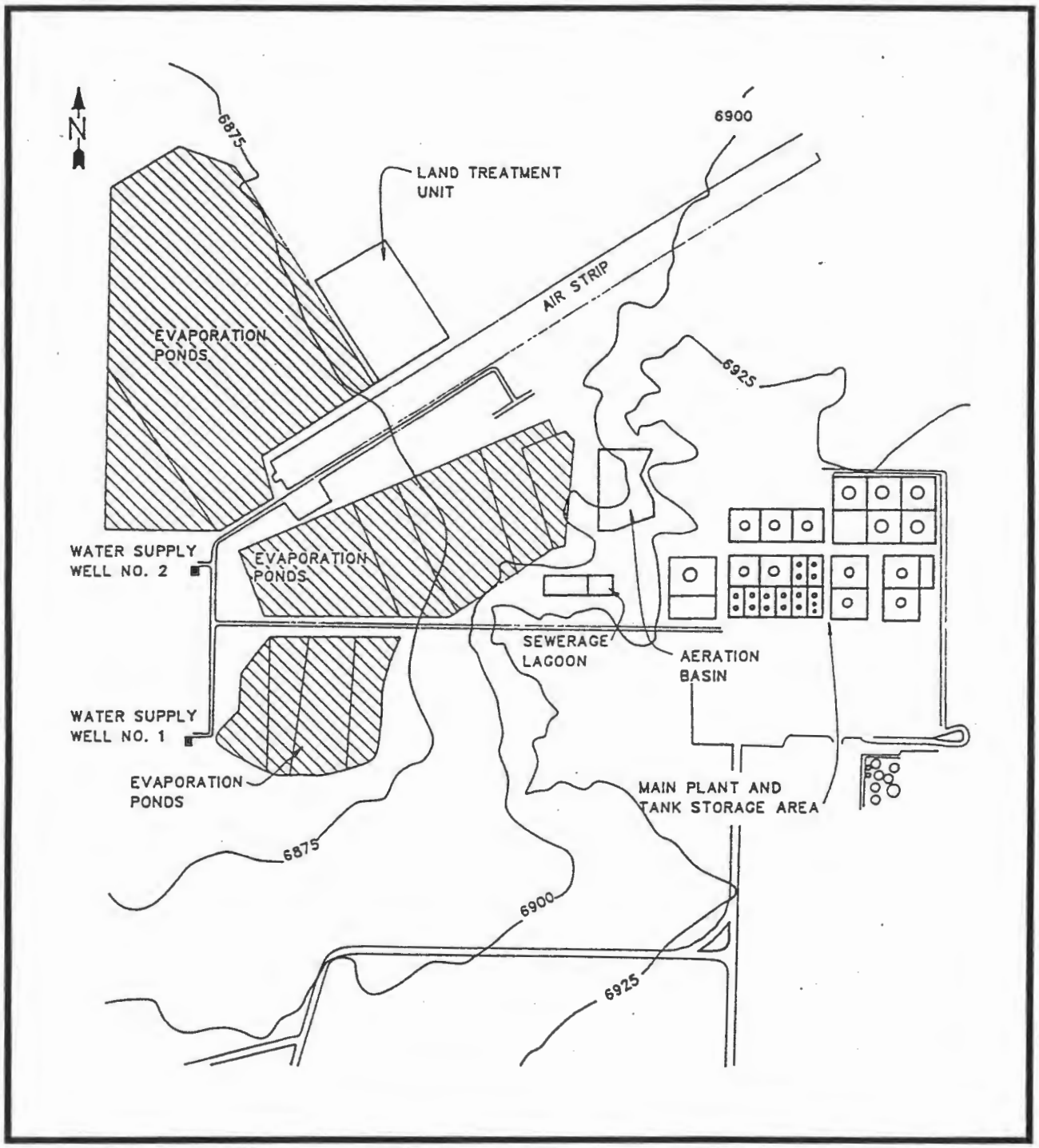
Job No.: 98-205-03

Date: April 23, 1998

Prepared and Certified by:

Thomas D. Atwood, P.E.
Colorado Registration No. 22866

Figure No. 1
Evaporation ponds Site



Evaporation Ponds Overview – Looking Northwest

Evaporation Pond – South Section

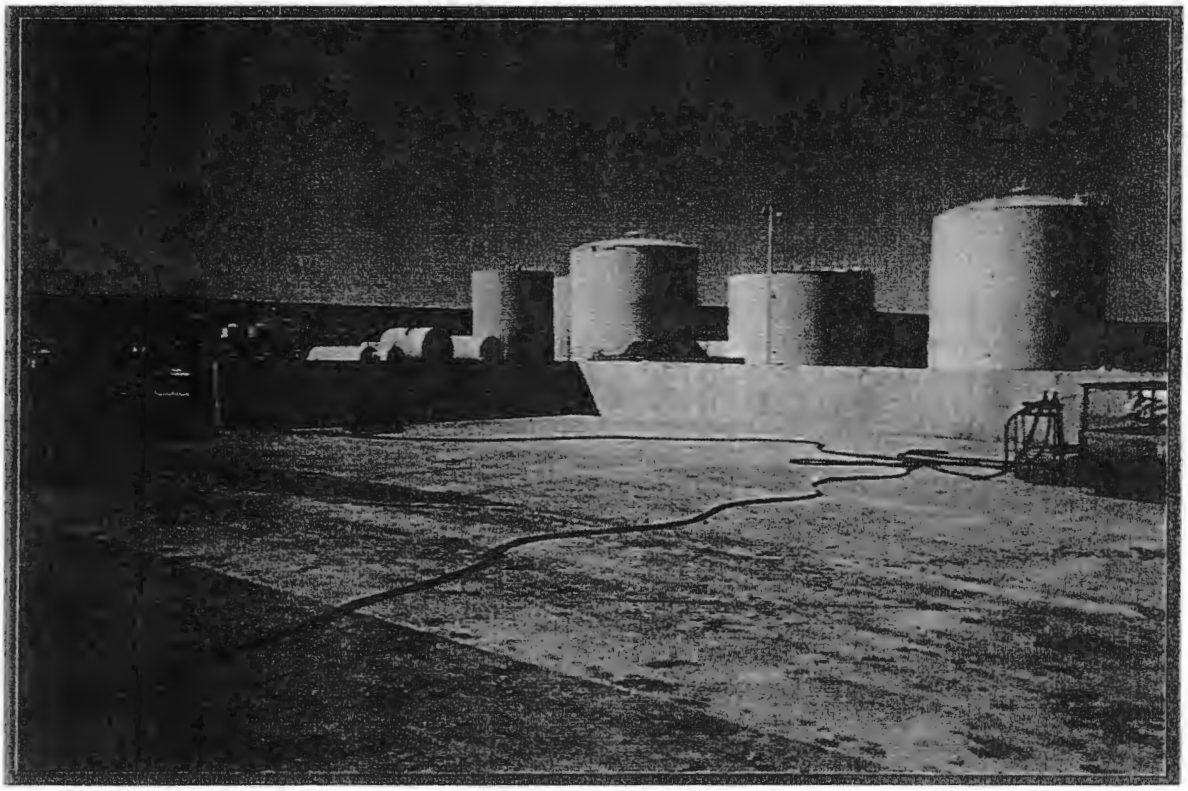
Appendix I-3

APPENDIX I-3

Empty Container Storage Area - SWMU No. 3 Summary

SWMU #3 Summary Report

Empty Container Storage Area
Ciniza Refinery
McKinley County, New Mexico



Prepared for:

Ciniza Refinery
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

Prepared by:

Practical Environmental Services, Inc.
1444 Wazee Street, Suite 225
Denver, Colorado 80202

Job No. 98-205-03

April 23, 1998

1.0 EXECUTIVE SUMMARY

Practical Environmental Services, Inc. (PES) has been retained by Giant-Ciniza Refinery (Ciniza) to perform a visual inspection, data evaluation, and status assessment for the empty container storage area located within the Ciniza Refinery, in McKinley County, New Mexico.

The empty container storage area was identified as a Solid Waste Management Unit (SWMU), and designated as SWMU #3, during a RCRA Facility Investigation (RFI) conducted at the refinery in the early 1990's. This investigation included soil sampling and analysis, determined that no significant impact had occurred, and recommended no further action (NFA).

In 1994, the Environmental Protection Agency Region VI Office (EPA) concurred in this finding and approved cessation of the investigative process.

This summary report for SWMU #3 has been prepared in conjunction with submittal of a Resource Conservation and Recovery Act (RCRA) Part B permit application covering post closure care of the Ciniza Refinery Land Treatment Unit. All investigative activities for SWMU #3 have been completed. This assessment is summarized as follows.

- ⇒ The empty container storage area identified in the RFI has been closed. A new empty container storage area is now in service at an adjoining location.
- ⇒ All drums were removed from the old site in the early 1990's. The site was then cleared and a new concrete containment pad was installed. The new pad is used for cleaning heat exchanger bundles.
- ⇒ Local soil underlying both the old and new empty container storage areas predominantly consists of bentonitic clays and silts having a very low hydraulic conductivity.
- ⇒ Soil sampling and analysis was conducted during the initial site investigation. Trace organic contaminants were detected below corrective action levels. The site was recommended for NFA and approved by the EPA.
- ⇒ SWMU #3 has been characterized in accordance with current applicable state and federal regulations, and the available data indicate that no significant environmental impact or migration has occurred.

2.0 BACKGROUND

During 1987, a RCRA Facility Assessment was conducted at the Ciniza Refinery. This assessment identified various "units of concern" and recommended further evaluation. A RCRA Facility Investigation was subsequently conducted and the empty container storage area was identified as SWMU #3.

Applied Earth Sciences (AES) investigated the empty container storage area during the early 1990s. Soil samples were collected and analyzed. Trace organic contaminants were found in three surface samples and non detect in all subsurface samples.

As a result of the investigation, AES recommended no further action for this SWMU. Results and recommendations were reported to the EPA in 1992. The EPA approved the NFA finding in 1994.

3.0 SITE LOCATION AND DESCRIPTION

SWMU #3 is located within the Ciniza Refinery's property boundary. This refinery is located on the north side of Interstate 40, approximately 17 miles east of Gallup, New Mexico. Within the refinery, SWMU #3 is located approximately 100 feet west of the maintenance shop. See Figure No. 1 for location details.

The old empty container storage area is a rectangular flat site measuring approximately 50 feet by 80 feet. When previously in service, it was reportedly surfaced with gravel. The site was used for storing empty 55 gallon drums prior to recycling.

The new empty container storage area is located adjacent to and west of the old site. Drums are emptied and triple rinsed prior to being placed in this new storage area.

4.0 SITE INSPECTION

During the week of March 23, 1998, an on-site inspection was performed. Photographs are included in the appendix to this report. Observations are noted as follows:

- The empty container storage area identified in the RFI has been closed. It is reported that all drums formerly located on this site were removed and recycled in the early 1990's. A new empty container storage area is now in service at an adjoining location.

- The old empty container storage area site has been cleared and a new concrete containment pad has been installed. The new pad is used for cleaning heat exchanger bundles. This pad overlays the SWMU #3 site.

- Local soil in the vicinity of the empty container storage area presents as bentonitic clays and silts. Similar soil strata from a neighboring SWMU exhibited a hydraulic conductivity of less than 10^{-7} cm/sec.

- No soil staining or distressed vegetation is present at the old empty container storage area site. Most of this site is now covered by the new heat exchanger cleaning pad.

- Rainwater run-off from the old empty container storage area is now collected within the new heat exchanger cleaning pad and directed to the refinery wastewater treatment system. Rainwater run-off from the new empty container storage area and surronding vicinity is similarly collected and directed to the refinery wastewater treatment system.

5.0 DATA REVIEW

Soil samples from within the empty container storage area were collected and analyzed during the initial site investigation. Samples were collected at four locations and three depths; surface, 3 feet, and 4.5 feet below ground surface.

Three of four surface samples detected trace hydrocarbon and solvent constituents; of which, xylenes at 8.6 mg/kg was the highest detection. Most of the remaining constituents were detected in much lower concentrations, typically less than 1 mg/kg. All subsurface samples found no detection of VOCs and SVOCs.

State of New Mexico corrective action levels for BTEX in soil is 50 mg/kg total and 10 mg/kg of benzene. Three of 12 samples indicated trace BTEX, the highest of which was less than 10 mg/kg total; well below the 50 mg/kg action level.

6.0 ASSESSMENT

Based on the site inspection and data review, the empty container storage area is assessed as follows.

- The old empty container storage area (SWMU #3) is closed and the site is now occupied by a heat exchanger cleaning pad. A new empty container storage area is now in service and drums are triple rinsed prior to being placed in the new storage area. The probability of a new contaminant release in this area is very low.

- The soil underlying this former SWMU has a very low hydraulic conductivity which effectively inhibits downward migration of contaminants. As such, any spill, either past or present, is likely to be confined near the surface.

- Trace detection of hydrocarbon and solvent constituents in surface samples at the old site is common for storage areas of this type and era. The absence of subsurface contaminants is confirmatory of the highly impermeable characteristic of the underlying soil. The low level of contaminant detection is indicative of no significant impact.

- A rainwater collection system has been installed to serve this area. Run-off is now directed to the refinery wastewater treatment system.

- The no further action finding that was recommended by AES and approved by the EPA is appropriate for this site.

7.0 PROFESSIONAL ENGINEER'S CERTIFICATION

This summary report for SWMU #3 has been prepared under the direct supervision and control of a Registered Professional Engineer.

Client: Ciniza Refinery
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

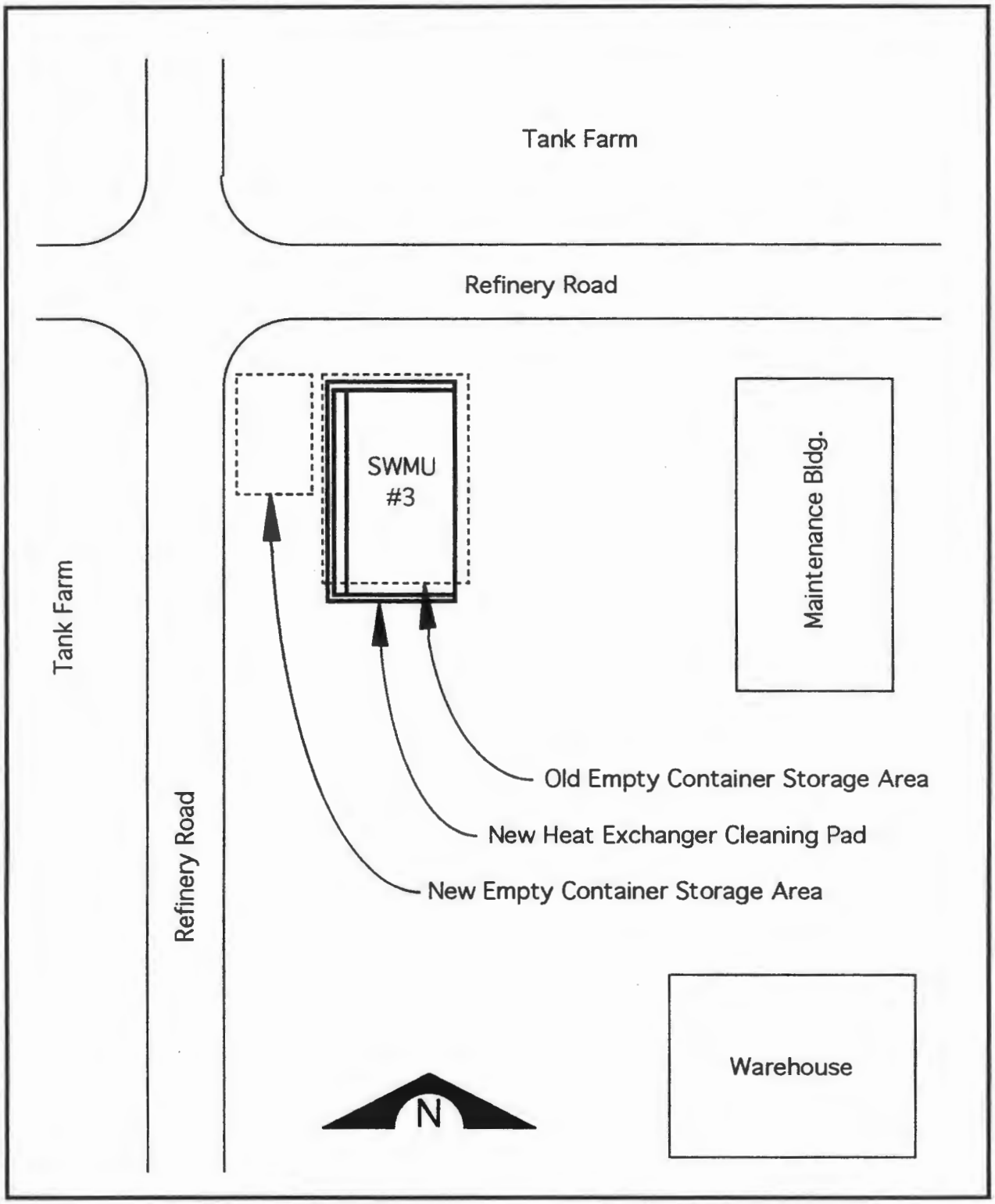
Job No.: 98-205-03

Date: April 23, 1998

Prepared and Certified by:

Thomas D. Atwood, P.E.
Colorado Registration No. 22866

Figure No. 1
Empty Container Storage Area Site



Site Inspection Photographs

New Empty Container Storage Area

Run-off Collection Trough – New Heat Exchanger Cleaning Pad

Appendix I-4

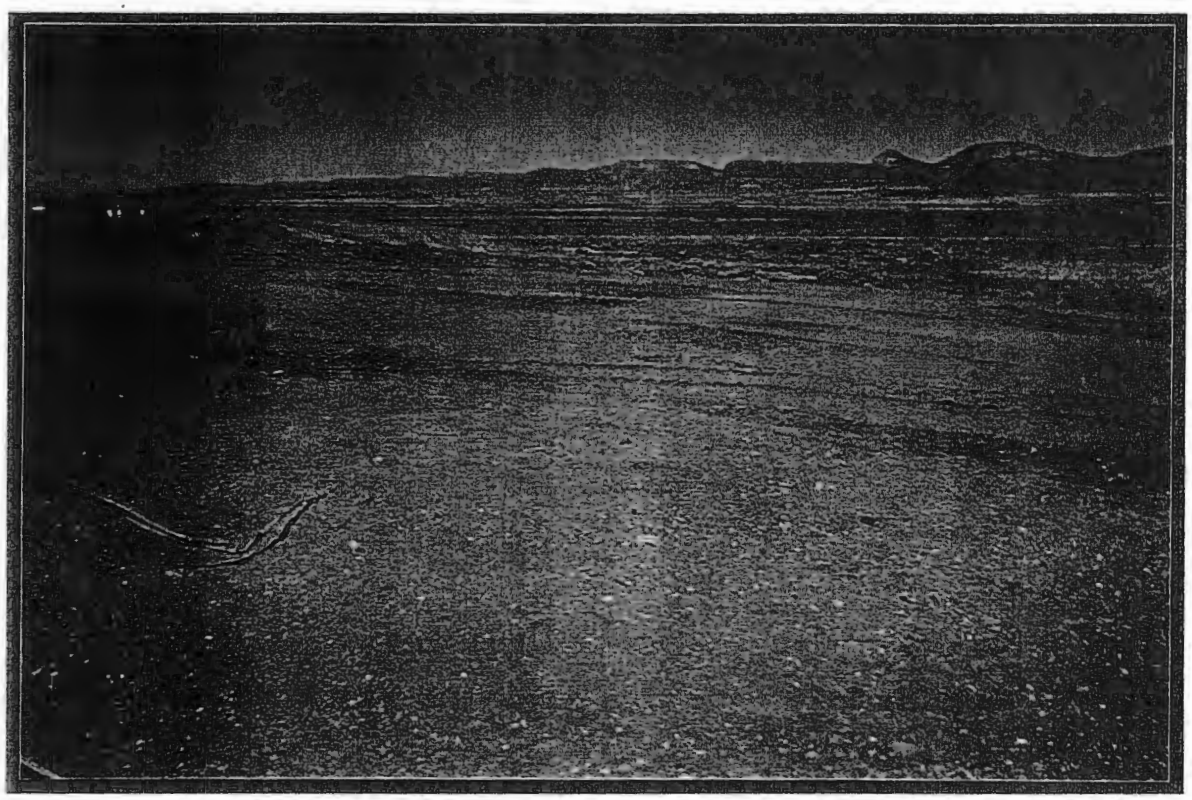
APPENDIX I-4

Old Burn Pit - SWMU No. 4 Summary

SWMU #4 Summary Report

Old Burn Pit Area

Ciniza Refinery
McKinley County, New Mexico



Prepared for:

Ciniza Refinery
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

Prepared by:

Practical Environmental Services, Inc.
1444 Wazee Street, Suite 225
Denver, Colorado 80202

Job No. 98-205-03

April 23, 1998

1.0 EXECUTIVE SUMMARY

Practical Environmental Services, Inc. (PES) has been retained by Giant-Ciniza Refinery (Ciniza) to perform a visual inspection, data evaluation, and status assessment for the old burn pit located within the Ciniza Refinery, in McKinley County, New Mexico.

The old burn pit area was identified as a Solid Waste Management Unit (SWMU), and designated as SWMU #4, during a RCRA Facility Investigation (RFI) conducted at the refinery in the early 1990's. This investigation included soil sampling and analysis, detected trace organics and metals, and recommended tilling and capping the site.

In 1994, the Environmental Protection Agency Region VI Office (EPA) requested additional sampling at greater depth. Results confirmed previous findings. The site was capped in 1997 in conjunction with the closure of SWMU #5.

This summary report for SWMU #4 has been prepared in conjunction with submittal of a Resource Conservation and Recovery Act (RCRA) Part B permit application covering post closure care of the Ciniza Refinery Land Treatment Unit. All investigative activities for SWMU #4 have been completed. This assessment is summarized as follows.

- ⇒ An engineered earthen cap composed of low hydraulic conductivity, native soil has been installed over the site. The surface has been crowned to prevent ponding and gradually sloped to inhibit erosion. Native manure, amendments, and a revegetation seed mix have been applied, tilled into the surface, and watered.

- ⇒ Soil underlying the old burn pit area predominantly consists of bentonitic clays and silts having a very low hydraulic conductivity.

- ⇒ Soil sampling and analysis was conducted during an initial site investigation and subsequent re-investigation at greater depth. Trace organic contaminants were detected below corrective action levels. The site was recommended for remedial action and capping.

- ⇒ SWMU #4 has been characterized in accordance with current applicable state and federal regulations, and the available data indicate that no significant environmental impact or migration has occurred.

- ⇒ The implemented remedy is appropriate for this site.

2.0 BACKGROUND

During 1987, a RCRA Facility Assessment was conducted at the Ciniza Refinery. This assessment identified various "Solid Waste Management Units" and recommended further evaluation. A RCRA Facility Investigation was subsequently conducted and the old burn pit area was identified as SWMU #4.

Applied Earth Sciences (AES) investigated the old burn pit area during the early 1990s. Soil samples were collected and analyzed. Trace VOCs, SVOCs, and metals were detected in several of the samples.

As a result of the investigation, AES recommended tilling the site to promote natural attenuation of organics, followed by capping to contain residual metal contaminants. Results and recommendations were reported to the EPA in 1992. The EPA requested additional sampling at greater depth. Follow-up sampling and analysis confirmed the original findings. In 1997, SWMU #4 was capped in conjunction with similar work being performed at SWMU #5.

3.0 SITE LOCATION AND DESCRIPTION

SWMU #4 is located within the Ciniza Refinery's property boundary. This refinery is located on the north side of Interstate 40, approximately 17 miles east of Gallup, New Mexico. Within the refinery, SWMU #4 is located approximately 700 feet north of the tank farm and west of the fire training area. See Figure No. 1 for location details.

The old burn pit area is a triangular site measuring approximately 20 feet by 40 feet. Within this area, an earthen pit was used as a safe location for combusting waste oil.

4.0 SITE INSPECTION

During the week of March 23, 1998, an on-site inspection was performed. Observations are noted as follows:

- The old burn pit area has been capped utilizing methods and materials as described in the Closure Certification Report for SWMU #5. Cap thickness is estimated at greater than three feet.

- Final installed surface contours and side slopes are adequate to inhibit ponding and erosion.

- Local soil in the vicinity of the old burn pit area presents as bentonitic clays and silts. Similar soil strata from a neighboring SWMU exhibited a hydraulic conductivity of less than 10^{-7} cm/sec.

- No soil staining or distressed vegetation was present at or in the vicinity of the old burn pit site.

5.0 DATA REVIEW

Soil samples from within the old burn pit area were collected and analyzed during the initial site investigation. Samples were collected at three locations and three depths; surface, 3 feet, and 4.5 feet below ground surface.

All samples detected trace VOCs and SVOCs; of which, di methyl phthalate at 18 mg/kg was the highest detection. Most of the remaining constituents were detected in much lower concentrations, typically less than 3 mg/kg.

Per EPA request, a second round of sampling and analysis was conducted at depths of 6 and 10 feet below ground surface. Methyl ethyl ketone was detected in one sample at 1.2 mg/kg and at a depth of 6 feet. All other samples found no detection of VOCs or SVOCs; including all samples collected at 10 feet below ground surface.

All samples detected trace metals; of which, chromium and nickel were detected at levels slightly above ambient background concentration.

6.0 ASSESSMENT

Based on the site inspection and data review, the old burn pit area is assessed as follows.

- The old burn pit area has been covered with an earthen cap using methods and materials consistent with State of New Mexico Environment Department requirements and regulations as set forth in 20 NMAC 9.1 Section 502.

- Residual organic contaminants are present in very low concentrations, confined to a 6 foot soil layer within the SWMU, and substantially consist of heavy molecular weight compounds with low mobility. These compounds are resistant to biodegradation and, as a result, containment is a preferred remedy to natural attenuation via tilling and aeration. The latter technique will expose soil metals to oxidation and precipitation; thereby mobilizing these contaminants and promoting migration.

- Residual metal contaminants are also present at very low levels; most of which fall within the range of ambient background concentration. However, chromium and nickel are present at slightly elevated levels and, as a result, isolation and containment is the preferred remedy.

- Local soil underlying this site has a very low hydraulic conductivity which effectively inhibits outward migration of contaminants. Similar low hydraulic conductivity soil has been used to cap the site and inhibit the infiltration of precipitation.

- The installation of the soil cap represents an appropriate remedy for the site.

7.0 PROFESSIONAL ENGINEER'S CERTIFICATION

This summary report for SWMU #4 has been prepared under the direct supervision and control of a Registered Professional Engineer.

Client: Ciniza Refinery
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

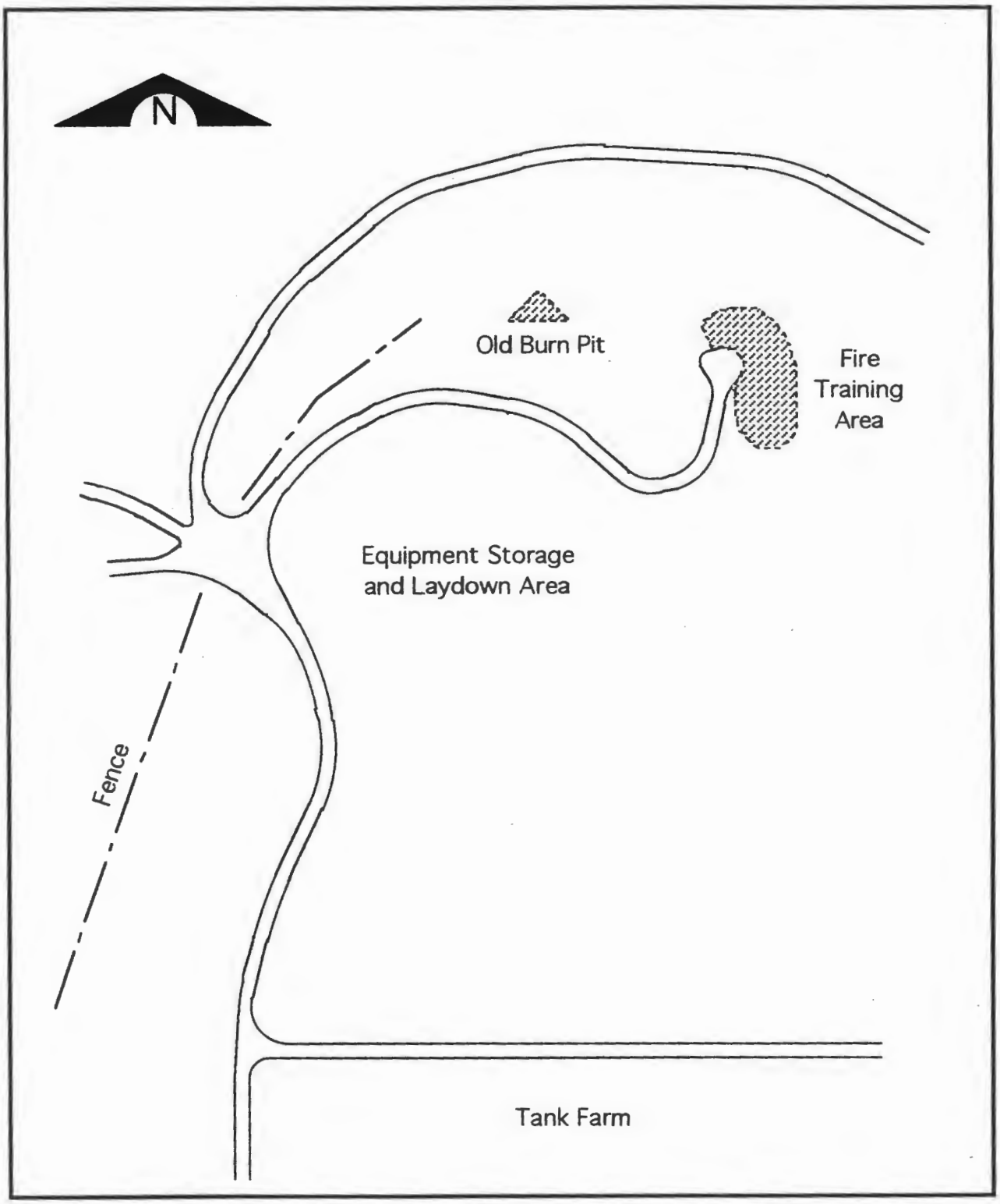
Job No.: 98-205-03

Date: April 23, 1998

Prepared and Certified by:

Thomas D. Atwood, P.E.
Colorado Registration No. 22866

Figure No. 1
Old Burn Pit Area



Appendix I-5

APPENDIX I-5

Landfill Areas - SWMU No. 5 Closure Certification

SWMU #5 Closure Certification Report

Solid Waste Landfill Areas

Ciniza Refinery
McKinley County, New Mexico

Prepared for:

Ciniza Refinery
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

Prepared by:

Practical Environmental Services, Inc.
1444 Wazee Street, Suite 225
Denver, Colorado 80202

Job No. 98-205-03

April 23, 1998

1.0 EXECUTIVE SUMMARY

Practical Environmental Services, Inc. (PES) has been retained by Giant-Ciniza Refinery (Ciniza) to perform detailed engineering design, construction oversight, and installation verification of a cap and related closure requirements for several solid waste landfill areas located within the Ciniza Refinery, in McKinley County, New Mexico.

These solid waste landfill areas were identified as a Solid Waste Management Unit (SWMU), and designated as SWMU #5, during a RCRA Facility Investigation conducted at the refinery in the early 1990's. This investigation included soil sampling and analysis, detected trace metals, and recommended corrective action.

In 1994, the Environmental Protection Agency Region VI Office (EPA) requested additional sampling at greater depth. Results confirmed previous findings. A voluntary corrective action plan (CAP) was prepared by Ciniza and approved by the EPA in 1994. The approved CAP was implemented in 1998.

Closure of SWMU #5 is now being performed in conjunction with submittal of a Resource Conservation and Recovery Act (RCRA) Part B permit application covering post closure care of the Ciniza Refinery Land Treatment Unit. Closure certification findings are summarized as follows.

- ⇒ The boundaries of the landfill areas have been delineated.
- ⇒ An engineered earthen cap composed of low hydraulic conductivity, native soil has been installed over the surface.
- ⇒ Run-on and run-off controls have been installed. The surface has been crowned to prevent ponding and gradually sloped to inhibit erosion. A perimeter ditch and culvert have been installed to redirect run-on.
- ⇒ Native manure, amendments, and a revegetation seed mix have been applied, tilled into the surface, and watered. Supplemental watering is planned until initial growth is well established.
- ⇒ Access roads in the vicinity of the landfill areas have been removed and redirected away from the site. Forbidden entry signs have been posted.
- ⇒ A post-closure care program is being implemented.

2.0 BACKGROUND

During 1987, a RCRA Facility Assessment was conducted at the Ciniza Refinery. This assessment identified various "solid waste management units" including five former solid waste landfill areas. No further action was recommended at one site. Further evaluation was recommended at four sites.

A RCRA Facility Investigation was subsequently conducted. The four sites recommended for further study were collectively designated as SWMU #5.

Applied Earth Sciences (AES) conducted the follow-up investigation. Soil samples were collected and analyzed. No organic contaminants were detected in any sample. Trace metals were detected in most samples; of which, a few samples indicated levels slightly above ambient background concentration. One surface soil sample indicated an elevated chromium concentration. As a result, AES recommended capping these areas. A voluntary corrective action plan was prepared and submitted to the EPA; which approved the plan in 1994.

These landfill areas are reported to contain inorganic, non-hazardous solid waste and debris from refinery construction, maintenance, and operational activities. No organic materials are known to be present in any of these areas.

All four landfill sites are located in close proximity to each other and are collectively identified as SWMU #5. Three of these sites are contiguous and therefore have been grouped under a single large cap. The fourth site is small and isolated, and has been capped separately. It is located approximately 50 feet north of the main area.

3.0 SITE LOCATION AND DESCRIPTION

SWMU #5 is located within the Ciniza Refinery's property boundary. This refinery is located on the north side of Interstate 40, approximately 17 miles east of Gallup, New Mexico. Within the refinery, SWMU #5 is located northwest of the tank farm, approximately 500 feet from Tank 337. See Drawing X1 in Appendix A for location details.

The main landfill cap is approximately kidney-shaped and borders an access road adjacent to an equipment laydown area. A 15 foot by 15 foot fenced storage area is located immediately to the east of the cap and is the most noteworthy local landmark. This area is located on an elevated bench. To the north and west of the cap is a flat plain at an elevation approximately 15 feet below the bench. The smaller, remote landfill area is located on the lower plain approximately 50 feet north of the main landfill cap.

4.0 CLOSURE REQUIREMENTS

State of New Mexico regulations (20 NMAC 9.1 Section 502) specify the following criteria for landfill closure:

- Installation of a final cover system to include a minimum 18 inch thick infiltration prevention layer of earthen material having a saturated hydraulic conductivity of less than or equal to natural subsoils or 10^{-5} cm/sec, whichever is less; plus a minimum 6 inch thick erosion layer capable of sustaining native plant growth; maximum 25% grade side slopes, and a final surface contour sufficient to prevent ponding.

- A written description of the final cover as installed, an estimate of the covered surface area and contained waste volume, and plan drawings showing the final contours and reclamation areas.

In addition, the approved corrective action plan also specifies closure criteria as follows:

- A soil cap shall be installed over the landfill areas to isolate waste material and prevent infiltration of precipitation. The cap shall be composed of native soil; properly wetted and compacted to achieve a low hydraulic conductivity.

- The site shall be graded and contoured to eliminate local depressions and achieve positive drainage.

- The surface soil shall be amended and seeded to promote revegetation.

- Post-closure care shall incorporate annual site inspections and maintenance of the soil cap.

5.0 DESIGN AND CONSTRUCTION

The four landfill areas associated with SWMU #5 have been located in the field. Due to close proximity to each other, a single contiguous cap has been specified for the three upper bench landfill areas. A small secondary cap has been specified for the remote landfill area located north of the main area.

Neighboring native soil, similar in composition to landfill area subsoils, has been specified and used for cap construction. This soil is predominantly bentonitic clays and silt, and has a very low hydraulic conductivity of less than 10^{-7} cm/sec. The use of locally derived soil also promotes a consistent appearance and character of the reclaimed areas vis-à-vis surrounding terrain.

Minimum depth of cover has been specified at two feet final compacted thickness. However, due to grading and surface contouring considerations, actual installed thickness ranges from four to eight feet.

Cap construction has been specified as building upward from existing grade by progressive placement of soil layers 6 to 8 inches thick; followed by wetting and compaction to 95 percent of Standard Proctor maximum dry density. Grading and contouring has been specified and conducted to achieve a finished slope of not greater than 25% (4:1) over any area of the landfill. Caps have been specified and installed as crowned masses with sustained downward slope and no local depressions.

A perimeter ditch has been specified and installed along the interior curve of the main cap adjacent to the access road. This ditch collects run-off from the adjoining equipment laydown area and funnels collected water to a low point invert as shown on Drawing X2. The ditch has been specified as not less than 2 feet wide by 2 feet deep, and sloped not less than 1/8th inch per foot downward to the invert.
In addition, a buried culvert is required to transmit collected water from the east side perimeter ditch to a west side outfall. This culvert has been specified and installed as 2 feet in diameter and sloped not less than 1/16th inch per foot downward to the outfall. The culvert has been buried within the built-up cap soil layer and above the landfill's solid waste zone.

Existing access roads, which traversed the main landfill area, have been covered over and eliminated. Access to the capped area has been restricted by road removal and realignment; plus installation of a new road which routes traffic around the landfill area. Forbidden access signs have also been posted adjacent to the remaining access road.

The surface of the cap has been amended to promote revegetation. Locally generated manure and appropriate grass seed have been tilled into soil and watered. Dryland Pasture Mix was used, consisting of various wheat and rye grass species.

Due to a lack of organic matter within the landfill areas, gas generation is not considered likely and therefore no venting system has been specified or installed.

6.0 SITE INSPECTION

During the week of January 20, 1998, while construction of the landfill caps and related facilities was in progress, an on-site inspection was performed. Photographs are presented in Appendix B. Observations are noted as follows:

- A small triangular portion of the equipment laydown area was eliminated in order to reshape the main landfill cap and improve the surface slope. This allowed consolidation of the main cap over the three landfill areas located on the upper bench.

- The main landfill cap has been crowned at high point west of the fenced storage area and then sloped progressively to the west and north until intersection with the lower plain. This has produced a gradual side slope which is less susceptible to erosion.

- A small, standalone cap was installed over the remote landfill area located north of the main cap.

- Two access roads in the area were eliminated and replaced by a new access road which routes traffic away from and around the main landfills area.

- Cap thickness was increased in several areas in order to accommodate contouring requirements. Installed thickness ranges from approximately four feet in some areas to over eight feet in other areas.

7.0 POST-CLOSURE CARE

A five year post-closure care period is proposed for the capped areas. During this time, the following activities shall be performed.

- During the first year's growing season, the site shall be watered monthly to promote initial rooting and plant growth. One gallon per square foot shall be spray applied.

- The site shall be visually inspected on an annual basis to detect erosion or deterioration of the caps, operability of the drainage ditch and culvert, health and coverage of the vegetation, and signs of unauthorized access.

- As necessary, maintain and repair the caps and drainage system. As necessary, re-seed areas where vegetation has not established. As necessary, prevent unauthorized access or other use of the landfill areas.

At the end of the five year post-closure care period, the site shall be inspected to confirm compliance with regulations and successful reclamation.

8.0 PROFESSIONAL ENGINEER'S CERTIFICATION

This landfill closure certification report has been prepared under the direct supervision and control of a Registered Professional Engineer.

Client: Ciniza Refinery
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

Job No.: 98-205-03

Date: April 23, 1998

Prepared and Certified by:

COLORADO REGISTERED
THOMAS D. ATWOOD
22866

Thomas D. Atwood, P.E.
Colorado Registration No. 22866

Site Inspection Photographs

Landfill Location Reference – Tank Farm

Landfill Site Prior To Cap Installation

Site Inspection Photographs

Side Slope Construction

Side Slope Profile

Clean Soil Being Trucked To Site

Soil Layer Placement

Site Inspection Photographs

Access Road Being Removed From Site

View of Landfill Site From Lower Flat

View of Adjacent Equipment Laydown Area

View of Storage Trailers

Appendix I-6

APPENDIX I-6

Tank Farm—Leaded Gasoline Tanks - SWMU No. 6 Summary

SWMU #6 Summary Report

Tank Farm
Ciniza Refinery
McKinley County, New Mexico

Prepared for:

Ciniza Refinery
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

Prepared by:

Practical Environmental Services, Inc.
1444 Wazee Street, Suite 225
Denver, Colorado 80202

Job No. 98-205-03

April 23, 1998

1.0 EXECUTIVE SUMMARY

Practical Environmental Services, Inc. (PES) has been retained by Giant-Ciniza Refinery (Ciniza) to perform a visual inspection, data evaluation, and status assessment for the tank farm located within the Ciniza Refinery, in McKinley County, New Mexico.

The tank farm area was identified as a Solid Waste Management Unit (SWMU), and designated as SWMU #6, during a RCRA Facility Investigation (RFI) conducted at the refinery in the early 1990's. This investigation included soil sampling and analysis, detected trace organics and metals, and recommended no further action (NFA).

In 1994, the Environmental Protection Agency Region VI Office (EPA) requested additional sampling at greater depth. BTEX and gasoline free product were detected under the tank farm. Interim corrective action to recover free product and contain plume spread was initiated and is ongoing at this time.

This summary report for SWMU #6 has been prepared in conjunction with submittal of a Resource Conservation and Recovery Act (RCRA) Part B permit application covering post closure care of the Ciniza Refinery Land Treatment Unit. All investigative activities for SWMU #6 have been completed. This assessment is summarized as follows.

- ⇒ The tank farm was identified as a SWMU because leaded gasoline was previously stored within seven tanks at this site.
- ⇒ Soil sampling and analysis was conducted during an initial site investigation and subsequent re-investigation at greater depth. BTEX and gasoline free product were detected in both soil and groundwater.
- ⇒ Contaminant plume boundaries have been investigated and defined.
- ⇒ Interim corrective action, consisting of a pump & treat extraction system, has been implemented and is in ongoing service.
- ⇒ A corrective action plan has been developed and submitted to the New Mexico Oil Conservation Division (NMOCD).

2.0 BACKGROUND

During 1987, a RCRA Facility Assessment was conducted at the Ciniza Refinery. This assessment identified various "Solid Waste Management Units" and recommended further evaluation. A RCRA Facility Investigation was subsequently conducted and the tank farm area was identified as SWMU #6.

Applied Earth Sciences (AES) investigated the tank farm area during the early 1990s. Soil samples were collected and analyzed. Trace BTEX and metals were detected in several of the samples.

As a result of the investigation, AES recommended no further action for this SWMU. Results and recommendations were reported to the EPA in 1990. In 1994, the EPA requested additional sampling at greater depth. Follow-up sampling and analysis revealed the presence of gasoline free product beneath the tank farm.

3.0 SITE LOCATION AND DESCRIPTION

SWMU #6 is located within the Ciniza Refinery's property boundary. This refinery is located on the north side of Interstate 40, approximately 17 miles east of Gallup, New Mexico. Within the refinery, SWMU #6 is located north of the office building and process unit area. See Figure No. 1 for location details.

The tank farm area encompasses a group of large, steel aboveground storage tanks located within bermed containment basins. These tanks store various refinery products and feedstocks. SWMU #6 consists of seven of hydrocarbon storage tanks which formerly contained leaded gasoline and are currently storing other refinery feedstocks and additives.

4.0 SITE INSPECTION

During the week of March 23, 1998, an on-site inspection was performed. Observations are noted as follows:

- The tank farm is in active service storing feedstocks and products. Leaded gasoline is no longer produced or stored within the refinery.

- Containment basins and bermed sidewalls were inspected and found to be intact and stable. No erosion, damage, or sign of containment failure was observed.

- Local soil in the vicinity of the tank farm presents as bentonitic clays and silts. Similar soil strata from a neighboring SWMU exhibited a hydraulic conductivity of less than 10^{-7} cm/sec.

5.0 DATA REVIEW

Soil samples from within the tank farm area were collected and analyzed during the initial site investigation and subsequent re-investigation at greater depth.

In 1990, the initial site investigation collected samples adjacent to each tank and at multiple depths; including surface, 4 feet, 7 feet, and 11 feet below ground surface. Trace BTEX and metals were detected in most samples.

In 1995, a second round of sampling and analysis was conducted at depths of 16 and 20 feet below ground surface. During this investigation, significant BTEX and gasoline free product was detected in both soil and groundwater.

6.0 ASSESSMENT

Based on the site inspection and data review, the tank farm area is assessed as follows.

- The tank farm area is in active remediation at this time. A pump & treat recovery system has been installed as an interim corrective action.
- A corrective action plan has been developed and submitted to the NMOCD for review and approval.

7.0 PROFESSIONAL ENGINEER'S CERTIFICATION

This summary report for SWMU #6 has been prepared under the direct supervision and control of a Registered Professional Engineer.

Client: Ciniza Refinery
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

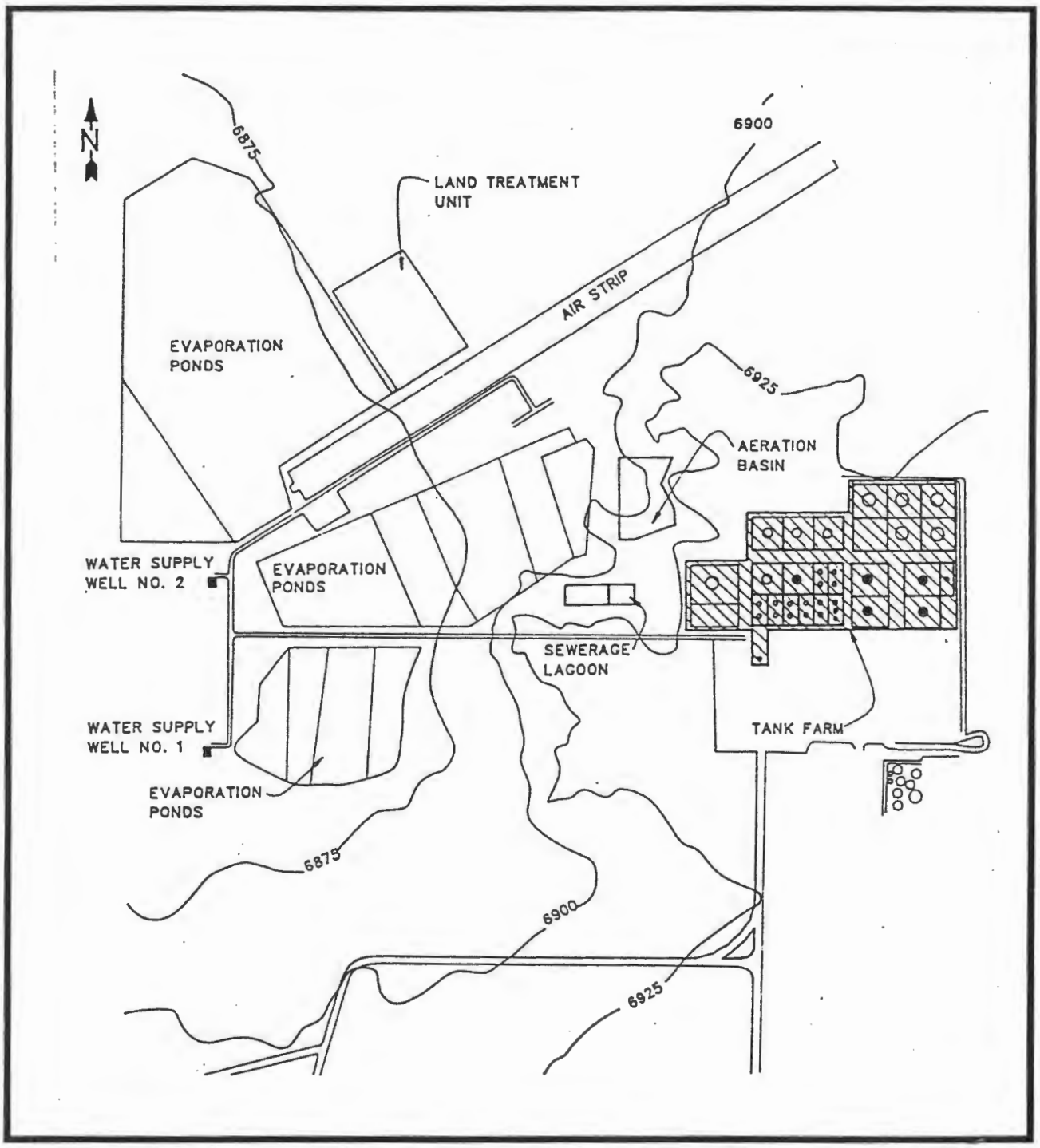
Job No.: 98-205-03

Date: April 23, 1998

Prepared and Certified by:

Thomas D. Atwood, P.E.
Colorado Registration No. 22866

Figure No. 1
Tank farm Area



Site Inspection Photographs

Pump & Treat Recovery System

Groundwater Monitoring Well

Appendix I-7

APPENDIX I-7

Fire Training Area - SWMU No. 7 Summary

SWMU #7 Summary Report

Fire Training Area
Ciniza Refinery
McKinley County, New Mexico

Prepared for:

Ciniza Refinery
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

Prepared by:

Practical Environmental Services, Inc.
1444 Wazee Street, Suite 225
Denver, Colorado 80202

Job No. 98-205-03

April 23, 1998

1.0 EXECUTIVE SUMMARY

Practical Environmental Services, Inc. (PES) has been retained by Giant-Ciniza Refinery (Ciniza) to perform a visual inspection, data evaluation, and status assessment for the fire training area located at the Ciniza Refinery, in McKinley County, New Mexico.

The fire training area was identified as a Solid Waste Management Unit (SWMU), and designated as SWMU #7, during a RCRA Facility Investigation (RFI) conducted at the refinery in the early 1990's. This investigation included soil sampling and analysis, detected hydrocarbon contaminants, and recommended corrective action.

In 1994, the Environmental Protection Agency Region VI Office (EPA) requested additional sampling at greater depth. These results demonstrated that hydrocarbon contaminants were confined to near-surface soils adjacent to a tank.

This summary report for SWMU #7 has been prepared in conjunction with submittal of a Resource Conservation and Recovery Act (RCRA) Part B permit application covering post closure care of the Ciniza Refinery Land Treatment Unit. All investigative activities for SWMU #7 have been completed. This assessment is summarized as follows.

- ⇒ The fire training area remains in active service at the refinery and is used to train employees in safe firefighting techniques.
- ⇒ Soil sampling and analysis was conducted during an initial site investigation and subsequent re-investigation at greater depth. Diesel fuel was detected in surface soil at the site.
- ⇒ Contaminated soil should be removed from the site and replaced with clean fill dirt prior to closure.

2.0 BACKGROUND

During 1987, a RCRA Facility Assessment was conducted at the Ciniza Refinery. This assessment identified various "units of concern" and recommended further evaluation. A RCRA Facility Investigation was subsequently conducted and the fire training area was identified as SWMU #7.

Applied Earth Sciences (AES) investigated the fire training area during the early 1990s. Soil samples were collected and analyzed. Hydrocarbon contaminants were detected above State of New Mexico corrective action levels.

As a result of the investigation, AES recommended in-situ bioremediation for this SWMU. Results and recommendations were reported to the EPA in 1992. In 1994, the EPA requested additional sampling at greater depth. Follow-up sampling and analysis demonstrated that hydrocarbon contaminants were confined to near-surface soils adjacent to a firefighting training tank.

3.0 SITE LOCATION AND DESCRIPTION

SWMU #7 is located within the Ciniza Refinery's property boundary. This refinery is located on the north side of Interstate 40, approximately 17 miles east of Gallup, New Mexico. Within the refinery, SWMU #7 is located approximately 700 feet north of the tank farm. See Figure No. 1 for location details.

The fire training area is a rectangular flat site measuring approximately 50 feet wide by 80 feet long. Within this area, several firefighting demonstration apparatus are located; including a tank, pump, column, and piping manifold. Approximately twice a year, diesel fuel is used to create fires within this equipment and refinery employees train in proper techniques for extinguishing the fires.

4.0 SITE INSPECTION

During the week of March 23, 1998, an on-site inspection was performed. Photographs are included in the appendix to this report. Observations are noted as follows:

- The fire training area remains in active service at the refinery.
- At the time of the inspection, no soil staining or distressed vegetation was present at or in the vicinity of the fire training equipment.
- Local soil in the vicinity of the fire training area presents as bentonitic clays and silts. Similar soil strata from a neighboring SWMU exhibited a hydraulic conductivity of less than 10^{-7} cm/sec.

5.0 DATA REVIEW

Soil samples from within the fire training area were collected and analyzed during the initial site investigation and subsequent re-sampling at greater depth.

In 1992, the initial site investigation collected samples at four locations and three depths; surface, 3 feet, and 4.5 feet below ground surface. Diesel fuel, analyzed as oil & grease, was detected in 10 of 12 samples. Surface samples collected adjacent to the tank indicated the highest levels of detection at approximately 3 percent.

In 1994, a second round of sampling and analysis was conducted at two locations and depths of 7 and 11 feet below ground surface. Oil & Grease and Total Petroleum Hydrocarbon (TPH) were not detected in any sample. Trace di-n-butyl phthalate, a diesel constituent, was detected in two samples.

The State of New Mexico corrective action level for diesel fuel in soil is 100 mg/kg; measured as TPH.

6.0 ASSESSMENT

Based on the site inspection and data review, the fire training area is assessed as follows.

- The fire training area remains in active service and is a necessary component of the refinery's safety program.
- Soil sampling and analysis has detected spilled diesel fuel in surface soil adjacent to the firefighting demonstration tank.
- Continuing releases of diesel fuel can be expected as long as firefighting demonstration equipment is located on bare earth. Relocation of this equipment to a concrete curbed pad will minimize future releases.
- Contaminated soil from beneath and surrounding the tank should be removed and replaced with clean fill dirt prior to site closure.

7.0 PROFESSIONAL ENGINEER'S CERTIFICATION

This summary report for SWMU #7 has been prepared under the direct supervision and control of a Registered Professional Engineer.

Client: Ciniza Refinery
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

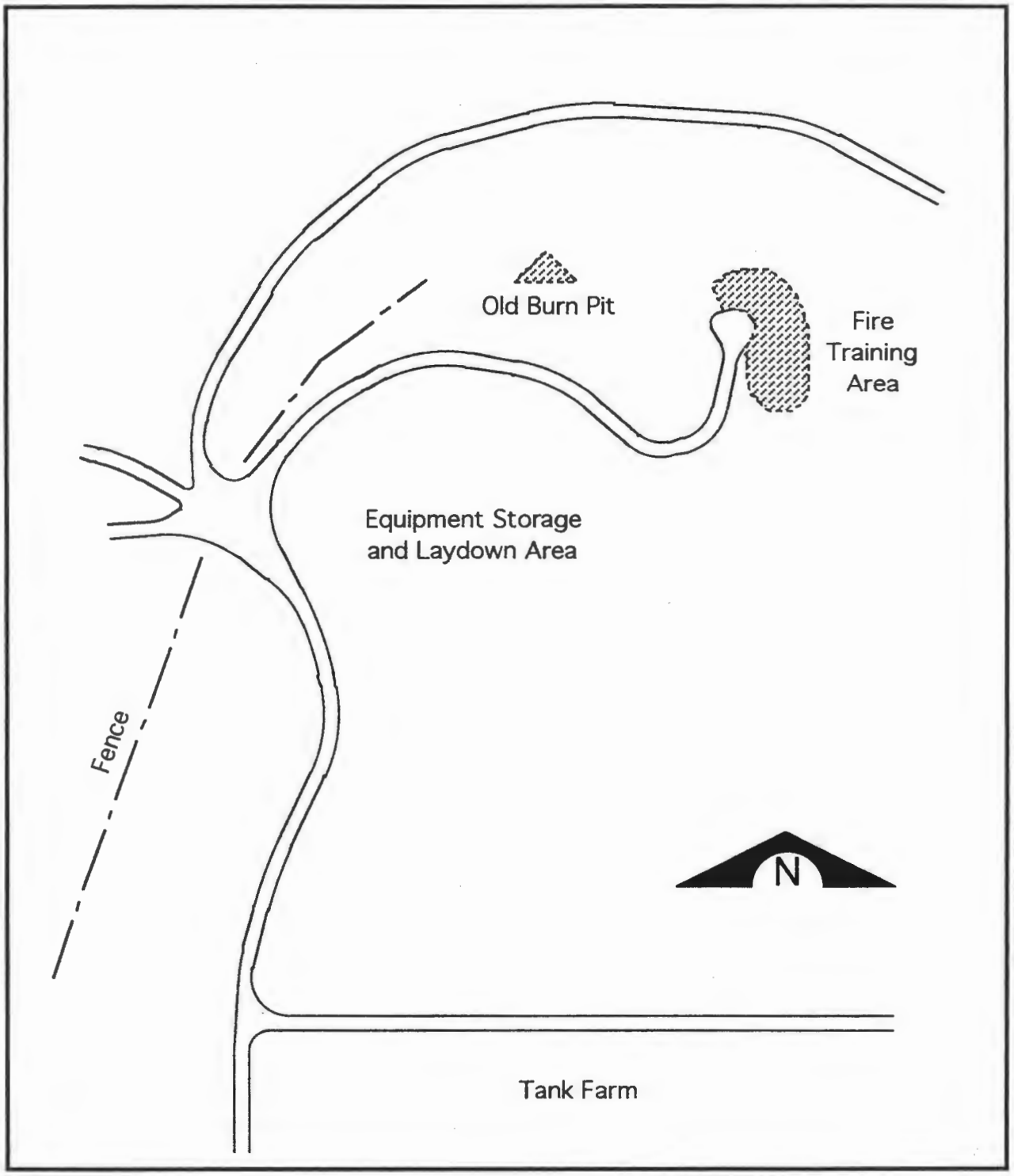
Job No.: 98-205-03

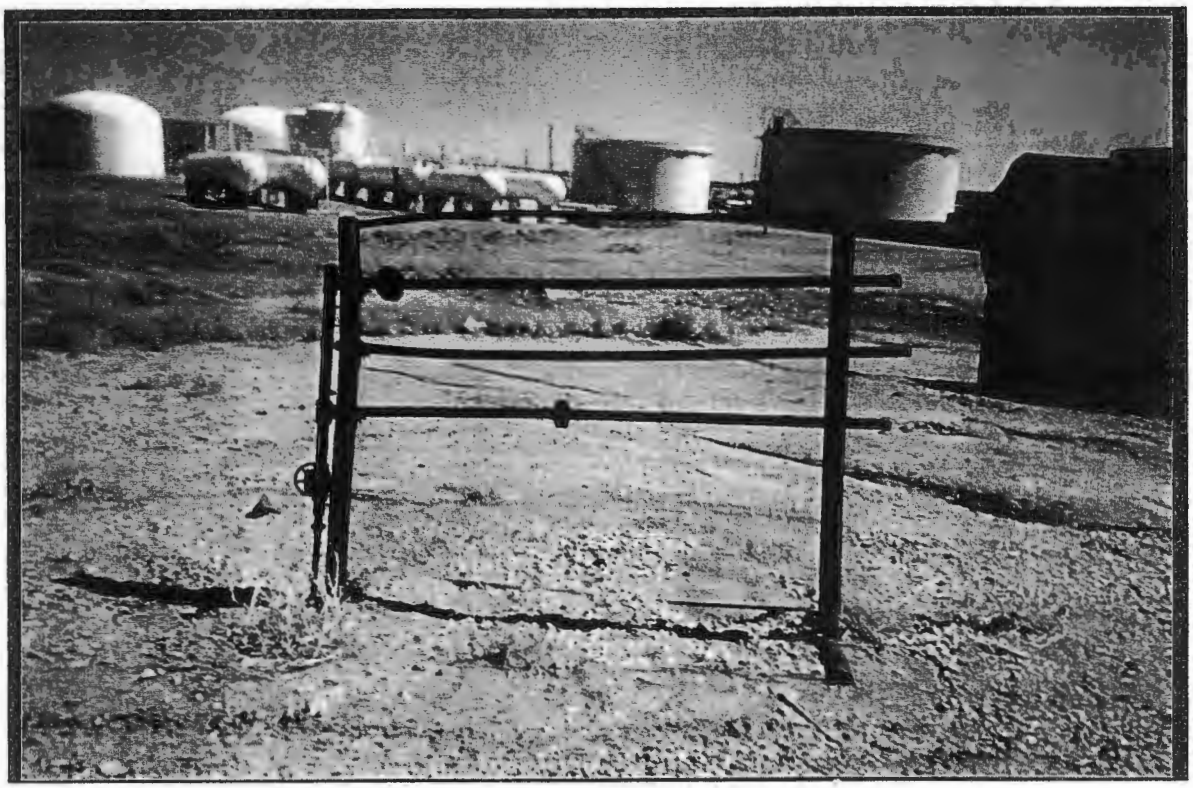
Date: April 23, 1998

Prepared and Certified by:

Thomas D. Atwood, P.E.
Colorado Registration No. 22866

Figure No. 1
Fire Training Area





Firefighting Demonstration Equipment – Piping Manifold

Firefighting Demonstration Equipment – Pump & Column

Appendix I-8

APPENDIX I-8

Railroad Rack Lagoon and Fan Out Area – SWMU #8 Summary

SWMU #8 Summary Report

Railroad Loading Rack Lagoon & Fanout Area

Ciniza Refinery
McKinley County, New Mexico

Prepared for:

Ciniza Refinery
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

Prepared by:

Practical Environmental Services, Inc.
1444 Wazee Street, Suite 225
Denver, Colorado 80202

Job No. 98-205-03

April 23, 1998

1.0 EXECUTIVE SUMMARY

Practical Environmental Services, Inc. (PES) has been retained by Giant-Ciniza Refinery (Ciniza) to perform a visual inspection, data evaluation, and status assessment for the railroad rack lagoon and associated fanout area located within the Ciniza Refinery, in McKinley County, New Mexico.

The railroad rack lagoon and fanout area was identified as a Solid Waste Management Unit (SWMU), and designated as SWMU #8, during a RCRA Facility Investigation (RFI) conducted at the refinery in the early 1990's. This investigation included soil sampling and analysis, detected organic contaminants, and recommended corrective action.

In 1994, the Environmental Protection Agency Region VI Office (EPA) concurred in this finding, but requested additional soil monitoring after the lagoon had been removed from service. A corrective action plan (CAP) was prepared by Ciniza and approved by the EPA.

This summary report for SWMU #8 has been prepared in conjunction with submittal of a Resource Conservation and Recovery Act (RCRA) Part B permit application covering post closure care of the Ciniza Refinery Land Treatment Unit. This assessment is summarized as follows.

- ⇒ In 1990, soil sampling and analysis was conducted during the initial site investigation. Trace organic contaminants and metals were detected.
- ⇒ In 1993, the railroad rack lagoon was taken out of service. Drainage from the loading rack was diverted from the lagoon to the refinery wastewater treatment system. The sewer line from the rack to the lagoon was plugged. Water and sludge from the lagoon were transported to the API spearator.
- ⇒ Additional soil sampling and analysis is scheduled for 1998.
- ⇒ The approved CAP recommends bioremediation for this site.
- ⇒ If additional soil monitoring confirms the initial finding of very low level contaminant detection, installation of an engineered earthen cap is a preferred alternative.

2.0 BACKGROUND

During 1987, a RCRA Facility Assessment was conducted at the Ciniza Refinery. This assessment identified various "solid waste management units" and recommended further evaluation. A RCRA Facility Investigation was subsequently conducted and the railroad rack lagoon and associated fanout area were identified as SWMU #8.

Applied Earth Sciences (AES) investigated the railroad rack lagoon and fanout area during the early 1990s. Soil samples were collected and analyzed. Trace VOC and SVOC contaminants were detected. Trace metals were also detected; of which, a few samples indicated levels slightly above ambient background concentration.

As a result of the investigation, AES recommended bioremediation via in-situ land treatment and mound composting to attenuate organics. Results and recommendations were reported to the EPA in 1990. A voluntary corrective action plan was prepared and submitted to the EPA in 1992. In 1994, the EPA approved the CAP and requested additional sampling after the lagoon had been removed from service.

3.0 SITE LOCATION AND DESCRIPTION

SWMU #8 is located within the Ciniza Refinery's property boundary. This refinery is located on the north side of Interstate 40, approximately 17 miles east of Gallup, New Mexico. Within the refinery, SWMU #8 is located approximately 200 feet northwest of the railcar loading rack. See Figure No. 1 for location details.

Formerly, wastewater from the railroad loading rack flowed via a dedicated sewer line to a settling and separation lagoon south of the rack. In 1993, the sewer system was changed and this wastewater was redirected to the refinery wastewater treatment system. The old sewer line to the lagoon was then plugged with concrete.

The railroad rack lagoon is an earthen basin measuring approximately 40 feet wide by 130 feet long by 6 feet deep. Wastewater formerly entered the lagoon at the south end via an 18 inch diameter concrete sewer pipe and then exited at the north end via an overflow ditch. Water leaving the lagoon was distributed across a flat open site known as the fanout area; which measured approximately 200 feet wide by 200 long.

The railroad rack lagoon is thought to have been placed in service during the late 1950's or early 1960's and operated for approximately 35 years.

4.0 SITE INSPECTION

During the week of March 23, 1998, an on-site inspection was performed. Observations are noted as follows:

- The railroad rack lagoon was observed inactive and empty. No standing water was present, but residual oily sludge was evident on the bottom.

- Native shrubs and grasses were observed growing around the basin and throughout the general vicinity. No signs of distress were evident.

- The overflow ditch and fanout area were also inspected. Native shrubs and grasses were observed growing throughout the general vicinity. No signs of distress or soil staining were evident.

- Local soil in the vicinity of the railroad rack lagoon presents as bentonitic clays and silts. Similar soil strata from a neighboring SWMU exhibited a hydraulic conductivity of less than 10^{-7} cm/sec.

5.0 DATA REVIEW

Soil samples from adjacent and under the railroad rack lagoon and within the overflow ditch and fanout area were collected and analyzed during the initial site investigation.

In 1990, the initial site investigation collected samples at 13 locations and multiple depths ranging from surface to 10 feet below ground surface. VOCs were detected in 4 of 39 samples; of which, xylenes at 6.6 mg/kg represented the highest detection. SVOCs were detected in 8 of 39 samples; of which, methylnaphthalene at 71 mg/kg represented the highest detection. The highest detection of total VOC/SVOC was 131 mg/kg.

State of New Mexico corrective action levels for Total Petroleum Hydrocarbons (TPH) and BTEX in soil is 100 mg/kgl and 50 mg/kg, respectively.

All samples detected trace metals; of which, several metals were detected at levels slightly above ambient background concentration.

6.0 ASSESSMENT

Based on the site inspection and data review, the railroad rack lagoon area is assessed as follows.

- The railroad rack lagoon and associated fanout area are no longer in service. Wastewater is no longer flowing to this area and therefore no new contaminants are being introduced to the site.

- A residual sludge layer is present on the bottom on the lagoon and should be removed prior to closure.

- Residual subsurface organic contaminants are present in very low concentrations and substantially below corrective action levels.

- The currently approved CAP recommends two bioremediation techniques to enhance attenuation of organics. This remedy will expose soil metals to oxidation and precipitation; thereby mobilizing these contaminants and promoting migration.

- Local soil underlying this site has a very low hydraulic conductivity which effectively inhibits outward migration of contaminants.

- An alternative corrective action is recommended. Installation of an engineered soil cap represents a preferred and appropriate remedy for this site.

7.0 PROFESSIONAL ENGINEER'S CERTIFICATION

This summary report for SWMU # has been prepared under the direct supervision and control of a Registered Professional Engineer.

Client: Ciniza Refinery
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

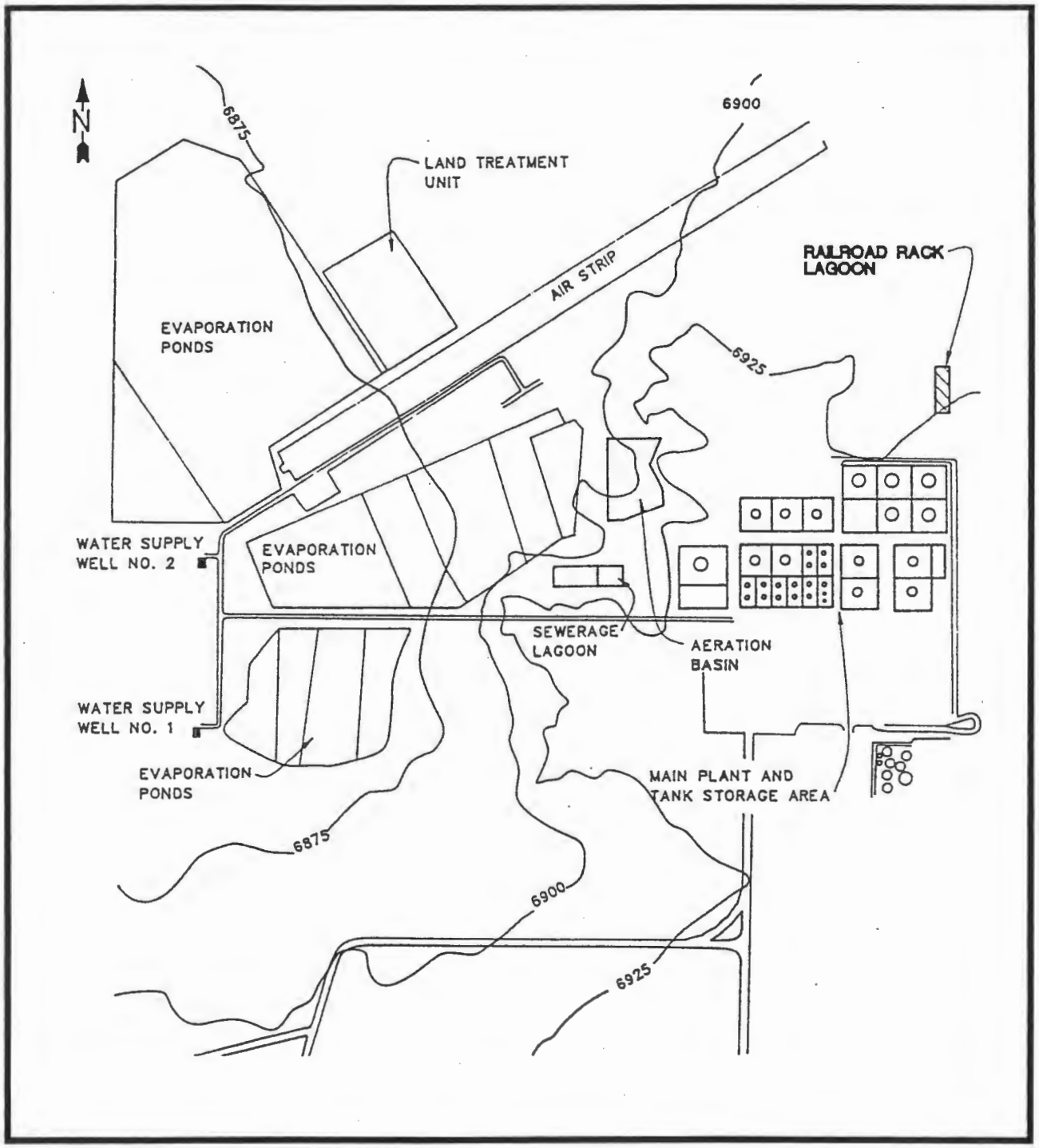
Job No.: 98-205-03

Date: April 23, 1998

Prepared and Certified by:

Thomas D. Atwood, P.E.
Colorado Registration No. 22866

Figure No. 1
Railroad Rack Lagoon Area



Appendix I-8A

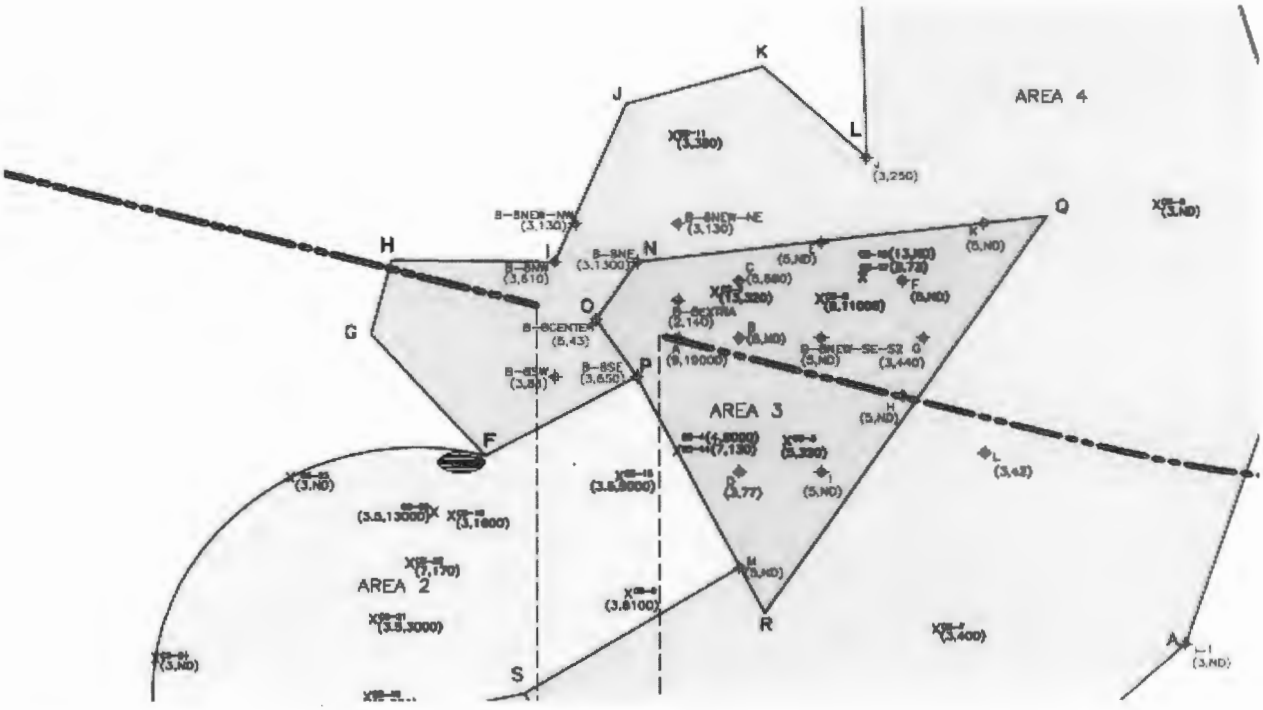
APPENDIX I-8A

Updated Summary of On-going Work Plan – SWMU #8 Fan Out Area

Railroad Rack Fan Out Area – looking North – Excavation, Soil Sampling activities

Railroad Rack Fan Out Area – Close up of soil excavated from pit.

Railroad Rack Fan Out Area – Looking East inside the pit.



Railroad Rack Fan Out Area – Locations of soil samples taken in 2009.

1.0 INTRODUCTION AND BACKGROUND

Western Refining (formerly known as Giant Industries, Arizona, Inc.) requested that Trihydro Corporation (Trihydro) assist in the preparation of this Solid Waste Management Unit (SWMU) No. 8 Summary Report to be submitted in conjunction with Western Refining Gallup Refinery (Gallup) Resource Conservation and Recovery Act (RCRA) Part B permit application covering post closure care of Gallup's Land Treatment Unit (LTU). SWMU No. 8, as identified during RCRA Facility Investigation (RFI) conducted during the early 1990's, includes Gallup's former Railroad Rack Lagoon, the Railroad Rack Lagoon Overflow Ditch, and Fan-out Area. Historically, the Railroad Rack Lagoon was used to store waste water associated with the railroad loading rack. The Overflow Ditch and Fan-out Area were used to manage overflow when the Railroad Rack Lagoon was filled beyond capacity. A brief summary of activities conducted at SWMU No. 8 is provided below:

- Late 1950's to early 1960's: The Railroad Rack Lagoon, Overflow Ditch, and Fan-out Area were put into use.
- Mid 1980's: Use of the Railroad Rack Lagoon, Overflow Ditch, and Fan-out Area ceased.
- Early 1990's: The RFI was conducted at Gallup, SWMU No. 8 was identified, and characterization soil samples were collected.
- 1993: The Railroad Rack Lagoon was officially taken out of service. Drainage was diverted from the lagoon to Gallup's waste water treatment system and the sewer line from the railroad loading rack to the lagoon was plugged with concrete.
- 1994: A Corrective Action Plan (CAP) was submitted to and approved by the Environmental Protection Agency (EPA) Region VI Office.
- 1998: Practical Environmental Services, Inc. (PES) conducted an on-site inspection of SWMU No. 8 and prepared a summary report for Gallup's RCRA Part B permit application.
- 1999: In 1999, a Request for Expenditure (RFE) was initiated for continued remediation of the tank farm and railroad rack lagoon. The RFE would provide funding for the preparation of closure reports, No Further Action (NFA) petitions, survey plats, and closure certifications by a professional engineer.

- 2004: The initial railroad rack lagoon excavation was performed in November 2004. 2119 cubic yards of soil was removed and transported to the central and north-east OCD non-hazardous land farms. The lagoon as originally constructed was approximately 130 feet long, by 30 feet wide, by 6 feet deep. The excavation was measured as 170 feet long by 40 feet wide by 12 feet deep. The extent of excavation was primarily determined by visual and olfactory observations. Confirmatory samples were taken from undisturbed soils at the bottom and side walls of the excavation. As two lagoon sidewall samples and two samples near a concrete inlet pipe exceeded the NMED's TPH cleanup criteria, additional excavation was deemed necessary.
- 2005: In August 2005, the concrete inlet pipe was excavated. The pipe was cleaned, broken up, sampled and analyzed for TCLP and later used as rip-rap at evaporation pond 6. Further rounds of excavation and sampling occurred. After a first set of excavations within the lagoon and along the inlet pipe's location, samples were taken. Some were found to be higher than NMED's cleanup criteria and further excavation occurred. In September 2005, all confirmatory samples were found to be below cleanup levels. In October 2005, the excavated lagoon and inlet pipe areas were filled in with clean soil and the soil was contoured to the level of the surrounding undisturbed soil.
- 2006: In October 2006, a revised Remedy Completion Report was submitted to and approved by the NMED. Further remedial work along an Overflow Ditch and in a Fan-out Area of the overflows from the railroad rack lagoon was determined to be necessary. Work on the railroad rack lagoon and inlet pipe locations was deemed complete.
- 2006 – 2007: Trihydro conducted characterization and delineation activities in the Overflow Ditch and Fan-out Area.
- 2008 – 2009: Trihydro conducted excavation and confirmation sampling activities to remove contaminated soil near the north end of the Overflow Ditch.
- 2010: A final subsurface investigation report was submitted to the New Mexico Environment Department (NMED) and is pending approval.

2.0 SITE LOCATION AND DESCRIPTION

The Railroad Rack Lagoon, Overflow Ditch, and Fan-out Area are located on land owned and controlled by Gallup, within industrial property boundaries of the refinery, northeast of the main process area. The refinery is located approximately 17 miles east of Gallup, New Mexico on the north side of Interstate 40. The location of SWMU No. 8 in relation to the refinery and Interstate 40 is illustrated on Figure 1.

According to the SWMU #8 Summary Report (PES 1998), the lagoon "is an earthen basin measuring approximately 40 feet wide by 130 feet long by 6 feet deep. Wastewater formerly entered the lagoon at the south end via an 18 inch diameter concrete sewer pipe and then exited at the north end via an Overflow Ditch". The Overflow Ditch is an unlined earthen ditch approximately 4 feet wide by 1 to 3 feet deep that follows surface topography and empties into the Fan-out Area approximately 200 feet north of the lagoon. Dimensions of the relatively flat Fan-out are shown on Figure 2.

Vegetation surrounding the SWMU No. 8 is sparse and consists mainly of sagebrush and native grasses. Signs of distress have not been observed and the vegetation appears to be similar to surrounding areas.

3.0 SITE INSPECTION

Applied Earth Sciences (AES) investigated the Railroad Rack Lagoon and Fan-out Area as part of the RFI during the early 1990s. This investigation included the collection of soil samples adjacent to and under the Railroad Rack Lagoon as well as within the Overflow Ditch and Fan-out Area. Results of these samples are summarized in Section 4.0.

PES was onsite during 1998 to perform an on-site inspection. PES observed that the Railroad Rack Lagoon was inactive and empty, but that an oil residual sludge was present on the bottom. Apparently healthy native shrubs and grasses were noted throughout the vicinity of the Railroad Rack Lagoon, Overflow Ditch, and Fan-out Area. PES's on-site inspection is summarized in the SWMU #8 Summary Report (PES 1998).

Cleanup and closure of a rail road rack loading lagoon (SWMU No. 8) located at the Ciniza Refinery of Giant Industries commenced in November 2004. Soils were excavated from the sides and bottom of the

lagoon. Soil samples obtained in the excavated lagoon and in the area of an inlet pipe showed SVOCs present at two locations in the walls and bottom at levels exceeding NMGW thresholds. Additional excavation work to remove the impacted soil and to remove an associated concrete inlet pipe was completed in September 2005. Sample results from the completed excavation work showed negligible SVOCs remaining in the soil. Details of these activities have been submitted to the NMED in a Revised Remedy Completion Report for Railroad Rack Lagoon (SWMU-8) on October 10, 2006, that was subsequently approved.

NMED requested that Gallup conduct an additional investigation of the Overflow Ditch and Fan-out Area to determine if residual contamination is present. In a letter dated June 29, 2006 asking for revision to the Remedy Completion Report, NMED asked for an investigation of the overflow ditch and fan-out area through a separate work plan. Trihydro Corporation was retained by Gallup to assist with this investigation. Characterization and delineation activities were conducted in 2006 and 2007. Soil sampling conducted during the characterization and delineation activities showed elevated diesel range organic (DRO) concentrations and prompted the excavation of DRO contaminated soil near the north end of the Overflow Ditch. Excavation and confirmation sampling took place during 2008 and 2009. A Subsurface Investigation Final Report (Trihydro 2010) prepared to document these activities was submitted to NMED and is currently pending approval.

4.0 DATA REVIEW

The Railroad Rack Lagoon, Overflow Ditch, and Fan-out Area were sampled during early 1900's as part of the RFI. During this investigation, soil samples from these areas were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and total metals. A total of 39 samples were collected from 13 locations near or within the Railroad Rack Lagoon, Overflow Ditch, and Fan-out Area. Samples depths ranged from 0 to 10 feet below ground surface (ft bgs). The RFI concluded that VOCs/SVOCs were far lower than what might have been expected for an approximately thirty-year operation of the unlined lagoon; however, the levels were high enough to warrant further investigation and corrective action. Inorganic levels were below background contamination levels with the exception of chromium. However, chromium levels were below the RCRA Corrective Action levels, thus no remediation was required.

The railroad rack lagoon was placed in service sometime during the 1950's to 1960's and continued operation over three decades. The lagoon was constructed to receive and hold wastewater from the railroad loading rack. Waste water from the rack entered into an 18" concrete sewer type pipe via a grate covered manhole and was conveyed via the pipe into the lagoon. The concrete pipe measured 250 feet in length. The Railroad Rack Lagoon was an earthen basin measuring approximately 40'x130'x'6 with an approximate capacity of 261,000 gallons. Wastewater entered via the 18" concrete pipe on the south end and exited at the north end via an overflow ditch. Effluent from the lagoon was distributed across a fan-out area which measured 200 feet by 200 feet in area.

Between November 1990 and October 1992, three RCRA Facility Investigations (Phase I, Phase II, and Phase III) were conducted and submitted along with four Corrective Action Plans (CAP) to the EPA for review and comment. During these investigations, 39 soil samples were taken at the Railroad Rack Lagoon (SWMU #8) and analyzed, nine contained low levels of VOC's and/or SVOC's. The VOC's consisted of ethylbenzene and xylenes, and the SVOC's consisted of naphthalene, methylnaphthalene, and phenanthrene.

On December 17, 1993, EPA approved the Phase I, Phase II, and the CAP with modifications. The CAP included diverting drainage water around the railroad rack lagoon into the refinery waste water system, plugging the old system, transferring the lagoon liquids to the refinery wastewater system, and treating the contaminated soil. EPA's modifications included "sampling within the footprint of the lagoon (five borings) and around the periphery of the lagoon (six borings). It also required in the overflow ditch (three borings to seven feet 5) and the fan out area (four borings to seven feet). Results were submitted in the 1994 Annual Monitoring Report. Moreover, required Giant to notify EPA and submit a survey plat when final closure as been initiated.

On June 28, 1994 Giant notified EPA the piping modifications to the Railroad Rack Lagoon system were completed and the remaining water from the lagoon was being disposed of in Giant's wastewater system. It also noted Giant was soliciting proposals for the survey requirement. Giant stated their intention to continue with the corrective action plan for the SWMU #8 during the first quarter 1995.

In 1999 a Request for Expenditure (RFE) was initiated for continued remediation of the Tank Farm and Railroad Rack Lagoon. It would fund the preparation of closure reports, No Further Action (NFA) petitions, survey plats, and closure certifications by a professional engineer.

Giant commenced excavation of the railroad lagoon in November 2004. Per the requirements of the NMED, lagoon soils were excavated and a total of 14 samples taken from undisturbed soils at the bottom and sides of the excavation. The samples were analyzed for general chemistry parameters, VOCs including analysis for DRO and MRO, and RCRA metals. Samples for which cumulative RO and MRO exceeded 500 mg/kg required additional analysis for SVOCs. The analysis of the soil samples showed low concentrations of VOCs to be present remaining in two sampled locations along the north and south sides of the lagoon.

Giant commenced additional excavation work in August 2005 to remove the contaminated soil from the two sampled locations at the sides of the excavation and to remove the inlet pipe. The results of the final post-excavation sampling conducted on soil samples from the sides of the excavation and along the length of the inlet pipe showed there to be non-detectable level of VOCs remaining. In October 2005, the lagoon and pipe excavations were filled in with clean fill soil brought in by Fuh's Trucking.

Trihydro's initial investigation of the Overflow Ditch and Fan-out Area included sampling ten test pits installed at NMED-approved locations. Samples were collected from each test pit at depths of 2 and 5 ft bgs and analyzed for DRO, SVOCs (if the DRO exceeded 500 mg/kg), VOCs, RCRA metals, mercury, and cyanide. Cyanide, mercury, VOCs, and SVOCs were not detected. Barium, chromium, and lead were the only metals detected. These metals were detected in each sample, but concentrations were below the NMED residential soil screening levels. DRO concentrations exceeding NMED's cleanup standard of 890 mg/kg were detected in 2 samples collected near the north end of the Overflow Ditch. These exceedances prompted the excavation of DRO contaminated soils in this area. Data associated with Trihydro's initial excavation and documentation of field activities were submitted to NMED in Trihydro's Subsurface Investigation Report (Trihydro 2007).

A series of delineation, excavation, and confirmation sampling events were conducted by Trihydro and Gallup between 2007 and 2009. During these activities, soils were analyzed for DRO as this was the only contaminant of concern identified during the 2006 investigation. Excavation continued until the

outermost (horizontal) and deepest (vertical) confirmation samples showed DRO concentrations below the cleanup standard. Over 100 soil samples were analyzed to assist in delineation and to confirm that DRO contaminated soils were removed. A total of 72 soil samples showing DRO concentrations below the cleanup standard surround the area that has been excavated. The Subsurface Investigation Final Report (Trihydro 2010) details the excavation activities and presents the analytical data showing that the DRO contaminated soil has been removed. DRO contaminated soil was been transported to Gallup's land farm as permitted by the oil conservation district (OCD). The Subsurface Investigation Final Report (Trihydro 2010) has been submitted to NMED and is currently pending approval.

5.0 ASSESSMENT

The initial lagoon excavation was performed in November 2004 on November 11th, 12th, 15th, and 16th. Giant contracted Fuh's Trucking to excavate the lagoon and transport soils. Fuh's removed a fence that surrounded the lagoon area. The excavation of soils in the lagoon included soil from the bottom and each of the four sides. The lagoon as originally constructed measured approximately 130 feet long by 30 feet wide by 6 feet deep. Fuh's Trucking used a mechanical excavator shovel to excavate the soils such that the lagoon excavation measured 170 feet long by 40 feet wide by 12 feet deep. The equivalent quantity of soil removed was approximately (((170'x40'x12')-(130'x30'x6'))x 1 yard/(3'x3'x3')))= 2,119 cubic yards of soil. The extent to which soils were excavated was determined based on visual and olfactory observations of the excavated soil. Soils showing staining were removed then field screening was performed on undisturbed soil using visual and olfactory observations prior to confirmatory sampling. The soils were trucked by Fuh's Trucking to the central and NE OCD Non Hazardous landfarm on Giant property.

November 18, 2004 Sampling

In November 2004, Giant performed sampling in the excavated lagoon following the sampling plan approved by the NMED for the lagoon closure. On November 18, 2004, Giant took samples from 14 locations in the excavated lagoon. Six of the 14 samples were collected from the bottom of the lagoon. Six of the samples were collected from the lagoon sidewalls at approximately 8 feet depth. Two samples were collected from beneath the inlet pipe. All the samples were taken from undisturbed soil.

Quality control samples including sample duplicates, control spikes and blank samples were analyzed by Hall Environmental. Each sample was sealed and placed in a cooler filled with ice and delivered to Hall Environmental Analysis Laboratory in Albuquerque under chain-of-custody. Hall Environmental analyzed each sample for the following parameters:

EPA Method 9056A: Anions
EPA Method 8015B: Diesel Range Organics
EPA Method 8012B: Volatiles
EPA Method 7471: Mercury
EPA Method 6010C: Soil Metals
EPA Method 150.1: pH

Two lagoon sidewall samples and the two pipe samples exceeded the NMED's cleanup criteria. Additional excavation work was determined to be necessary. In an email to NMED on January 12, 2005, Giant proposed to excavate soil from each of the two sidewall locations to dimensions of 25 feet by 8 feet wide by 12 to 14 feet deep. From each sidewall location, one sample would be taken from the wall and one sample from the bottom. Giant also proposed to remove the concrete inlet pipe and underlying impacted soils. The pipe conveyed waste water from a manhole at the railroad rack to the lagoon over a length of 250 feet. The pipe was installed 3 feet underground and underlain with 6 inches of sand.

Initial Pipe Excavation

In the January 12 email, Giant proposed to excavate the pipe in 25 foot sections and use field screening to determine when to take confirmatory samples. In an email of January 24, 2005, NMED directed Giant to field screen and take samples from the sides and underlying soil at points every 50 feet and approximately 6 inches beneath the surface. At each area where contaminated soil was removed, three samples were to be taken (one from each wall and one from the bottom of the excavation. Samples from the lagoon and pipe would be taken from undisturbed soil based on visual and olfactory observations of the soil.

Excavation Second Phase

The second phase of excavation of the SWMU No. 8 was initiated in August 2005 and completed in September 2005. Fuh's Trucking began the additional excavation of the two sidewall locations in the lagoon and removal of pipe on August 15, 2005. Six inches of soil was excavated from the previous excavation limit in the lagoon at the two sidewall locations.

August 18 and 19, 2005 Sampling

On August 18, 2005, the pipe was dug out and cleaned. The underlying soil was removed to a depth of at least 6 inches before sampling began. On August 18 samples were taken from undisturbed soil every 50 feet along the length of the pipe. Visual and olfactory observations were used to determine when confirmation samples were taken.

Quality control samples including sample duplicates, control spikes and blank samples were analyzed by Hall Environmental. Each sample was sealed and placed in a cooler filled with ice and delivered to Hall Environmental Analysis Laboratory in Albuquerque under chain-of-custody. Hall Environmental analyzed each sample for the following parameters:

EPA Method 8015B: Diesel Range Organics
EPA Method 8012B: Volatiles
EPA Method 8270: Semi-volatiles

On August 19 confirmation samples were taken from undisturbed soil at each sidewall location and were labeled as North Wall, South Wall, North Bottom, and South Bottom. Visual observations and olfactory observations were used to determine when confirmation samples were taken. All the samples were taken from undisturbed soil. Quality control samples including sample duplicates, control spikes and blank samples were analyzed by Hall Environmental.

Each sample was sealed and placed in a cooler filled with ice and delivered to Hall Environmental Analysis Laboratory in Albuquerque under chain-of-custody.

Per NMED directive, any samples where the mid-range and diesel range organic concentrations exceeded 500 mg/kg were required to be tested for SVOCs. Samples from the North Wall, South Wall, and North bottom showed DRO+MRO greater than 500 mg/kg threshold and were therefore also tested for SVOCs. The sample from the South Bottom was 15 mg/kg. Because the DRO+MRO results for three of the four sample locations were greater than the 500 mg/kg threshold, Giant re-excavated the lagoon sidewalls.

August 22, 2005 Sampling

On August 22, samples were retaken from newly excavated areas.. All the samples were taken from undisturbed soil. Quality control samples including sample duplicates, control spikes and blank samples were analyzed by Hall Environmental. Each sample was sealed and placed in a cooler filled with ice and delivered to Hall Environmental Analysis Laboratory in Albuquerque under chain-of-custody.

The results of the lagoon re-sampling showed that the lagoon excavation resulted in removal of all the impacted soils and the remaining soils meet the NMED cleanup criteria.

On August 22, 2005 Giant sampled the cleaned concrete pipe and submitted a sample to Hall Environmental Analysis Lab for TCLP analysis. These results showed all TCLP levels less than regulatory criteria.

August 30, 2005 Sampling

Because some samples nar and under the pipe had tested above 500 mg/kg, Giant re-excavated these particular areas of the pipe to a depth at least six inches deeper than the previous excavation and re-sampled. Visual and olfactory observations were used prior to confirmatory sampling. Giant sampled the re-excavated pipe area on August 30, 2005

All the samples were taken from undisturbed soil. Quality control samples including sample duplicates, control spikes and blank samples were analyzed by Hall Environmental. Each sample was sealed and placed in a cooler filled with ice and delivered to Hall Environmental Analysis Laboratory in Albuquerque under chain-of-custody.

September 15, 2005 Sampling

Samples taken at some points showed MRO+DRO values greater than 500 mg/kg. Therefore, the areas where these samples were taken were re-excavated by Fuh's Trucking to a depth at least 6 inches beyond the previous excavation. Confirmatory samples were taken on September 15. All the samples were taken from undisturbed soil. Quality control samples including sample duplicates, control spikes and blank samples were analyzed by Hall Environmental. Each sample was sealed and placed in a cooler filled with ice and delivered to Hall Environmental Analysis Laboratory in Albuquerque under chain-of-custody.

The sample results from the final round of sampling of the inlet pipe are less than the applicable regulatory criteria.

October 2005 Activities

On October 11th and 12th, 2005 Fuh's trucking filled in the excavated lagoon and pipe with soil and contoured the soil to the level of the surrounding undisturbed soil.

Overflow Ditch and Fan-Out Area

Trihydro's initial investigation of the Overflow Ditch and Fan-out Area identified DRO as a contaminant of concern. As shown in the Subsurface Investigation Final Report (Trihydro 2010), the DRO contaminated soil identified since 2006 has been excavated from the north end of the Overflow Ditch and transported to Gallup's landfarm as approved by OCD. The excavation is currently open pending NMED approval of the Subsurface Investigation Final Report (Trihydro 2010). Upon NMED approval, the excavation will be backfilled with clean fill material.

6.0 REFERENCES

Giant Industries Inc., 2006. *Remedy Completion Report for Railroad Rack Lagoon (SWMU-8) Revised Report, Giant Refining Company, Ciniza Refinery*, October 10.

Practical Environmental Services, Inc. (PES), 1998. *SWMU # 8 Summary Report, Railroad Loading Rack Lagoon & Fan-out Area, Ciniza Refinery, McKinley County, New Mexico*, April 23.

Trihydro Corporation (Trihydro), 2007. *Railroad Rack Lagoon Overflow Ditch and Fan-out Area, SWMU No. 8, Subsurface Investigation, Giant Refining Company, Ciniza Refinery, Gallup, New Mexico*, February 8.

Trihydro Corporation (Trihydro), 2010. *Railroad Rack Lagoon Overflow Ditch and Fan-out Area, SWMU No. 8, Subsurface Investigation Final Report, Western Refining Company, Gallup Refinery, Gallup, New Mexico*, January 6.

Appendix I-9

APPENDIX I-9

Drainage Ditch and the Inactive Land Farm - SWMU No. 9 and No. 14 Summary

SWMUs # 9 & #14 Summary Report

Inactive Land Treatment Area & Drainage Ditch

Ciniza Refinery
McKinley County, New Mexico

Prepared for:

Ciniza Refinery
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

Prepared by:

Practical Environmental Services, Inc.
1444 Wazee Street, Suite 225
Denver, Colorado 80202

Job No. 98-205-03

April 23, 1998

1.0 EXECUTIVE SUMMARY

Practical Environmental Services, Inc. (PES) has been retained by Giant-Ciniza Refinery (Ciniza) to perform a visual inspection, data evaluation, and status assessment for the inactive land treatment area and associated drainage ditch located within the Ciniza Refinery, in McKinley County, New Mexico.

The inactive land treatment area and drainage ditch sites were identified as a Solid Waste Management Units (SWMU), and designated as SWMU #9 and #14 respectively, during a RCRA Facility Investigation conducted at the refinery in the early 1990's. This investigation included soil sampling and analysis, determined that no significant impact had occurred, and recommended no further action (NFA).

Findings and recommendations were reported to the Environmental Protection Agency Region VI Office (EPA) in 1991 and 1992.

This summary report for SWMUs #9 and #14 has been prepared in conjunction with submittal of a Resource Conservation and Recovery Act (RCRA) Part B permit application covering post closure care of the Ciniza Refinery Land Treatment Unit. All investigative activities for SWMUs #9 and #14 have been completed. This assessment is summarized as follows.

- ⇒ The inactive land treatment area and associated drainage ditch remain inactive and vacant. No indication of current waste treatment was evident. No soil staining or residual waste material was observed.
- ⇒ The site is naturally revegetating. No distressed vegetation was evident.
- ⇒ Local soil underlying the site predominantly consists of bentonitic clays and silts having a very low hydraulic conductivity.
- ⇒ Soil sampling and analysis was conducted during an initial site investigation. Trace organic contaminants were detected below corrective action levels. The site was recommended for NFA.
- ⇒ SWMUs #9 and #14 have been characterized in accordance with current applicable state and federal regulations, and the available data indicate that no significant environmental impact or migration has occurred.

2.0 BACKGROUND

During 1987, a RCRA Facility Assessment was conducted at the Ciniza Refinery. This assessment identified various "solid waste management units" and recommended further evaluation. A RCRA Facility Investigation (RFI) was subsequently conducted and the inactive land treatment area and associated drainage ditch were identified as SWMU #9 and SWMU #14, respectively.

Applied Earth Sciences (AES) investigated the inactive land treatment area and drainage ditch sites during the early 1990s. Soil samples were collected and analyzed. Trace organic contaminants were detected in a few samples. Trace metals were detected in all samples; all of which indicated levels within the range of ambient background concentration.

As a result of the investigation, AES recommended no further action for these SWMUs. Results and recommendations were reported to the EPA in 1991 and 1992.

3.0 SITE LOCATION AND DESCRIPTION

SWMUs #9 and #14 are located within the Ciniza Refinery's property boundary. This refinery is located on the north side of Interstate 40, approximately 17 miles east of Gallup, New Mexico. Within the refinery, SWMUs #9 and #14 are contiguous and located approximately 200 feet north of the tank farm and 300 feet west of the railcar loading spur. See Figure No. 1 for location details.

The inactive land treatment area is a rectangular flat site measuring approximately 80 feet wide by 130 feet long. Oily wastes were formerly biodegraded on this site.

The associated drainage ditch is a man-made shallow channel cut into the earth along the western boundary of the inactive land treatment area. The ditch is approximately 3 feet wide by 2 feet deep by 150 feet long.

The inactive land treatment area and associated drainage ditch were placed in service in 1958. Land treatment area operations were discontinued in the early 1980's.

4.0 SITE INSPECTION

During the week of March 23, 1998, an on-site inspection was performed. Observations are noted as follows:

- The inactive land treatment area and associated drainage ditch were observed vacant and inactive. No sign of soil staining or residual waste was evident in either location.

- Native shrubs and grasses were observed growing throughout the general vicinity and thickly within the drainage ditch. No signs of distress were evident.

- Local soil in the vicinity of these SWMUs presented as bentonitic clays and silts. Similar soil strata from a neighboring SWMU exhibited a hydraulic conductivity of less than 10^{-7} cm/sec.

5.0 DATA REVIEW

Soil samples from within the inactive land treatment area and along the associated drainage ditch were collected and analyzed during the initial site investigation.

In 1990, the initial site investigation collected samples from seven locations and four depths; surface, 3, 5, and 7 feet below ground surface. Four of these locations were within the inactive land treatment area and three were along the drainage ditch.

Analysis detected trace VOC (ethanol) in six samples and trace SVOC in one sample. The highest detection of VOC was 24 mg/kg and the highest detection of SVOC was 26 mg/kg. The VOC was detected in several subsurface samples and the SVOC was detected in a single surface sample. The remaining 21 samples indicated no detection of either VOCs or SVOCs.

State of New Mexico corrective action levels for total hydrocarbons and BTEX in soil is 100 mg/kg and 50 mg/kg, respectively. All samples were below these action levels.

Trace metals were detected in all samples; all of which indicated levels within the range of ambient background concentration.

6.0 ASSESSMENT

Based on the site inspection and data review, the inactive land treatment area and drainage ditch site is assessed as follows.

- The inactive land treatment area and associated drainage ditch are inactive, vacant, and naturally revegetating.

- The inactive land treatment area and associated drainage ditch are located in a geologic setting in which the underlying bentonitic soil has a very low hydraulic conductivity which effectively serves as an aquiclude.

- Trace detection of VOC (ethanol) is below action levels. Also, ethanol is readily biodegradable and will naturally attenuate. Trace detection of SVOC is also below action levels. This detection is from a single surface sample and may represent an anomalous data point. The low level of detection for these contaminants is indicative of no significant impact.

- The no further action finding that was recommended by AES is appropriate for this site.

7.0 PROFESSIONAL ENGINEER'S CERTIFICATION

This summary report for SWMUs #9 and #14 has been prepared under the direct supervision and control of a Registered Professional Engineer.

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Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

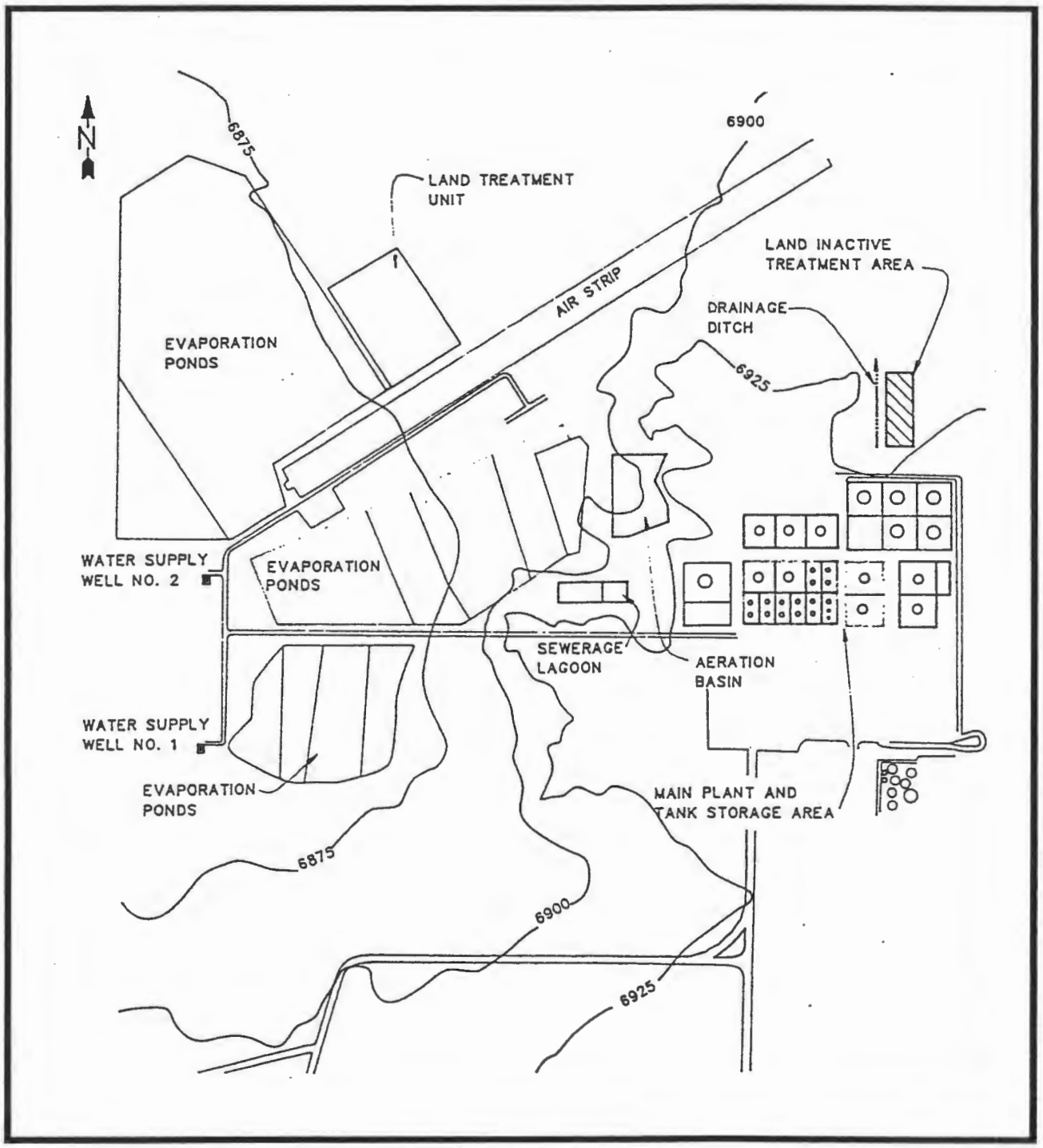
Job No.: 98-205-03

Date: April 23, 1998

Prepared and Certified by:

Thomas D. Atwood, P.E.
Colorado Registration No. 22866

Figure No. 1
Inactive Land Treatment Area & Drainage Ditch Site



Appendix I-10

APPENDIX I-10

Sludge Pits - SWMU No. 10 Summary

SWMU #10 Summary Report

Sludge Pits
Ciniza Refinery
McKinley County, New Mexico

Prepared for:

Ciniza Refinery
Giant Refining Company
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Gallup, New Mexico 87301

Prepared by:

Practical Environmental Services, Inc.
1444 Wazee Street, Suite 225
Denver, Colorado 80202

Job No. 98-205-03

April 23, 1998

1.0 EXECUTIVE SUMMARY

Practical Environmental Services, Inc. (PES) has been retained by Giant-Ciniza Refinery (Ciniza) to perform a visual inspection, data evaluation, and status assessment for the sludge pits located at the Ciniza Refinery, in McKinley County, New Mexico.

The sludge pits area was identified as a Solid Waste Management Unit (SWMU), and designated as SWMU #10, during a RCRA Facility Investigation (RFI) conducted at the refinery in the early 1990's. This investigation included soil sampling and analysis, detected organic contaminants, and recommended corrective action.

In 1994, the Environmental Protection Agency Region VI Office (EPA) requested additional sampling at greater depth. Results confirmed previous findings. A corrective plan was prepared by Ciniza and approved by the EPA.

This summary report for SWMU #10 has been prepared in conjunction with submittal of a Resource Conservation and Recovery Act (RCRA) Part B permit application covering post closure care of the Ciniza Refinery Land Treatment Unit. All investigative activities for SWMU #10 have been completed. This assessment is summarized as follows.

- ⇒ Sludge was removed from the pits in 1980 and replaced with clean soil. The site was then covered with a layer of clean soil.
- ⇒ Soil sampling and analysis was conducted during an initial site investigation and subsequent re-investigation at greater depth. Organic contaminants were detected above corrective action levels.
- ⇒ SWMU #10 has been characterized in accordance with current applicable state and federal regulations.
- ⇒ Installation of an engineered earthen cap is recommended as corrective action for this site.

2.0 BACKGROUND

During 1987, a RCRA Facility Assessment was conducted at the Ciniza Refinery. This assessment identified various "solid waste management units" and recommended further evaluation. A RCRA Facility Investigation was subsequently conducted and the sludge pits area was identified as SWMU #10.

Applied Earth Sciences (AES) investigated the sludge pits area during the early 1990s. Soil samples were collected and analyzed. Organic contaminants were detected above State of New Mexico corrective action levels. Trace metals were also detected; of which, a few samples indicated levels slightly above ambient background concentration.

As a result of the investigation, AES recommended tilling the site to promote natural attenuation of organics, followed by capping to contain residual metals. Results and recommendations were reported to the EPA in 1990. In 1994, the EPA requested additional sampling at greater depth. Follow-up sampling and analysis confirmed the original findings.

3.0 SITE LOCATION AND DESCRIPTION

SWMU #10 is located within the Ciniza Refinery's property boundary. This refinery is located on the north side of Interstate 40, approximately 17 miles east of Gallup, New Mexico. Within the refinery, SWMU #10 is located approximately 200 feet southwest of the API separator. See Figure No. 1 for location details.

The sludge pits area is an oblong flat site measuring approximately 120 feet wide by 200 feet long. Within this area, two pits were previously excavated and filled with oily waste from the API separator.

In 1980, the sludge was removed from the pits and replaced with clean fill soil. The site was then covered with a layer of clean soil.

4.0 SITE INSPECTION

During the week of March 23, 1998, an on-site inspection was performed. Observations are noted as follows:

- The sludge pits area was observed vacant and inactive. No sign of soil staining or residual waste was evident at or in the vicinity of the site.
- Native shrubs and grasses were observed growing throughout the general vicinity. No signs of distress were evident.
- Local soil in the vicinity of the sludge pits presents as bentonitic clays and silts. Similar soil strata from a neighboring SWMU exhibited a hydraulic conductivity of less than 10^{-7} cm/sec.

5.0 DATA REVIEW

Soil samples from within the sludge pits area were collected and analyzed during the initial site investigation and subsequent re-sampling at greater depth.

In 1990, the initial site investigation collected samples at eight locations and multiple depths; including surface, 3, 6, 9, and 12.5 feet below ground surface. VOCs were detected in 7 of 27 samples; of which, xylenes at 540 mg/kg represented the highest detection. SVOCs were detected in 10 of 27 samples; of which, methylnaphthalene at 1,400 mg/kg represented the highest detection.

In 1995, a second round of sampling and analysis was conducted at eight locations and depths of 19 and 25 feet below ground surface. No VOCs were detected in any sample. Trace SVOCs were detected in four samples; of which, di-n-butyl phthalate at 13 mg/kg represents the highest detection.

State of New Mexico corrective action levels for BTEX in soil is 50 mg/kg total and 10 mg/kg of benzene. Seven of 43 samples indicated BTEX constituents, the highest of which was over 900 mg/kg total; which is above the 50 mg/kg action level.

All samples detected trace metals; of which, chromium and lead were detected at levels above ambient background concentration.

6.0 ASSESSMENT

Based on the site inspection and data review, the sludge pits area is assessed as follows.

- Oily waste originally placed in the sludge pits has been substantially removed and the pits now contain a mixture of residual waste and backfilled clean soil.

- Residual organic contaminants, consisting of both VOCs and SVOCs, are present in moderate concentrations and substantially confined to a 20 foot soil layer beneath the surface cover.

- Residual metal contaminants, consisting primarily of chromium and lead, are present in the same soil layer at elevated levels.

- The currently approved CAP recommends excavation and tilling to enhance biodegradation of organics. This technique will expose soil metals to oxidation and precipitation; thereby mobilizing these contaminants and promoting migration.

- Local soil underlying this site has a very low hydraulic conductivity which effectively inhibits outward migration of contaminants.

- An alternative corrective action is recommended. Installation of an engineered soil cap represents a preferred and appropriate remedy for this site.

7.0 PROFESSIONAL ENGINEER'S CERTIFICATION

This summary report for SWMU #10 has been prepared under the direct supervision and control of a Registered Professional Engineer.

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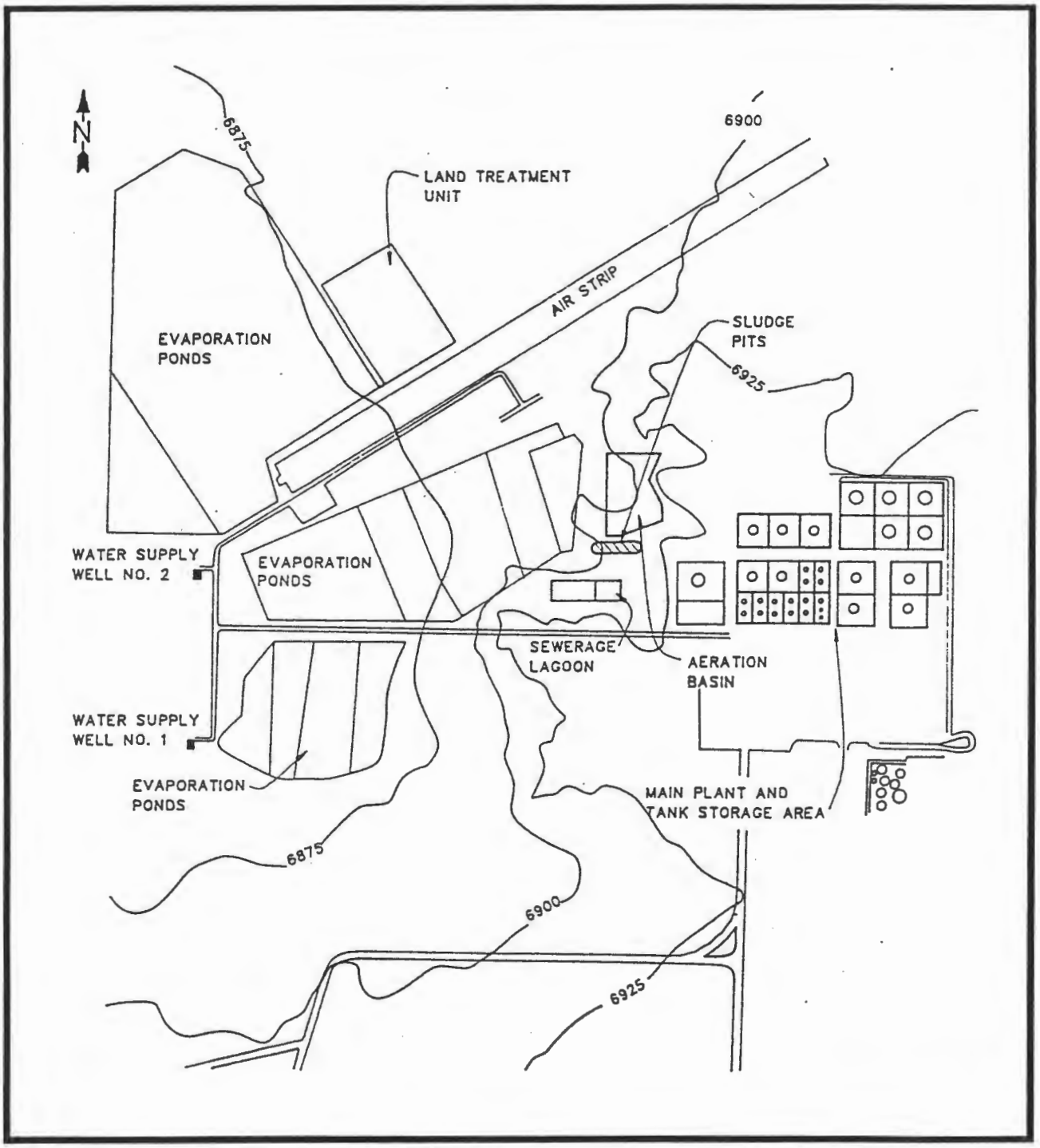
Job No.: 98-205-03

Date: April 23, 1998

Prepared and Certified by:

Thomas D. Atwood, P.E.
Colorado Registration No. 22866

Figure No. 1
Sludge Pits Area



Appendix I-11

APPENDIX I-11

Secondary Oil Skimmer - SWMU No. 11 Summary

SWMU #11 Summary Report

Secondary Oil Skimmer
Ciniza Refinery
McKinley County, New Mexico

Prepared for:

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Prepared by:

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Job No. 98-205-03

April 23, 1998

1.0 EXECUTIVE SUMMARY

Practical Environmental Services, Inc. (PES) has been retained by Giant-Ciniza Refinery (Ciniza) to perform a visual inspection, data evaluation, and status assessment for the secondary oil skimmer located at the Ciniza Refinery, in McKinley County, New Mexico.

The secondary oil skimmer site was identified as a Solid Waste Management Unit (SWMU), and designated as SWMU #11, during a RCRA Facility Investigation (RFI) conducted at the refinery in the early 1990's. This investigation included soil sampling and analysis, detected organic contaminants, and recommended no further action (NFA).

In 1994, the Environmental Protection Agency Region VI Office (EPA) requested additional sampling at greater depth. Trace organic contaminants were again detected and remediation by natural attenuation was recommended.

This summary report for SWMU #11 has been prepared in conjunction with submittal of a Resource Conservation and Recovery Act (RCRA) Part B permit application covering post closure care of the Ciniza Refinery Land Treatment Unit. All investigative activities for SWMU #11 have been completed. This assessment is summarized as follows.

- ⇒ The secondary oil skimmer enclosure has been removed and is no longer present in the drainage ditch adjoining Evaporation No. 4.
- ⇒ Soil sampling and analysis was conducted during an initial site investigation and subsequent re-investigation at greater depth. Organic contaminants were detected in both investigations.
- ⇒ BTEX constituents have been detected at levels exceeding New Mexico corrective action levels.
- ⇒ Contaminated soil should be removed from the site and replaced with clean fill dirt prior to closure.

2.0 BACKGROUND

During 1987, a RCRA Facility Assessment was conducted at the Ciniza Refinery. This assessment identified various "units of concern" and recommended further evaluation. A RCRA Facility Investigation was subsequently conducted and the secondary oil skimmer site was identified as SWMU #11.

Applied Earth Sciences (AES) investigated the secondary oil skimmer site during the early 1990s. Soil samples were collected and analyzed. Organic contaminants, including BTEX constituents, were detected.

As a result of the investigation, AES recommended no further action for this SWMU. Results and recommendations were reported to the EPA in 1992.

In 1994, the EPA requested additional sampling at greater depth. Follow-up sampling and analysis again detected organic contaminants.

3.0 SITE LOCATION AND DESCRIPTION

SWMU #11 is located within the Ciniza Refinery's property boundary. This refinery is located on the north side of Interstate 40, approximately 17 miles east of Gallup, New Mexico. Within the refinery, SWMU #11 is located along the drainage ditch south of Evaporation Pond No. 5. See Figure No. 1 for location details.

The secondary oil skimmer site is a rectangular area measuring approximately 10 feet wide by 25 feet long, and centered over an earthen stormwater drainage ditch. Within this area, a steel box was previously installed and used to collect suspended oil and sediment from stormwater flowing through the ditch. This box was known as the secondary oil skimmer.

4.0 SITE INSPECTION

During the week of March 23, 1998, an on-site inspection was performed. Observations are noted as follows:

- The secondary oil skimmer box has been removed and is no longer present at the site.
- At the time of the inspection, no water was present in the ditch.
- Local soil in the vicinity of the secondary oil skimmer site presents as bentonitic clays and silts. Similar soil strata from a neighboring SWMU exhibited a hydraulic conductivity of less than 10^{-7} cm/sec.
- No soil staining or distressed vegetation was present at or in the vicinity of the secondary oil skimmer site.

5.0 DATA REVIEW

Soil samples from within the secondary oil skimmer site were collected and analyzed during the initial site investigation and subsequent re-sampling at greater depth.

In 1992, the initial site investigation collected samples at two locations and two depths; surface and 3 feet below ground surface. Trace VOCs and SVOCs were detected in three of four samples; of which, xylenes at 98 mg/kg and ethylbenzene at 15 mg/kg represented the highest detections. Most of the remaining constituents were detected in much lower concentrations, typically less than 5 mg/kg.

In 1994, a second round of sampling and analysis was conducted at two locations and depths of 6 and 10 feet below ground surface. Xylenes were detected in one sample at 5 mg/kg at a depth of 6 feet and 0.5 mg/kg at a depth of 10 feet.

State of New Mexico corrective action levels for BTEX in soil is 50 mg/kg total and 10 mg/kg of benzene. Four of six samples indicated BTEX constituents, the highest of which was over 100 mg/kg total; which is above the 50 mg/kg action level.

6.0 ASSESSMENT

Based on the site inspection and data review, the secondary oil skimmer site is assessed as follows.

- The secondary oil skimmer is no longer present in the drainage ditch. Oily stormwater no longer flows in the drainage ditch.
- Soil sampling and analysis has detected organic contaminants, primarily BTEX constituents, at the site. Significant contamination is localized to single "hot spot" underlying the former location of the skimmer box.
- Contaminated soil should be removed from the site and replaced with clean fill dirt prior to closure.

7.0 PROFESSIONAL ENGINEER'S CERTIFICATION

This summary report for SWMU #11 has been prepared under the direct supervision and control of a Registered Professional Engineer.

Client: Ciniza Refinery
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

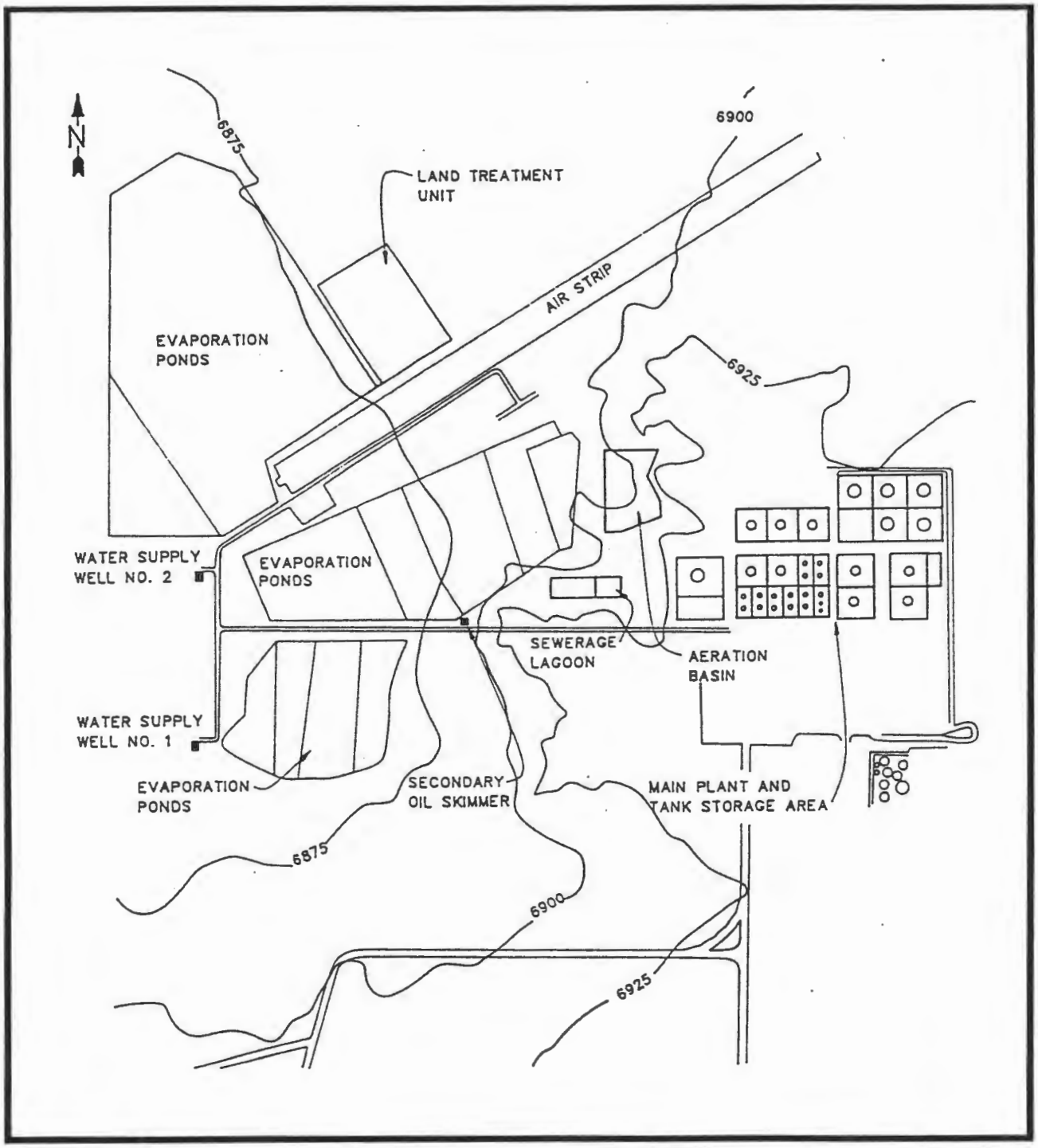
Job No.: 98-205-03

Date: April 23, 1998

Prepared and Certified by:

Thomas D. Atwood, P.E.
Colorado Registration No. 22866

Figure No. 1
Secondary Oil Skimmer Area



Appendix I-12

Appendix I-12

APPENDIX I-12

Contact Wastewater Collection System - SWMU No. 12 Summary

SWMU #12 Summary Report

Contact Wastewater Collection System

Ciniza Refinery
McKinley County, New Mexico

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1444 Wazee Street, Suite 225
Denver, Colorado 80202

Job No. 98-205-03

April 23, 1998

1.0 EXECUTIVE SUMMARY

Practical Environmental Services, Inc. (PES) has been retained by Giant-Ciniza Refinery (Ciniza) to perform a visual inspection, data evaluation, and status assessment for the contact wastewater collection system located within the Ciniza Refinery, in McKinley County, New Mexico.

The contact wastewater collection system was identified as a Solid Waste Management Unit (SWMU), and designated as SWMU #12, during a RCRA Facility Investigation (RFI) conducted at the refinery in the early 1990's. This investigation included a visual inspection of underground piping and catch basins, determined that no leakage had occurred, and recommended no further action (NFA).

In 1994, the Environmental Protection Agency Region VI Office (EPA) requested that inspections be performed every five years.

This summary report for SWMU #12 has been prepared in conjunction with submittal of a Resource Conservation and Recovery Act (RCRA) Part B permit application covering post closure care of the Ciniza Refinery Land Treatment Unit. This assessment is summarized as follows.

- ⇒ In 1992, a video camera inspection of the underground piping and catch basins was conducted. No indications of leakage were detected.
- ⇒ The stormwater collection system within the refinery was replaced in 1997. The process wastewater collection system is scheduled to be replaced during 1999.
- ⇒ Routine surveillance of the wastewater collection system is mandated as a condition of New Mexico Oil Conservation Division (NMOCD) Discharge Plan GW-032.

2.0 BACKGROUND

During 1987, a RCRA Facility Assessment was conducted at the Ciniza Refinery. This assessment identified various "units of concern" and recommended further evaluation. A RCRA Facility Investigation was subsequently conducted and the contact wastewater system was identified as SWMU #12.

Cook Construction Company conducted a comprehensive video surveillance of the contact wastewater collection system during 1992. All underground piping and catch basins were examined. No indications of leakage were detected.

As a result of the investigation, no further action was recommended for this SWMU. Results and recommendations were reported to the EPA in 1992. In 1994, the EPA requested that inspections be performed every five years.

3.0 SITE LOCATION AND DESCRIPTION

SWMU #12 is located within the Ciniza Refinery's property boundary. This refinery is located on the north side of Interstate 40, approximately 17 miles east of Gallup, New Mexico. Within the refinery, SWMU #12 is located predominantly within the process unit area and includes a main trunk line running to the API Separator. See Figure No. 1 for location details.

The contact wastewater collection system is a component of the refinery wastewater treatment system. It consists of a network of underground piping and catch basins which are located beneath various refinery processing units and used to collect process wastewater. This wastewater flows by gravity through the system and to the API separator.

This system was installed in 1957 when the refinery was constructed and has operated continuously since that time.

4.0 SITE INSPECTION

During the week of March 23, 1998, an on-site inspection was performed. Observations are noted as follows:

- The piping component of the contact wastewater collection system is located below grade and cannot be directly viewed. A representative number of catch basins were opened and inspected. No signs of waste accumulation, deterioration, or leakage were evident.

- Local soil in the vicinity of the contact wastewater system presents as bentonitic clays and silts. Similar soil strata from a neighboring SWMU exhibited a hydraulic conductivity of less than 10^{-7} cm/sec.

5.0 DATA REVIEW

Soil sampling and analysis was not performed at this site.

6.0 ASSESSMENT

Based on the site inspection and data review, the railroad rack lagoon area is assessed as follows.

- The contact wastewater collection system is scheduled for replacement in 1999. At that time, subsurface soil will be exposed for inspection. If contaminated soil is detected, it should excavated and removed prior to installation of the new piping and catch basins.

7.0 PROFESSIONAL ENGINEER'S CERTIFICATION

This summary report for SWMU #12 has been prepared under the direct supervision and control of a Registered Professional Engineer.

Client: Ciniza Refinery
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

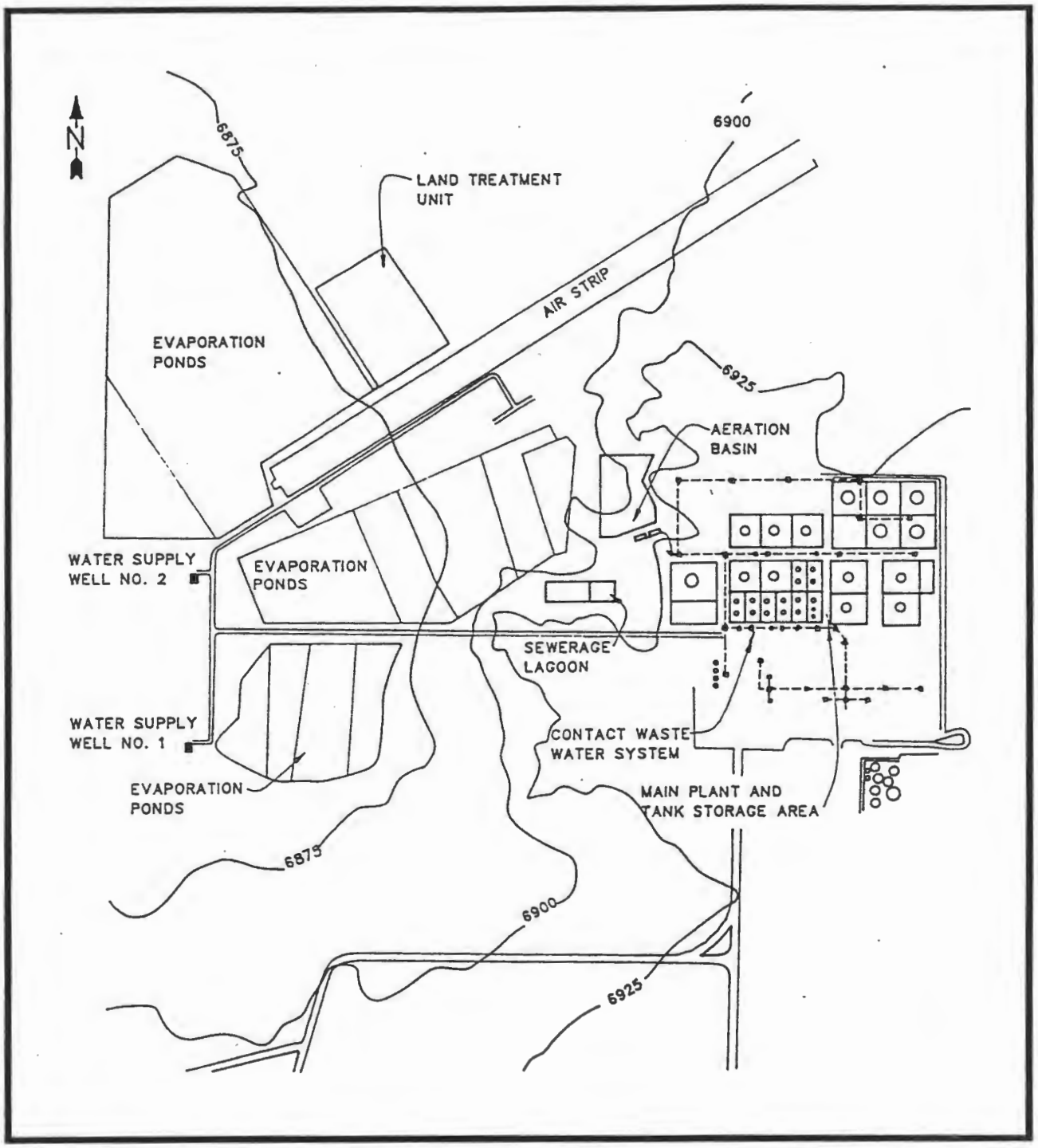
Job No.: 98-205-03

Date: April 23, 1998

Prepared and Certified by:

Thomas D. Atwood, P.E.
Colorado Registration No. 22866

Figure No. 1
Contact Wastewater Collection System



Appendix I-13

APPENDIX I-13

Drainage Ditch Between API Evaporation Ponds and Neutralization Tank Evaporation Ponds - SWMU No. 13 Summary

SWMU # 13 Summary Report

Drainage Ditch at Evaporation Ponds

Ciniza Refinery
McKinley County, New Mexico

Prepared for:

Ciniza Refinery
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

Prepared by:

Practical Environmental Services, Inc.
1444 Wazee Street, Suite 225
Denver, Colorado 80202

Job No. 98-205-03

April 23, 1998

1.0 EXECUTIVE SUMMARY

Practical Environmental Services, Inc. (PES) has been retained by Giant-Ciniza Refinery (Ciniza) to perform a visual inspection, data evaluation, and status assessment for the drainage ditch located at the evaporation ponds within the Ciniza Refinery, in McKinley County, New Mexico.

This drainage ditch site was identified as a Solid Waste Management Unit (SWMU), and designated as SWMU #13, during a RCRA Facility Investigation conducted at the refinery in the early 1990's. This investigation included soil sampling and analysis, determined that no significant impact had occurred, and recommended no further action (NFA).

In 1994, the Environmental Protection Agency Region VI Office (EPA) concurred in this finding, approved cessation of the investigative process, and requested follow-up soil monitoring. Monitoring samples were collected and analyzed in 1996, and the results confirmed that no significant impact has occurred.

This summary report for SWMU #13 has been prepared in conjunction with submittal of a Resource Conservation and Recovery Act (RCRA) Part B permit application covering post closure care of the Ciniza Refinery Land Treatment Unit. All investigative activities for SWMU #13 have been completed. This assessment is summarized as follows.

- ⇒ The drainage ditch located at the evaporation ponds continues in active service conveying wastewater to north area evaporation ponds.
- ⇒ Local soil underlying the drainage ditch predominantly consists of bentonitic clays and silts having a very low hydraulic conductivity.
- ⇒ Soil sampling and analysis was conducted during an initial site investigation and subsequent monitoring assessment. No organic contaminants were detected in any sample. Trace metals were detected within ambient background concentration. The site was recommended for NFA and approved by the EPA.
- ⇒ SWMU #13 has been characterized in accordance with current applicable state and federal regulations, and the available data indicate that no significant environmental impact or migration has occurred.

2.0 BACKGROUND

During 1987, a RCRA Facility Assessment was conducted at the Ciniza Refinery. This assessment identified various "units of concern" and recommended further evaluation. A RCRA Facility Investigation (RFI) was subsequently conducted and this drainage ditch site was identified as SWMU #13.

Applied Earth Sciences (AES) investigated this drainage ditch site during the early 1990s. Soil samples were collected and analyzed. No organic contaminants were detected in any sample. Trace metals were detected in all samples; all of which indicated levels within the range of ambient background concentration.

As a result of the investigation, AES recommended no further action for this SWMU. Results and recommendations were reported to the EPA in 1991. The EPA approved the NFA finding in 1994, with the added provision that on-going soil monitoring be performed every five years.

3.0 SITE LOCATION AND DESCRIPTION

SWMU #13 is located within the Ciniza Refinery's property boundary. This refinery is located on the north side of Interstate 40, approximately 17 miles east of Gallup, New Mexico. Within the refinery, SWMU #13 is located within the evaporation pond area and north of Evaporation Pond No. 2. See Figure No. 1 for location details.

The referenced drainage ditch is a component of the refinery wastewater treatment system. Effluent water from Evaporation Pond No. 10 is conveyed along the ditch and distributed to north area evaporation ponds.

SWMU #13 consists of a man-made earthen channel measuring approximately 20 feet wide by 120 feet long. Nominal water depth ranges from 1 to 4 feet. Total hydraulic holding capacity is approximately 50,000 gallons.

This drainage ditch was constructed in 1970's and has been in continuous operation since that time.

4.0 SITE INSPECTION

During the week of March 23, 1998, an on-site inspection was performed. Observations are noted as follows:

- The referenced drainage ditch was observed in active service conveying wastewater to north area evaporation ponds.
- Ditch sidewalls were visually inspected and found to be intact and stable. No erosion, damage, or sign of containment failure was observed.
- Native shrubs and grasses were observed growing around the perimeter of the ditch. No signs of distress were evident.
- Local soil in the vicinity of the drainage ditch presented as bentonitic clays and silts. Similar soil strata from a neighboring SWMU exhibited a hydraulic conductivity of less than 10^{-7} cm/sec.

5.0 DATA REVIEW

Soil samples from around the perimeter of the drainage ditch site were collected and analyzed during the initial site investigation and a subsequent monitoring assessment. Samples were collected at multiple locations and depths. Angled borings were made during the monitoring assessment to obtain samples from beneath the ditch.

In 1991, the initial site investigation collected samples from four locations and depths of 2 and 4 feet below ground surface. Analysis found no detection of VOCs or SVOCs in any sample. Trace metals were detected in all samples; all of which indicated levels within ambient background concentration.

In 1996, monitoring samples were collected at three locations at a depth of 6 feet below ground surface. As with the previous investigation, analysis found no detection of VOCs or SVOCs in any sample. Trace metals were detected in all samples; all of which indicated levels within ambient background concentration

6.0 ASSESSMENT

Based on the site inspection and data review, the aeration basins site is assessed as follows.

- The drainage ditch remains in active service conveying and distributing wastewater to north area evaporation ponds.
- The drainage ditch is located in a geologic setting in which the underlying bentonitic soil has a very low hydraulic conductivity which effectively serves as an aquiclude.
- The no further action finding that was recommended by AES and approved by the EPA is appropriate for this site.
- The next soil monitoring event is scheduled for 2001. If this sampling and analysis confirms previous findings, further monitoring is unnecessary and should be discontinued.

7.0 PROFESSIONAL ENGINEER'S CERTIFICATION

This summary report for SWMU #13 has been prepared under the direct supervision and control of a Registered Professional Engineer.

Client: Ciniza Refinery
Giant Refining Company
Route 3, Box 7
Gallup, New Mexico 87301

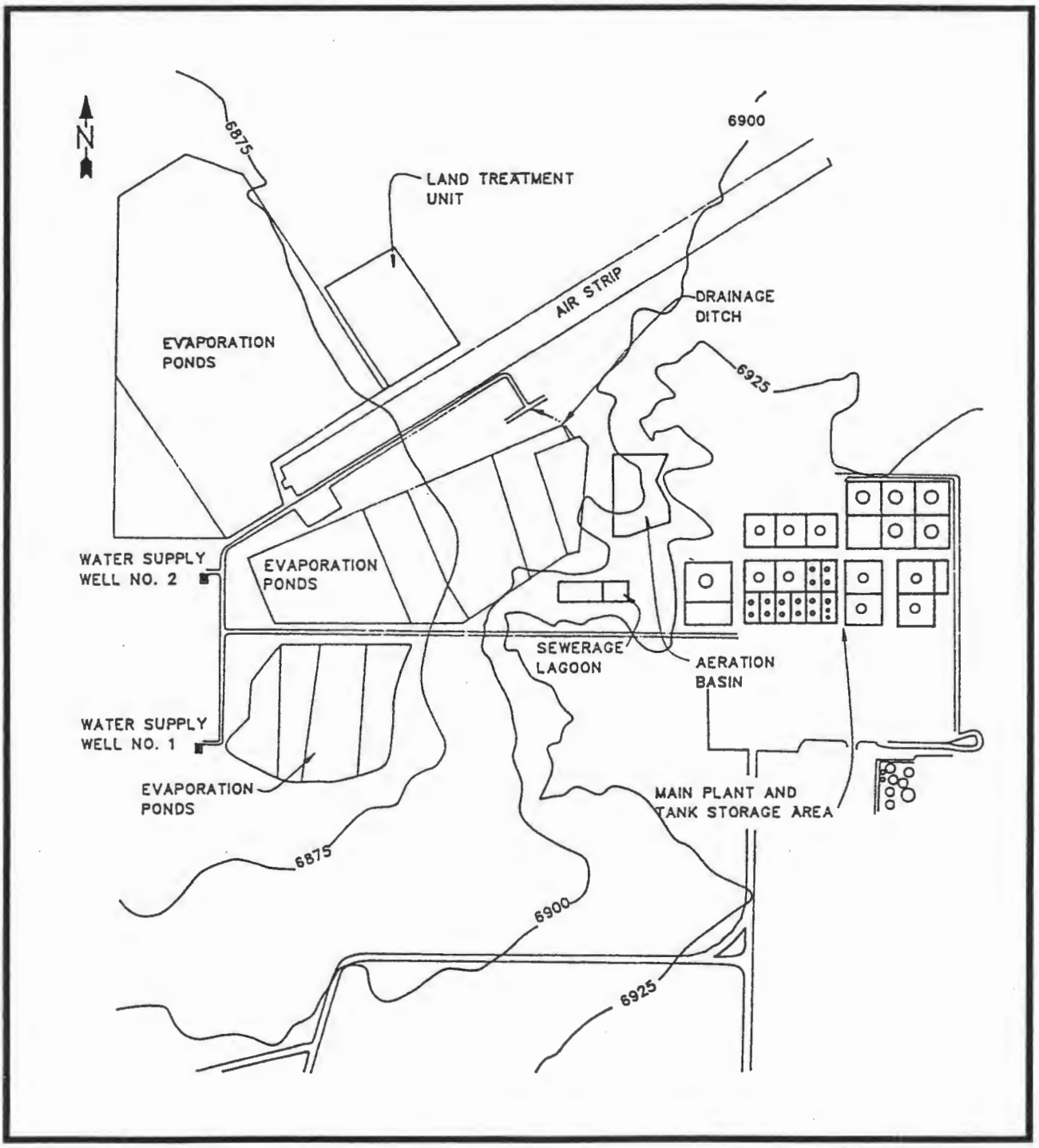
Job No.: 98-205-03

Date: April 23, 1998

Prepared and Certified by:

Thomas D. Atwood, P.E.
Colorado Registration No. 22866

Figure No. 13
Drainage Ditch Site



Appendix I-14

APPENDIX I-14

Old API Separator

Western Refining
GALLUP

WNR
LISTED
NYSE

February 5, 2010

CERTIFIED MAIL No. 7008 2810 0000 4726 2069

Hope Monzeglio
Hazardous Waste Bureau
New Mexico Environmental Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303

RE: **INVESTIGATION WORK PLAN SWMU No. 14 Old API SEPARATOR, WESTERN REFINING SOUTHWEST INC., GALLUP REFINERY; EPA ID #NMD000333211**

Dear Ms. Monzeglio,

Enclosed please find the Investigation Work Plan prepared by RPS for the SWMU No. 14 Old API Separator (OAPIS). The purpose of the site investigation is to determine and evaluate the presence, nature, and extent of releases of contaminants in accordance with 20.4.1.500 NMAC incorporating 40 CFR Section 264.101. The investigation activities will be conducted in accordance with Section IV.B.5 of the Post-Closure Care Permit.

Please feel free to contact me at 505-722-0217 with any questions.

Sincerely,

Ed Riege
Environmental Manager

cc: Carl Chavez OCD

I-40 Exit 39, Jamestown, New Mexico 87347 • 505 722-3833 • www.wnr.com
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RPS

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INVESTIGATION WORK PLAN
SWMU No. 14 Old API Separator

Gallup Refinery
Western Refining Southwest, Inc.
Gallup, New Mexico

EPA ID# NMD000333211

January 2010

Ed Riege
Environmental Manager
Western Refining Southwest, Inc.
Gallup Refinery

Scott T. Crouch, P.G.
Senior Consultant
RPS
404 Camp Craft Rd.
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Executive Summary

The Gallup Refinery, which is located 17 miles east of Gallup, New Mexico, has been in operation since the 1950s. Past inspections by State and federal environmental inspectors have identified locations where releases to the environment may have occurred. These locations are generally referred to as Solid Waste Management Units (SWMUs). Pursuant to the terms and conditions of the facility Post-Closure Care Permit and 20.4.1.500 New Mexico Administrative Code, this Investigation Work Plan has been prepared for the Old API Separator as directed by the New Mexico Environment Department (NMED) on April 15, 2009. Appendix A of the facility's Post-Closure Care Permit provides a list of designated SWMUs and the "API Separator" is listed as SWMU No. 14.

There are two API Separators, referred as "Old API Separator" and "New API Separator" to distinguish between the units. Additional discussion on the two separators is presented in Section 2.0 but this Investigation Work Plan is focused on the Old API Separator, which is planned to be removed from service after the new Wastewater Treatment Plant is demonstrated to be operational.

The planned investigation activities include collection of soil and ground water samples, which will be analyzed for potential site-related constituents. The analyses will include both volatile and semi-volatile organic constituents, petroleum hydrocarbons, Skinner List metals, and a few additional inorganic constituents as specified by NMED. Soil borings will be drilled around the perimeter of the Old API Separator with one of the borings completed as a permanent monitoring well. The specific sampling locations and sample collection procedures are discussed in more detail in Section 5.

Section 1
Introduction

The Gallup Refinery is located approximately 17 miles east of Gallup, New Mexico along the north side of Interstate Highway I-40 in McKinley County. The physical address is I-40, Exit #39 Jamestown, New Mexico 87347. The Gallup Refinery is located on 810 acres. Figure 1 presents the refinery location and the regional vicinity, which is characterized as high desert plain comprised primarily of public lands used for grazing by cattle and sheep.

The Gallup Refinery is a crude oil refinery currently owned by Western Refining Southwest, Inc. ("Western"), which is a wholly owned subsidiary of Western Refining Company. It is operated by Western Refining Southwest – Gallup Refinery. The refinery was most recently owned by Giant Refining Company. The Gallup Refinery generally processes crude oil from the Four Corners area transported to the facility by pipeline or tanker truck.

Various process units are operated at the facility, including crude distillation, reforming, fluidized catalytic cracking, alkylation, isomerization, sulfur recovery, merox treater, and hydrotreating. Current and past operations have produced gasoline, diesel fuels, jet fuels, kerosene, propane, butane, and residual fuel.

On August 17, 2000, the NMED issued a Post-Closure Care Permit ("Permit") to the former owner, Giant Refining Company. The Permit authorized the post-closure care at a hazardous waste land treatment unit and also includes corrective action provisions. Section IV.B.5.a. requires the Permitee to prepare and submit a RCRA Facility Investigation Work Plan after notice from the NMED that an RFI is required under Sections IV.B.4 or IV.b.2.d. On April 15, 2009, the NMED provided such notice to Western and requested a schedule for submittal of an investigation work plan to address releases from the Old API Separator.

This Investigation Work Plan has been prepared for the SWMU No. 14 Old API Separator (OAPIS). The location of the SWMU is shown on Figure 2, in the western portion of the refinery property. Photographs of the SWMU and the surrounding area are included in Appendix A.

The purpose of the site investigation is to determine and evaluate the presence, nature, and extent of releases of contaminants in accordance with 20.4.1.500 New Mexico Administrative Code (NMAC) incorporating 40 Code of Federal Regulations (CFR) Section 264.101. The investigation activities will be conducted in accordance with Section IV.B.5 of the Post-Closure Care Permit.

Section 2
Background

This section presents background information for the OAPIS, including a review of historical waste management activities to identify the following:

- Type and characteristics of all waste and all contaminants handled in the SWMU
- Known and possible sources of contamination
- History of releases and
- Known extent of contamination

The API Separator was not originally included as a SWMU in the 1988 Hazardous and Solid Waste Act (HSWA) permit or the subsequent 1990 RFI Work Plan. The "API Separator" was first added as a SWMU in the August 2000 Post-Closure Care Permit. There are two API Separators at the refinery as shown in Figure 2. The original separator, now referred to as the Old API Separator was put into service in 1957. The OAPIS initially only received process wastewater and in 1996 a stormwater sewer system was installed that also flowed to the OAPIS. A new API Separator was put into service in October 2004 and the process wastewater was redirected to the New API Separator. The intention was that only the stormwater sewer system would continue to be directed to the OAPIS.

After the wastewater flows were diverted to the New API Separator, all residual materials were removed from the OAPIS in October 2004. The material was removed using vacuum trucks and sent off-site for recycling at the NORCO refinery. The OAPIS was steam cleaned and sand blasted in preparation for inspection and repairs. The concrete was patched in numerous locations in both bays and the weir wall down-stream of the pipe skimmer was rebuilt on both bays. Stained soil (approx. 4,500 lbs) identified around the perimeter of the separator was removed and sent off-site for disposal as hazardous waste (K051).

In 2006, Western identified potential "dry weather" flows into the OAPIS and undertook an investigation of the sewer systems to determine if process wastewater was continuing to flow to the OAPIS. Flows from the OAPIS were directed to the New API Separator to ensure any potential process wastewaters entering the OAPIS were appropriately managed. A dye tracer study did not identify any cross-connections between the process wastewater and stormwater sewers. To help reduce the potential for process wastewater to flow to the OAPIS, numerous changes were made to both the stormwater drains and the process sewer drains in the summer of 2006.

The OAPIS is currently in service to handle stormwater flows but in spite of extensive efforts to eliminate dry weather flows, it appears that some dry weather flow still enters the unit. The discharge from the OAPIS is directed to the New API Separator to ensure appropriate treatment of any dry weather flow that may enter the OAPIS. A new wastewater treatment plant is planned for the Gallup Refinery and the OAPIS will no longer be required when the new treatment plant is put into operation.

The API Separator is the first step in the treatment process of the refinery's wastewater. Its purpose is to remove free oil and suspended solids from the wastewater prior to subsequent downstream treatment. An API Separator functions as a gravitational separation unit and is designed based on the difference in specific gravity of the oil to be separated and the wastewater. Three phases result in the separator, with oil at the top, wastewater in the middle and accumulated sediment in the bottom. The oil is constantly removed from the upper layer, wastewater flows through continuously, and the bottom sediment layer is periodically removed to ensure proper function of the separator. The material accumulating in the bottom of the OAPIS has been routinely removed once a year or more frequently, as necessary.

The material handled in the OAPIS has primarily been petroleum hydrocarbons, with a lesser potential for refinery catalyst and gasoline additives to enter the sewer systems. As the solids that accumulate in the bottom of the separator are routinely removed, the greatest potential for a release from the unit would be the liquid phase containing dissolved petroleum hydrocarbons. Liquids could leak from the unit along cracks in the below ground concrete structure or from piping that transfers liquids into and from the unit.

There have not been any documented historical releases from the OAPIS. As described above, some surface soils with hydrocarbon stains around the sides of the unit were removed but this was a limited volume of material that did not indicate a significant release.

There has not been an investigation of soils or ground water in the immediate vicinity of the OAPIS. There are existing monitoring wells in the general area, with two wells (GMW-1 and GWM-2) located along the down-gradient side of the aeration lagoons and also possibly down-gradient of the OAPIS and four monitoring wells near the New API Separator (NAPIS 1, NAPIS 2, NAPIS 3, and KA-3), which are cross-gradient to the OAPIS (Figure 2). Analyses of ground water samples collected at GWM-1 and NAPIS 2 have indicated only very low concentrations of constituents such as BTEX and methyl tertiary butyl ether (MTBE) that would indicate a

potential for historical releases in the area (Table 1). The fact that the well GMW-1 is located immediately adjacent to the aeration lagoons makes it impossible to determine if the impacts are from the lagoons or other possible up-gradient sources (e.g., the OAPIS) without additional ground water information.

It should be noted that a Corrective Measures Implementation Work Plan was recently submitted to the NMED for SWMU No. 1 Wastewater Aeration Lagoons, which includes a Scope of Work to conduct an investigation of environmental media around the aeration lagoons and the benzene strippers. The soil borings planned near the benzene strippers are shown on Figure 3. The results from these soils borings may also be useful in assessing any potential releases from the OAPIS.

Section 3
Site Conditions

The conditions at the site, including surface and subsurface conditions that could affect the fate and transport of any contaminants, are discussed below. This information is based on recent visual observations and historical subsurface investigations.

3.1 Surface Conditions

A topographic map of the area near the OAPIS is included as Figure 4. Local site topographic features include high ground in the southeast gradually decreasing to lowland fluvial plain in the northwest. Elevations on the refinery property range from 7,040 feet to 6,860 feet. The area of the site near the separator is at an approximate elevation of 6,920 feet above mean sea level (msl). The ground surface is nearly level with the top of the OAPIS on the south side of the unit with a drop of approximately three feet on the north side. The pictures in Appendix A show the land surface relative to the top of the OAPIS.

The soils in the immediate vicinity of the separator include two soil types. The McKinley County soil survey indicates that the soil type changes just north of the OAPIS. Surface soils to the north are primarily Rehobeth silty clay loam. The soils beneath the OAPIS are the Simitarq-Celavar sandy loams. Rehobeth soil properties include a pH ranging from 8 to 9 standard units and salinity typically measuring up to approximately 8 mmhos/cm. The Simitarq-Celevar soils are well drained with a conservative permeability of 0.20 in/hr and minimal salinity. Simitarq soils have nearly neutral pH values ranging from 7.2 to 7.4 standard units.

Regional surface water features include the refinery evaporation ponds and aeration lagoons and a number of small ponds. The site is located in the Rio Puerco valley, north of the Zuni Uplift with overland flows directed northward to the tributaries of the Rio Puerco. The Rio Puerco continues to the east to the confluence with the Rio Grande. The South Fork of the Puerco River is intermittent and retains flow only during and immediately following precipitation events.

3.2 Subsurface Conditions

The shallow subsurface soils consist of fluvial and alluvial deposits comprised of clay and silt with minor inter-bedded sand layers. Very low permeability bedrock (e.g., claystones and siltstones) underlie the surface soils and effectively form an aquitard. The Chinle Formation, which is Upper Triassic, crops out over a large area on the southern margin of the San Juan

Basin. The uppermost recognized local member is the Petrified Forest and the Sonsela Sandstone Bed is the uppermost recognized regional aquifer. Aquifer test of the Sonsela Bed northeast of Prewitt indicated a transmissivity of greater than 100 ft^2/day (Stone and others, 1983). The Sonsela Sandstone's highest point occurs southeast of the site and slopes downward to the northwest as it passes under the refinery. The Sonsela Sandstone forms a water-bearing reservoir with artesian conditions throughout the central and western portions of the refinery property.

The diverse properties and complex, irregular stratigraphy of the surface soils across the site cause a wide range of hydraulic conductivity ranging from less than 10^{-2} cm/sec for gravely sands immediately overlying the Chinle Formation to 10^{-8} cm/sec in the clay soils located near the surface (Western Refining, 2009). Generally, shallow ground water at the refinery follows the upper contact of the Chinle Formation with prevailing flow from the southeast to the northwest.

Three monitoring wells (KA-1, KA-2, and KA-3) were installed near the New API Separator in 2007. Wells KA-1 and KA-2 were plugged in 2008 and three new wells (NAPIS 1, NAPIS 2, and NAPIS 3) were installed near the New API Separator. The predominantly lithology of the materials overlying the Chinle Formation was logged as a sandy lean clay. The boring log for GMW-1, which is located immediately west of AL-2, indicated that clay was present from the land surface to a depth of 21.5 feet, where a sandy gravel extend from 21.5 feet to 24 feet at the top of a mudstone bedrock (Petrified Forest Member of the Chinle Formation).

A copy of the boring/monitoring well completion logs for GWM-1, KA-1, KA-2, KA-3, NAPIS 1 (KA-1R), NAPIS 2 (KA-2R), and NAPIS 3 (KA-3R) are provided in Appendix B. The occurrence of shallow ground water in the area is sporadic and temporal, as indicated with the absence of ground water in GWM-2 and GWM-3 during quarterly ground water gauging events.

Figure 5 shows a cross-section of the shallow subsurface based on borings logs from on-site monitoring well completions and Figure 5A shows the locations of the wells used in the cross-section. The uppermost aquifer is under water table conditions and occurs sporadically within the sand and gravel deposits that overlie the Chinle Formation. The next deeper laterally persistent aquifer occurs within the Sonsela Formation, where ground water is present under artesian conditions. The potentiometric surface as measured in August 2009 is presented as Figure 6 and shows the ground water flowing to the west-northwest. The water level data used to prepare Figure 6 is included in Table 2.

Section 4
Scope of Services

4.1 Anticipated Activities

Pursuant to Section IV.B.5.a. of the Post-Closure Care Permit, a scope of services was developed to determine the nature and extent of contamination and the potential pathways of contaminant releases to the air, soil, surface water, and ground water. To accomplish this objective, soil and ground water samples will be collected at SWMU No. 14 – OAPIS. The following activities will be completed:

- Three soil borings will be installed to a minimum depth of ten feet and soil samples will be collected from the intervals shown below in accordance with the procedures discussed in Section 5.2:
  - 0-0.5' (all borings);
  - 1.5-2.0' (all borings);
  - from the 6" interval at the top of saturation, if encountered;
  - the sample from each boring with the greatest apparent degree of contamination, based on field observations and field screening; and
  - any additional intervals as determined based on field screening results.
- If evidence of impacts in soils extends below ten feet, then soil borings will be drilled to a depth of five feet below the deepest evidence of impacts. If ground water is encountered, then a ground water sample will be collected from a temporary well completion.
- One of the soil borings on the north side of the OAPIS will be completed as a permanent monitoring well (Figure 7). The installation of a monitoring well and collection of ground water samples is discussed in Section 5.3.
- Soil samples from depths of 0-0.5' and 1.5-2.0' will be collected from five additional locations using a hand auger due to limited access and/or the potential to encounter underground utilities (Figure 7).
- The soil and ground water samples will be analyzed for volatile and semi-volatile organic constituents, petroleum hydrocarbons, Skinner List metals, iron, and manganese.

4.2 Analysis Background Information Research

Documents containing the results of previous investigations that explored the subsurface geology and ground water monitoring data from monitoring wells in the general area of the

OAPIS were reviewed to facilitate development of this work plan. The previously collected data provides information on the overall subsurface conditions, including hydrogeology and contaminant distribution within ground water on a site-wide basis. The data collected under this scope of services will supplement the existing ground water information and provide site-specific information regarding contaminant occurrence and distribution within soils and ground water.

4.3 Collection And Management Of Investigation Derived Waste

Drill cuttings, excess sample material and decontamination fluids, and all other investigation derived waste (IDW) associated with soil borings will be contained and characterized using methods based on the boring location, boring depth, drilling method, and type of contaminants suspected or encountered. All purged ground water and decontamination water will be characterized prior to disposal unless it is disposed in the refinery wastewater treatment system upstream of the New API Separator. An IDW management plan is included as Appendix C.

4.4 Surveys

The horizontal coordinates and elevation of the monitoring well casing, and the ground surface at the monitoring well location, and the locations of all other pertinent structures will be determined by a registered New Mexico professional land surveyor in accordance with the State Plane Coordinate System (NMSA 1978 47-1-49-56 (Repl. Pamp. 1993)). Alternate survey methods may be proposed in site-specific work plans. Any proposed survey method must be approved by the Department prior to implementation. The surveys will be conducted in accordance with Sections 500.1 through 500.12 of the Regulations and Rules of the Board of Registration for Professional Engineers and Surveyors Minimum Standards for Surveying in New Mexico. Horizontal positions will be measured to the nearest 0.1-ft and vertical elevations will be measured to the nearest 0.01-ft.

Section 5
Investigation Methods

The purpose of the site investigation is to determine and evaluate the presence, nature, and extent of releases of contaminants. Guidance on selecting and developing sampling plans as provided in *Guidance for Choosing a Sampling Design for Environmental Data Collection* (EPA, 2000) was utilized to select the appropriate sampling strategy.

5.1 Drilling Activities

Soil and monitoring well borings will be drilled using either hollow-stem auger or if necessary, air rotary methods including ODEX. The preferred method will be hollow-stem auger to increase the ability to recover undisturbed samples and potential contaminants. The drilling equipment will be properly decontaminated before drilling each boring. Shallow soil samples (0 – 2') will be collected at some locations using a hand auger.

The NMED will be notified as early as practicable if conditions arise or are encountered that do not allow the advancement of borings to the specified depths or at planned sampling locations. Appropriate actions (e.g., installation of protective surface casing or relocation of borings to a less threatening location) will be taken to minimize any negative impacts from investigative borings. If contamination is detected at the water table, then the boring will be drilled five feet below the water table or to refusal. The boring to be completed as a permanent monitoring well will be drilled to the top of bedrock (Chinle Formation) and the anticipated completion depth ranges from 20 to 30 feet. Soil samples will be collected continuously and logged by a qualified geologist or engineer. Slotted (0.01 inch) PVC well screen will be placed at the bottom of the well and will extend for 10 feet to ensure that the well is screened across the water table. A 10/20 sand filter pack will be installed to two feet over the top of the well screen.

The drilling and sampling will be accomplished under the direction of a qualified engineer or geologist who will maintain a detailed log of the materials and conditions encountered in each boring. Both sample information and visual observations of the cuttings and core samples will be recorded on the boring log. Known site features and/or site survey grid markers will be used as references to locate each boring prior to surveying the location as described in Section 4.4. The boring locations will be measured to the nearest foot, and locations will be recorded on a scaled site map upon completion of each boring.

5.2 Soil Sampling

As the greatest potential for releases from the OAPIS is from either overflows, cracks in the concrete or penetrations of the unit (e.g., pipeline connections), the proposed soil borings are located close to the perimeter of the unit and near associated piping. As there are known locations at which to target sample collection, a judgmental sampling design was selected (EPA, 2000).

The soil borings completed with a drilling rig will be drilled to a minimum depth of ten feet, or five feet below the deepest detected impacted media or waste material, whichever is deeper. Borings installed using a hand auger will be completed to a depth of two feet. A decontaminated split-barrel sampler or continuous five-foot core barrel will be used to obtain samples during the drilling of each boring. Surface samples may be collected using decontaminated, hand-held stainless steel sampling device, shelby tube, or thin-wall sampler, or a pre-cleaned disposable sampling device. A portion of the sample will be placed in pre-cleaned, laboratory-prepared sample containers for laboratory chemical analysis. The use of an Encore® Sampler or other similar device will be used during collection of soil samples for VOC analysis. The remaining portions of the sample will be used for logging and field screening as discussed in Section 5.2.1. Sample handling and chain-of-custody procedures will be in accordance with the procedures presented below in Section 5.4.

Discrete soil samples will be collected for laboratory analyses at the following intervals:

- 0-0.5' (all borings and hand auger locations);
- 1.5-2.0' (all borings and hand auger locations);
- From the 6" interval at the top of saturation, if encountered;
- The sample from each boring with the greatest apparent degree of contamination, based on field observations and field screening; and
- Any additional intervals as determined based on field screening results.

Quality Assurance/Quality Control (QA/QC) samples will be collected to monitor the validity of the soil sample collection procedures as follows:

- Field duplicates will be collected at a rate of 10 percent;
- Equipment blanks will be collected from all sampling apparatus at a frequency of 10 percent or one per day if disposable sampling equipment is used; and
- Field blanks will be collected at a frequency of one per day.

5.2.1 Soil Sample Field Screening and Logging

Samples obtained from the borings will be screened in the field on 2.5 foot intervals for evidence of impacts. Field screening results will be recorded on the exploratory boring logs. Field screening results will be used to aid in the selection of soil samples for laboratory analysis. The primary screening methods include: (1) visual examination, (2) olfactory examination, and (3) headspace vapor screening for volatile organic compounds. Additional screening for site- or release-specific characteristics such as pH or for specific compounds using field test kits may be conducted where appropriate.

Visual screening includes examination of soil samples for evidence of staining caused by petroleum-related compounds or other substances that may cause staining of natural soils such as elemental sulfur or cyanide compounds. Headspace vapor screening targets volatile organic compounds and involves placing a soil sample in a plastic sample bag or a foil sealed container allowing space for ambient air. The container will be sealed and then shaken gently to expose the soil to the air trapped in the container. The sealed container will be allowed to rest for a minimum of 5 minutes while vapors equilibrate. Vapors present within the sample bag's headspace will then be measured by inserting the probe of the instrument in a small opening in the bag or through the foil. The maximum value and the ambient air temperature will be recorded on the field boring or test pit log for each sample.

The monitoring instruments will be calibrated each day to the manufacturer's standard for instrument operation. A photo-ionization detector (PID) equipped with a 10.6 or higher electron volt (eV) lamp or a combustible gas indicator will be used for VOC field screening. Field screening results may be site- and boring-specific and the results may vary with instrument type, the media screened, weather conditions, moisture content, soil type, and type of contaminant, therefore, all conditions capable of influencing the results of field screening will be recorded on the field logs.

The physical characteristics of the samples (such as mineralogy, ASTM soil classification, moisture content, texture, color, presence of stains or odors, and/or field screening results), depth where each sample was obtained, method of sample collection, and other observations will be recorded in the field log by a qualified geologist or engineer. Detailed logs of each boring will be completed in the field by a qualified engineer or geologist. Additional information, such as the presence of water-bearing zones and any unusual or noticeable conditions encountered during drilling, will be recorded on the logs.

5.3 Ground Water Monitoring

5.3.1 Ground Water Levels

Ground water level and SPH thickness measurements will be obtained at the new monitoring well prior to purging in preparation for a sampling event. Measurement data and the date and time of each measurement will be recorded on a site monitoring data sheet. The depth to ground water and SPH thickness level will be measured to the nearest 0.01 ft. The depth to ground water and SPH thickness will be recorded relative to the surveyed well casing rim or other surveyed datum. A corrected water table elevation will be provided if the well contains SPH by adding 0.8 times the measured SPH thickness to the measured water table elevation.

5.3.2 Ground Water Sampling

One new permanent monitoring well will be completed at the location shown on Figure 7. The location was chosen to evaluate ground water quality immediately down-gradient of potential releases at the OAPIS. The new monitoring well will be developed within one week of completion. Ground water samples will be obtained no later than five days after the completion of well development.

5.3.3 Well Purging

The well will be purged by removing ground water with a dedicated bailer, disposable bailer or peristaltic pump prior to sampling in order to ensure that formation water is being sampled. Purge volumes (a minimum of three well volumes including filter pack) will be determined by monitoring, at a minimum, ground water pH, specific conductance, dissolved oxygen concentrations, oxidation-reduction potential, and temperature after each well volume has been purged from the well. Purging will continue, as needed, until the specific conductance, pH, and temperature readings are within 10 percent between readings for three consecutive measurements. The volume of ground water purged, the instruments used, and the readings obtained at each interval will be recorded on the field-monitoring log. Well purging may also be conducted in accordance with the NMED's Position Paper *Use of Low-Flow and other Non-Traditional Sampling Techniques for RCRA Compliant Groundwater Monitoring* (October 30, 2001, as updated).

5.3.4 Ground Water Sample Collection

Ground water samples will be collected within 24 hours of the completion of well purging using dedicated bailers or disposal bailers. Alternatively, well sampling may also be conducted in accordance with the NMED's Position Paper *Use of Low-Flow and other Non-Traditional*

Sampling Techniques for RCRA Compliant Groundwater Monitoring (October 30, 2001, as updated). Sample collection methods will be documented in the field monitoring reports. The samples will be transferred to the appropriate, clean, laboratory-prepared containers provided by the analytical laboratory. Sample handling and chain-of-custody procedures will be in accordance with the procedures presented below in Section 5.4.

Ground water samples intended for metals analysis will be submitted to the laboratory as total metals samples. QA/QC samples will be collected to monitor the validity of the ground water sample collection procedures as follows:

- Field duplicate water samples will be obtained at a frequency of ten percent, with a minimum, of one duplicate sample per sampling event;

- Field blanks will be obtained at a minimum frequency of one per day. Field blanks will be generated by filling sample containers in the field with deionized water and submitting the samples, along with the ground water samples, to the analytical laboratory for the appropriate analyses.

- Equipment rinsate blanks will be obtained for chemical analysis at the rate of ten percent or a minimum of one rinsate blank per sampling day. Equipment rinsate blanks will be collected at a rate of one per sampling day if disposable sampling equipment is used. Rinsate samples will be generated by rinsing deionized water through unused or decontaminated sampling equipment. The rinsate sample will be placed in the appropriate sample container and submitted with the ground water samples to the analytical laboratory for the appropriate analyses.

- Trip blanks will accompany laboratory sample bottles and shipping and storage containers intended for VOC analyses. Trip blanks will consist of a sample of analyte-free deionized water prepared by the laboratory and placed in an appropriate sample container. The trip blank will be prepared by the analytical laboratory prior to the sampling event and will be kept with the shipping containers and placed with other water samples obtained from the site each day. Trip blanks will be analyzed at a frequency of one for each shipping container of samples to be analyzed for VOCs.

5.4 Sample Handling

At a minimum, the following procedures will be used at all times when collecting samples during investigation, corrective action, and monitoring activities:

1. Neoprene, nitrile, or other protective gloves will be worn when collecting samples. New disposable gloves will be used to collect each sample;

2. All samples collected of each medium for chemical analysis will be transferred into clean sample containers supplied by the project analytical laboratory with the exception of soil, rock, and sediment samples obtained in Encore® samplers. Sample container volumes and preservation methods will be in accordance with the most recent standard EPA and industry accepted practices for use by accredited analytical

laboratories. Sufficient sample volume will be obtained for the laboratory to complete the method-specific QC analyses on a laboratory-batch basis; and

3. Sample labels and documentation will be completed for each sample following procedures discussed below. Immediately after the samples are collected, they will be stored in a cooler with ice or other appropriate storage method until they are delivered to the analytical laboratory. Standard chain-of-custody procedures, as described below, will be followed for all samples collected. All samples will be submitted to the laboratory soon enough to allow the laboratory to conduct the analyses within the method holding times. At a minimum, all samples will be submitted to the laboratory within 48 hours after their collection.

Chain-of-custody and shipment procedures will include the following:

1. Chain-of-custody forms will be completed at the end of each sampling day, prior to the transfer of samples off site.

2. Individual sample containers will be packed to prevent breakage and transported in a sealed cooler with ice or other suitable coolant or other EPA or industry-wide accepted method. The drainage hole at the bottom of the cooler will be sealed and secured in case of sample container leakage. Temperature blanks will be included with each shipping container.

3. Each cooler or other container will be delivered directly to the analytical laboratory.

4. Glass bottles will be separated in the shipping container by cushioning material to prevent breakage.

5. Plastic containers will be protected from possible puncture during shipping using cushioning material.

6. The chain-of-custody form and sample request form will be shipped inside the sealed storage container to be delivered to the laboratory.

7. Chain-of-custody seals will be used to seal the sample-shipping container in conformance with EPA protocol.

8. Signed and dated chain-of-custody seals will be applied to each cooler prior to transport of samples from the site.

9. Upon receipt of the samples at the laboratory, the custody seals will be broken, the chain-of-custody form will be signed as received by the laboratory, and the conditions of the samples will be recorded on the form. The original chain-of-custody form will remain with the laboratory and copies will be returned to the relinquishing party.

10. Copies of all chain-of-custody forms generated as part of sampling activities will be maintained on-site.

5.5 Decontamination Procedures

The objective of the decontamination procedures is to minimize the potential for cross-contamination. A designated decontamination area will be established for decontamination of drilling equipment, reusable sampling equipment and well materials. The drilling rig will be decontaminated prior to entering the site or unit. Drilling equipment or other exploration equipment that may come in contact with the borehole will be decontaminated by high pressure washing prior to drilling each new boring.

Sampling or measurement equipment, including but not limited to, stainless steel sampling tools, split-barrel or core samplers, non-dedicated well developing or purging equipment, ground water quality measurement instruments, and water level measurement instruments, will be decontaminated in accordance with the following procedures or other methods approved by the Department before each sampling attempt or measurement:

1. Brush equipment with a wire or other suitable brush, if necessary or practicable, to remove large particulate matter;
2. Rinse with potable tap water;
3. Wash with nonphosphate detergent or other detergent approved by the Department (examples include Fantastik™, Liqui-Nox®);
4. Rinse with potable tap water; and
5. Double rinse with deionized water.

All decontamination solutions will be collected and stored temporarily as described in Section 4.3. Decontamination procedures and the cleaning agents used will be documented in the daily field log.

5.6 Field Equipment Calibration Procedures

Field equipment requiring calibration will be calibrated to known standards, in accordance with the manufacturers' recommended schedules and procedures. At a minimum, calibration checks will be conducted daily, or at other intervals approved by the Department, and the instruments will be recalibrated, if necessary. Calibration measurements will be recorded in the daily field logs. If field equipment becomes inoperable, its use will be discontinued until the necessary repairs are made. In the interim, a properly calibrated replacement instrument will be used.

5.7 Documentation Of Field Activities

Daily field activities, including observations and field procedures, will be recorded in a field log book. The original field forms will be maintained at the Facility. Copies of the completed forms will be maintained in a bound and sequentially numbered field file for reference during field activities. Indelible ink will be used to record all field activities. Photographic documentation of field activities will be performed, as appropriate. The daily record of field activities will include the following:

1. Site or unit designation;
2. Date;
3. Time of arrival and departure;
4. Field investigation team members including subcontractors and visitors;
5. Weather conditions;
6. Daily activities and times conducted;
7. Observations;
8. Record of samples collected with sample designations and locations specified;
9. Photographic log, as appropriate;
10. Field monitoring data, including health and safety monitoring;
11. Equipment used and calibration records, if appropriate;
12. List of additional data sheets and maps completed;
13. An inventory of the waste generated and the method of storage or disposal; and
14. Signature of personnel completing the field record.

5.8 Chemical Analyses

All samples collected for laboratory analysis will be submitted to an accredited laboratory. The laboratory will use the most recent standard EPA and industry-accepted analytical methods for target analytes as the testing methods for each medium sampled. Chemical analyses will be performed in accordance with the most recent EPA standard analytical methodologies and extraction methods.

Ground water and soil samples will be analyzed by the following methods:

- SW-846 Method 8260 volatile organic compounds;
- SW-846 Method 8270 semi-volatile organic compounds; and
- SW-846 Method 8015B gasoline range (C5-C10), diesel range (>C10-C28), and motor oil range (>C28-C36) organics.

Ground water and soil samples will also be analyzed for the following metals using the indicated analytical methods.

Analyte	Analytical Method
Antimony	SW-846 method 6010/6020
Arsenic	SW-846 method 6010/6020
Barium	SW-846 method 6010/6020
Beryllium	SW-846 method 6010/6020
Cadmium	SW-846 method 6010/6020
Chromium	SW-846 method 6010/6020
Cobalt	SW-846 method 6010/6020
Cyanide	SW-846 method 335.4/335.2 mod
Lead	SW-846 method 6010/6020
Mercury	SW-846 method 7470/7471
Nickel	SW-846 method 6010/6020
Selenium	SW-846 method 6010/6020
Silver	SW-846 method 6010/6020
Vanadium	SW-846 method 6010/6020
Zinc	SW-846 method 6010/6020
Iron	SW-846 method 6010/6020
Manganese	SW-846 method 6010/6020

As discussed in section 5.3.3, field measurements will be obtained for pH, specific conductance, dissolved oxygen concentrations, oxidation-reduction potential, and temperature.

5.9 Data Quality Objectives

The Data Quality Objectives (DQOs) were developed to ensure that newly collected data are of sufficient quality and quantity to address the projects goals, including Quality Assurance/Quality Control (QA/QC) issues (EPA, 2006). The project goals are to determine and evaluate the presence, nature, and extent of releases of contaminants. The type of data required to meet the project goals includes chemical analyses of soil and ground water to determine if there has been a release of contaminants.

The quantity of data is based on the historical operations at the OAPIS. The quality of data that is required is consistent across samplings locations and in general, method detection limits should be 20% or less of the applicable background levels, cleanup standards and screening levels.

Additional DQOs include precision, accuracy, representativeness, completeness, and comparability. Precision is a measurement of the reproducibility of measurements under a given set of circumstances and is commonly stated in terms of standard deviation or coefficient of variation (EPA, 1987). Precision is also specific to sampling activities and analytical performance. Sampling precision will be evaluated through the analyses of duplicate field samples and laboratory replicates will be utilized to assess laboratory precision.

Accuracy is a measurement in the bias of a measurement system and may include many sources of potential error, including the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and analysis techniques (EPA, 1987). An evaluation of the accuracy will be performed by reviewing the results of field/trip blanks, matrix spikes, and laboratory QC samples.

Representativeness is an expression of the degree to which the data accurately and precisely represent the true environmental conditions. Sample locations and the number of samples have been selected to ensure the data is representative of actual environmental conditions. Based on SWMU specific conditions, this may include either biased (i.e., judgmental) locations/depths or unbiased (systematic grid samples) locations, as discussed in Section 5.2 for soils and 5.3.2 for ground water. In addition, sample collection techniques (e.g., purging of monitoring wells to collect formation water) will be utilized to help ensure representative results. An evaluation of on-going ground water monitoring results will be performed to assess representativeness.

Completeness is defined as the percentage of measurements taken that are actually valid measurements, considering field QA and laboratory QC problems. EPA Contract Laboratory Program (CLP) data has been found to be 80-85% complete on a nationwide basis and this has been extrapolated to indicate that Level III, IV, and V analytical techniques will generate data that are approximately 80% complete (EPA, 1987). As an overall project goal, the completeness goal is 85%; however, some samples may be critical base on location or field screening results and thus a sample–by-sample evaluation will be performed to determine if the completeness goals have been obtained.

Comparability is a qualitative parameter, which expresses the confidence with which one data set can be compared to another. Industry standard sample collection techniques and routine EPA analytical methods will be utilized to help ensure data are comparable to historical and future data. Analytical results will be reported in appropriate units for comparison to historical data and cleanup levels.

Section 6
Monitoring and Sampling Program

6.1 Ground Water Monitoring

After the initial investigation activities are completed, a second ground water sampling event will be conducted to confirm the initial ground water analyses for samples collected at the new permanent monitoring well. The ground water samples will be collected no sooner than 30 days after the initial sampling event and no later than 120 days after the initial sampling event. The samples will be analyzed for the same constituents for which the first samples were analyzed.

Any subsequent sampling events will be based on the results of the first two analyses and will be approved by the NMED prior to implementation.

Section 7
Schedule

This investigation Work Plan will be implemented within 90 days of demonstrating that the upgraded wastewater treatment system is achieving treatment criteria as specified in an approved Process Design Report for Wastewater Treatment Plant Workplan. The estimated timeframes for each of the planned activities is as shown below:

- Field work (inclusive of all soil and initial ground water sampling) -- four weeks;
- Laboratory analyses for initial sampling event – four weeks;
- Data reduction and validation (soils and initial ground water event) – three weeks;
- Second ground water sampling event – one week;
- Laboratory analyses for second ground water sampling event – three weeks;
- Data reduction and validation (second ground water event) – two weeks; and
- Data gap analysis – three weeks.

Completion of the data gap analysis will complete all activities conducted under this investigation Work Plan. Western will then prepare an Investigation Report that details the field collection procedures and presents the information collected during the investigation, including subsurface stratigraphy and results of chemical analyses. The analytical results will be presented in tables with applicable screening levels. The identification of data gaps will be discussed with recommendations for subsequent investigation, as necessary. The Investigation Report will be submitted to the NMED within 120 calendar days of completion of the data gap analysis.

Section 8
References

EPA, 1987, Data Quality Objectives for Remedial Response Activities; United States Environmental Protection Agency, Office of Emergency and Remedial Response and Office of Waste Programs Enforcement, OSWER Directive 9355.0-7B, 85p

EPA, 2000, Guidance on Choosing a Sampling Design for Environmental Data Collection, EPA/240/R-02/005, EPA QA/G-5S, 168 p.

EPA, 2006, Guidance on Systematic Planning Using the Data Quality Objectives Process, United States Environmental Protection Agency, Office of Environmental Information; EPA/240/B-06/001, p. 111.

Western Refining, 2009, Facility Wide Groundwater Monitoring Work Plan, Western Refining Company Southwest, Inc., p. 78.

Tables

TABLE 1
WESTERN REFINING - GALLUP REFINEY
HISTORICAL GROUND WATER MONITORING DATA

	Date Sampled	Benzene	Toluene	Ethylbenzene	Xylene	MTBE	Ba	Ca	Pb	Mg	K	Na	Fl	Cl	Nitrate + Nitrite as N	Orthophosphate (as P)	Sulfate	pH	Specific Conductance (umhos/cm)
GWM-1	7/27/2009	0.0089	0.002	0.0074	0.034	0.085	0.53	310	0.007	78	3.0	1300	2.1	1600	<4.0	<0.5	73	7.03	6200
	7/10/2008	0.011	0.0021	0.0039	0.019	0.12	0.45	350	0.01	3.6	3.3	1400	1.7	1800	<2.0	<0.5	110	6.92	7400
	5/24/2007	0.016	<0.001	<0.001	<0.0015	0.23	0.44	360	--	--	3.7	1300	1.9	1800	<2.0	<0.5	120	6.8	8100
	10/27/2006	0.012	<0.001	<0.001	<0.0015	0.16	0.53	380	--	--	4.2	1400	2	3700	<2.0	<2.5	120	6.87	--
NAPIS 1 (KA-1R)	8/11/2009	<0.001	<0.001	<0.001	<0.002	<0.001	0.11	56	<0.005	11	1.7	380	1.2	160	0.54	<0.5	93	7.67	1800
	5/28/2009	<0.001	<0.001	<0.001	<0.002	<0.0025	0.091	57	<0.005	11	<1.0	390	1.2	150	0.31	<0.5	71	7.82	1900
	3/24/2009	<0.001	<0.001	<0.001	<0.002	<0.0025	0.1	37	<0.005	12	<1.0	340	0.69	120	<1	<0.5	38	7.69	2000
	4/11/2008	<0.001	<0.001	<0.001	<0.002	<0.0025	--	72	--	13	1.5	370	0.79	170	0.55 <0.10	<0.50	80	7.26	2000
	7/9/2008	<0.001	<0.001	<0.001	<0.002	<0.0025	--	70	--	12	2.1	430	1.4	180	<1.0	<0.50	98	7.27	1900
	9/30/2008	<0.001	<0.001	<0.001	<0.002	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	11/10/2008	<0.001	<0.001	<0.001	<0.002	<0.0025	0.13	51		14	1.2	390	0.73	160	1.6 <0.10	<0.50	63	7.3	1900
NAPIS 2 (KA-2R)	8/11/2009	0.057	<0.01	0.022	<0.02	0.089	0.94	57	<0.005	11	<1.0	300	1.7	250	<0.1	<0.5	17	7.56	1500
	5/28/2009	0.028	<0.005	0.0053	<0.01	0.13	0.65	57	<0.005	9.9	<1.0	290	1.7	210	0.16	<0.5	22	7.51	1400
	3/24/2009	0.019	0.011	0.0081	<0.002	0.09	0.76	53	--	10	<1.0	280	1.5	240	<1	<0.5	23	7.47	1800
	4/11/2008	0.91	0.019	0.051	0.12	0.32	--	110	--	19	1.3	380	0.92	360	<0.10 <1.0	<0.50	42	7	2100
	7/9/2008	0.013	<0.001	0.011	0.0056	0.2	--	70	--	13	<0.001	360	1.1	270	<1.0	<0.50	33	7.18	2000
	9/30/2008	0.016	<0.001	0.0016	0.0041	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	11/10/2008	0.025	<0.001	0.011	<0.002	0.18	0.42	50	0.0065	9.7	--	330	1.4	200	<0.1	<0.50	32	7.21	1600
NAPIS 3 (KA-3R)	8/31/2009	<0.001	<0.001	<0.001	<0.002	<0.0025	0.092	39	<0.005	6.4	4	870	0.47	1000	14	<0.5	<10	8.07	4000
	6/15/2009	<0.001	<0.001	<0.001	<0.002	<0.0025	0.14	49	<0.005	6.8	4.2	840	0.46	1200	18	<0.5	330	8.23	4200
	3/25/2009	<0.001	<0.001	<0.001	<0.002	<0.0025	0.13	47	<0.005	6.5	3.9	880	0.43	1200	<1	<0.5	340	8.11	5200
	7/9/2008	<0.001	<0.001	<0.001	<0.002	<0.0025	--	65		7.8	4.1	910	0.46	1100	9.1	<0.50	270	8.29	4200
	9/30/2008	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	11/10/2008	<0.001	<0.001	<0.001	<0.002	<0.0025	0.13	41		6.6	4.4	960	1.1	1100	2.6 <1.0	<0.50	310	8.05	4300
KA-3	8/31/2009	<0.001	<0.001	<0.001	<0.002	0.17	0.22	53	<0.005	8.9	0.73	330	2.4	230	<2	<0.5	50	7.58	1500
	5/28/2009	0.0033	0.0012	<0.001	<0.002	0.13	0.29	71	<0.005	11	<1.0	330	1.6	260	0.22	<0.5	66	7.71	1700
	3/25/2009	<0.001	<0.001	<0.001	<0.002	0.11	0.22	67	0.0055	10	--	360	1.5	340	0.9	<0.5	76	7.64	2400
	11/10/2008	<0.001	<0.001	<0.001	<0.002	0.13	0.2	65	0.0095	11	1.8	570	0.46	590	11 2.0	<0.50	140	7.34	2700
EPA MCLS		0.005	1	0.7	10	--	2	--	0.015	--	--	--	4	--	Nitrate-10, Nitrite-1	--	--	--	--
NMED WQCC Standard		0.01	0.75	0.75	0.62	--	1	--	0.05	--	--	--	1.6	250	10	--	600	--	--

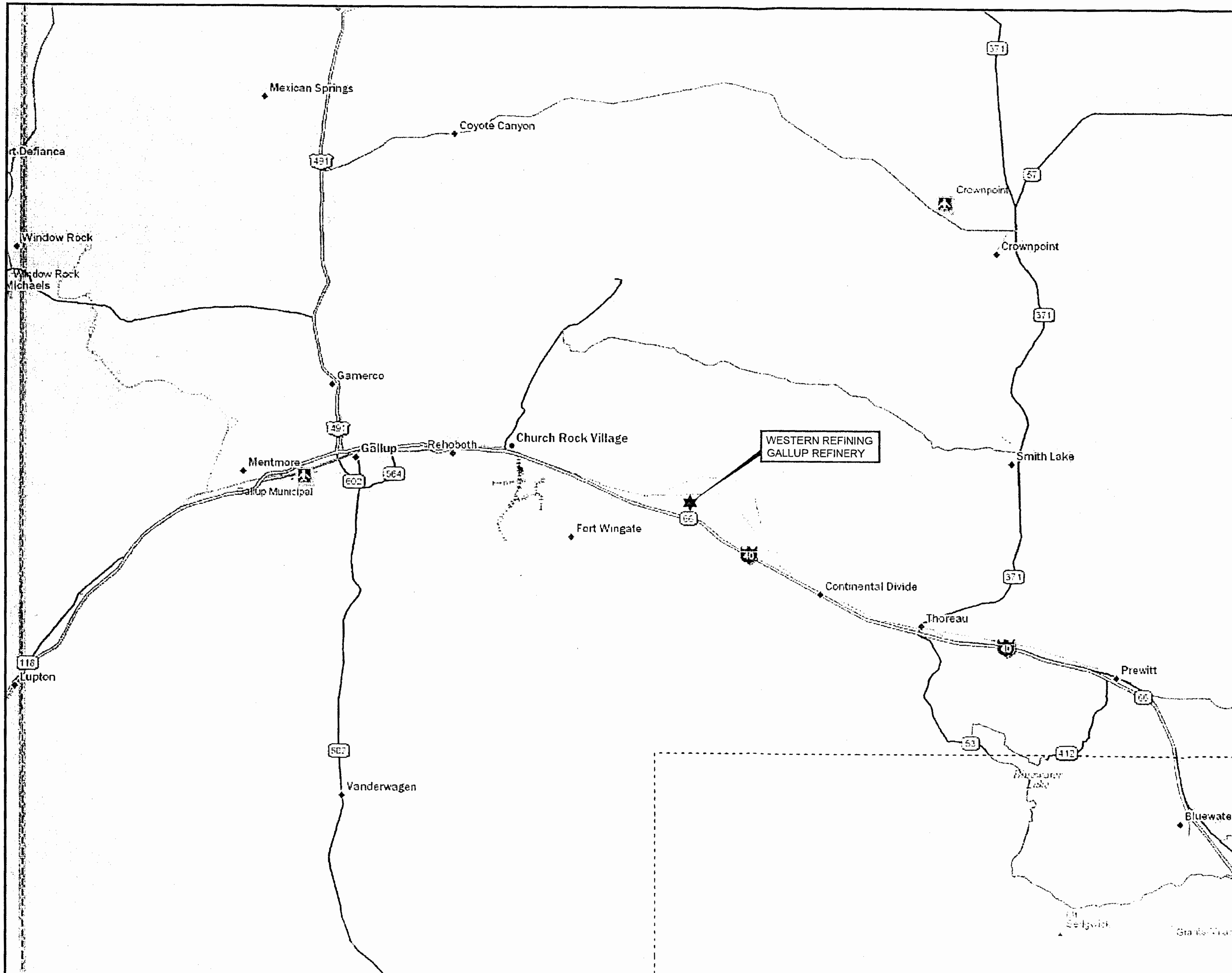
* - limited chemical analyses – not enough water in well for testing after purging.
-- No data or screening level available
All concentrations reported in units of mg/l except for pH and specific conductance

TABLE 2
WESTERN REFINING - GALLUP REFINERY
WATER LEVEL MEASUREMENTS

Well	Date	Top of Casing (ft-msl)	Depth to Bottom (ft)	Depth to Product (ft)	Depth to Water (ft)	Groundwater Elevation (ft-msl)	Product Thickness (ft)
GWM-1	8/10/2009	6912.65	NM	NPP	20.32	6892.33	0
GMW-2	8/10/2009	6913.17	19.07	NPP	DRY	--	0
GMW-3	8/10/2009	6912.65	18.05	NPP	DRY	--	0
NAPIS 1 (KA-1R)	8/31/2009	6918.43	13.76	NPP	9.06	6909.37	0
NAPIS 2 (KA-2R)	8/31/2009	6917.27	13.84	NPP	9.39	6907.88	0
NAPIS 3 (KA-3R)	8/31/2009	6917.31	30.7	NPP	8.39	6908.92	0
KA-3	8/31/2009	6917.17	25	NPP	9.36	6907.81	0
OW-1	8/10/2009	6868	NM	NPP	1.86	6866.14	0
OW-10	8/10/2009	6872	NM	NPP	2.67	6869.33	0

NPP - no product present
NM - not measured

Figures



Map Source: DeLorme Street Atlas USA 2007 Plus.

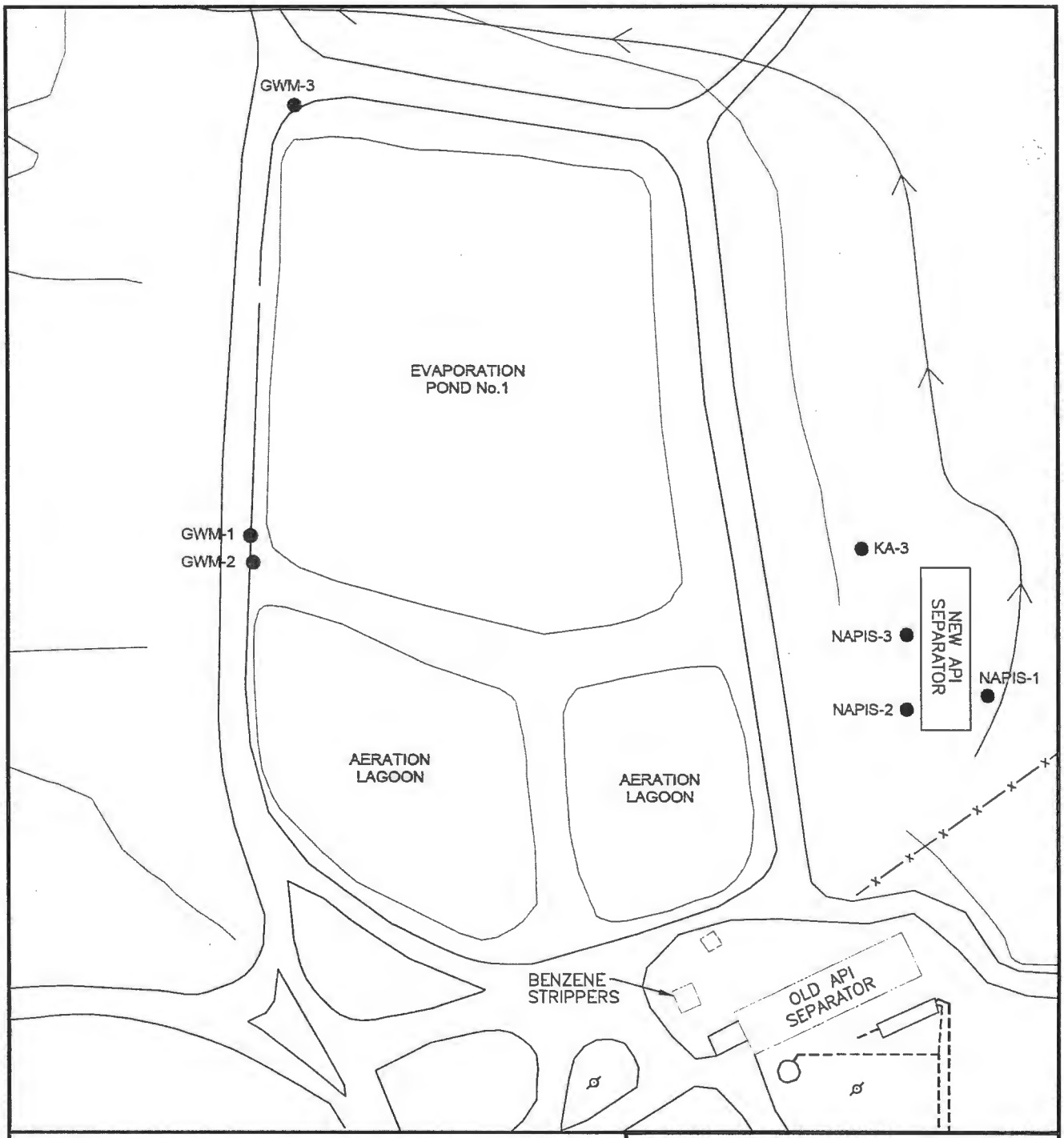
0 5
SCALE IN MILES

Western Refining
GALLUP REFINERY

PROJ. NO.: Western Refining	DATE: 11/10/09	FILE: WestRef–B47

FIGURE 1
SITE LOCATION MAP
GALLUP REFINERY

RPS
404 Camp Craft Road
Austin, Texas 78746



Map Source: Compiled by Photogrammetric Methods from Photography Acquired on March 1, 1998.

LEGEND

GWM-1 ● MONITORING WELL LOCATION

- - - - - - - - PIPELINE

N

0 80

SCALE IN FEET

QUADRANGLE LOCATION

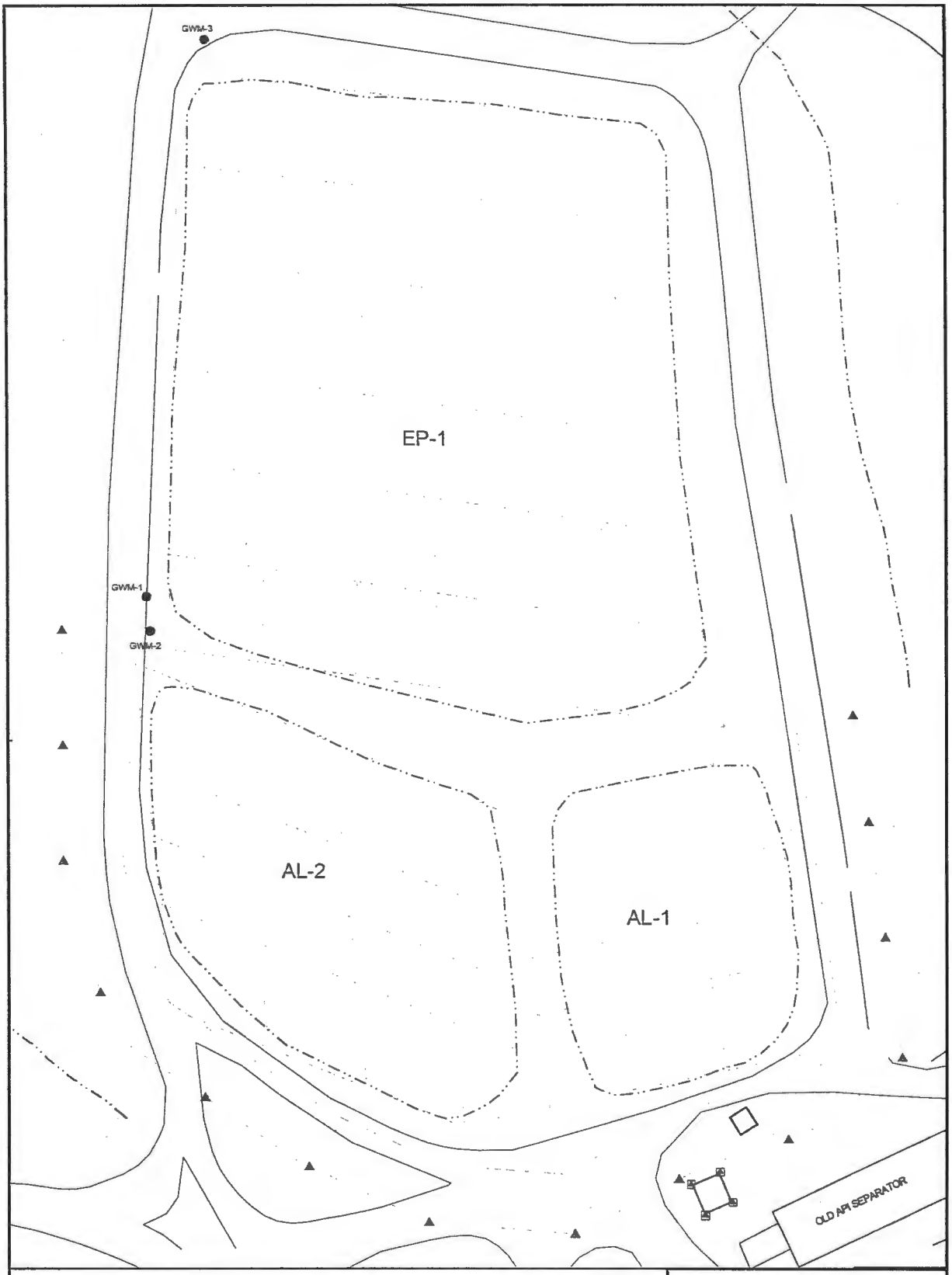
Western Refining
GALLUP REFINERY

PROJ. NO.: Western Refining	DATE: 11/10/09	FILE: WestRef-A36

FIGURE 2
SITE MAP
GALLUP REFINERY

RPS

404 Camp Craft Road
Austin, Texas 78746



Western Refining
GALLUP REFINERY

PROJ. NO.: Western Refining | DATE: 11/10/09 | FILE: WestRef-B46

FIGURE 3
PROPOSED SAMPLE LOCATIONS
FROM CMI WORK PLAN
GALLUP REFINERY

N

0 40
SCALE IN FEET

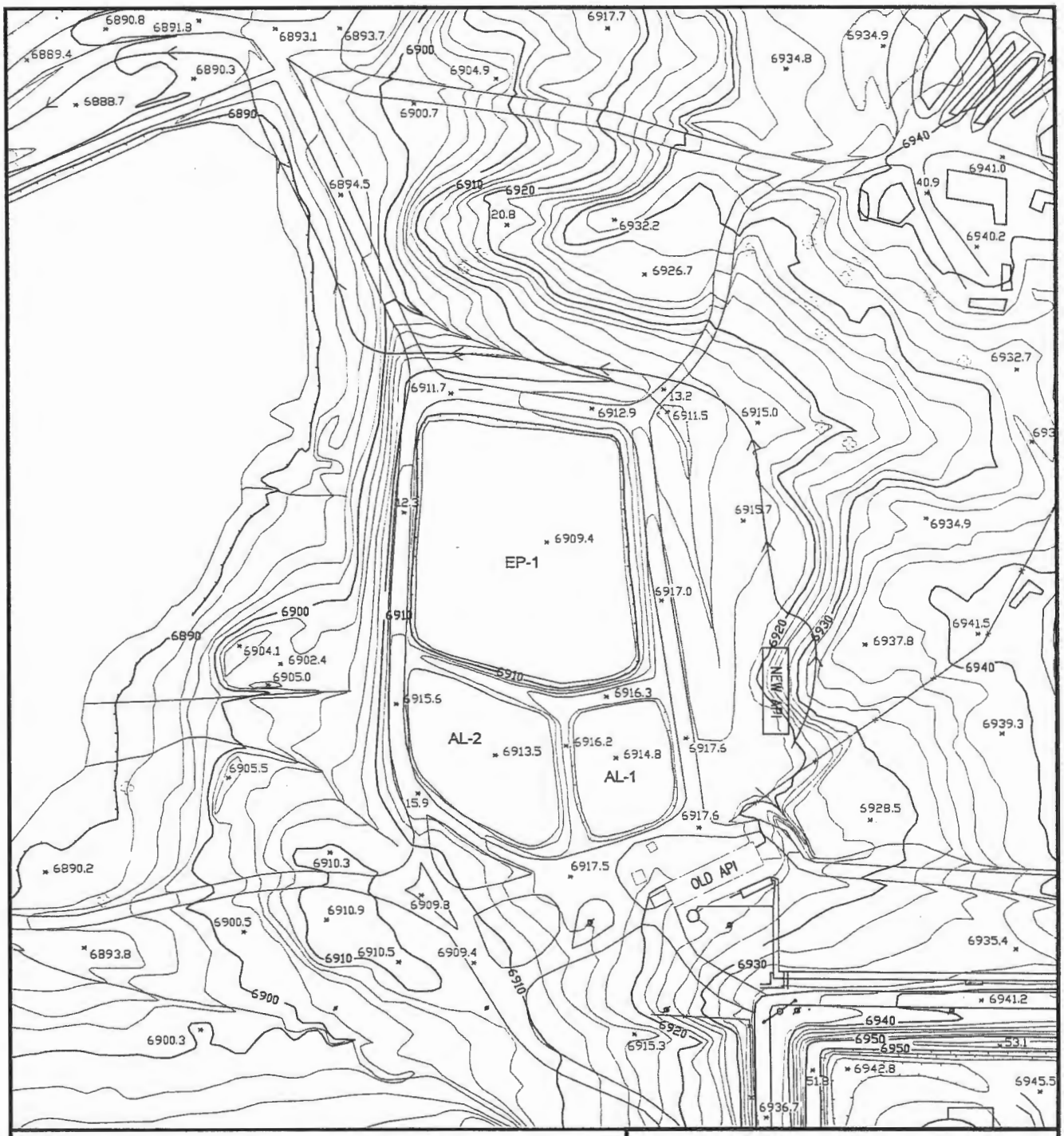
LEGEND

▲ SURROUNDING SOIL SAMPLE LOCATION [SURFACE (0-6"), SUBSURFACE (18-24")]

BENZENE STRIPPER UNIT SOIL SAMPLE LOCATION [SURFACE (0-6"), SUBSURFACE (18-24")]

GWM-1 ● GROUNDWATER WELL LOCATION

RPS
404 Camp Craft Road
Austin, Texas 78746



Map Source: Compiled by Photogrammetric Methods from Photography Acquired on March 1, 1998.

0 150
SCALE IN FEET

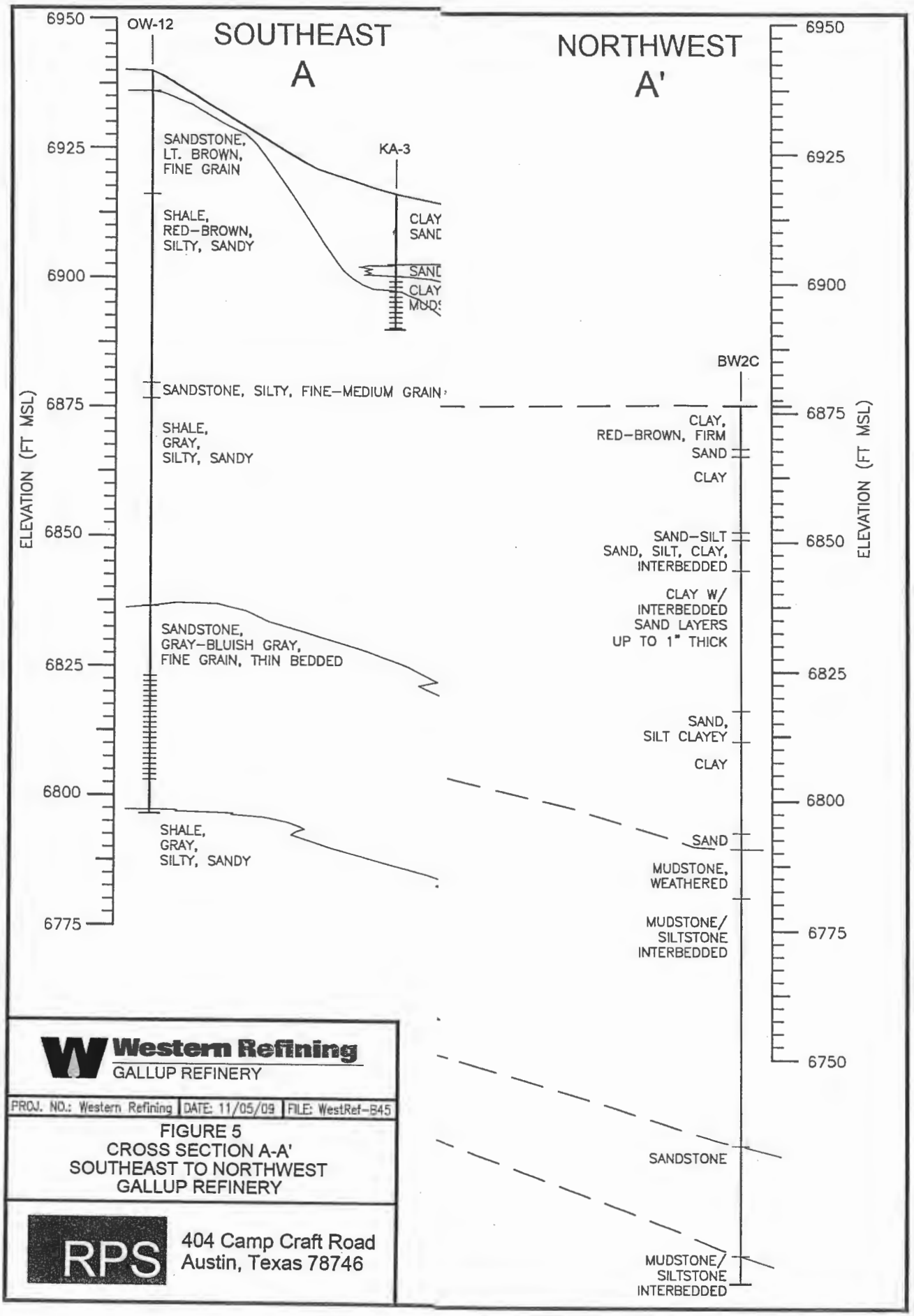
QUADRANGLE LOCATION

Western Refining
GALLUP REFINERY

PROJ. NO.: Western Refining	DATE: 11/10/09	FILE: WestRef-A35

FIGURE 4
TOPOGRAPHIC MAP
GALLUP REFINERY

RPS
404 Camp Craft Road
Austin, Texas 78746

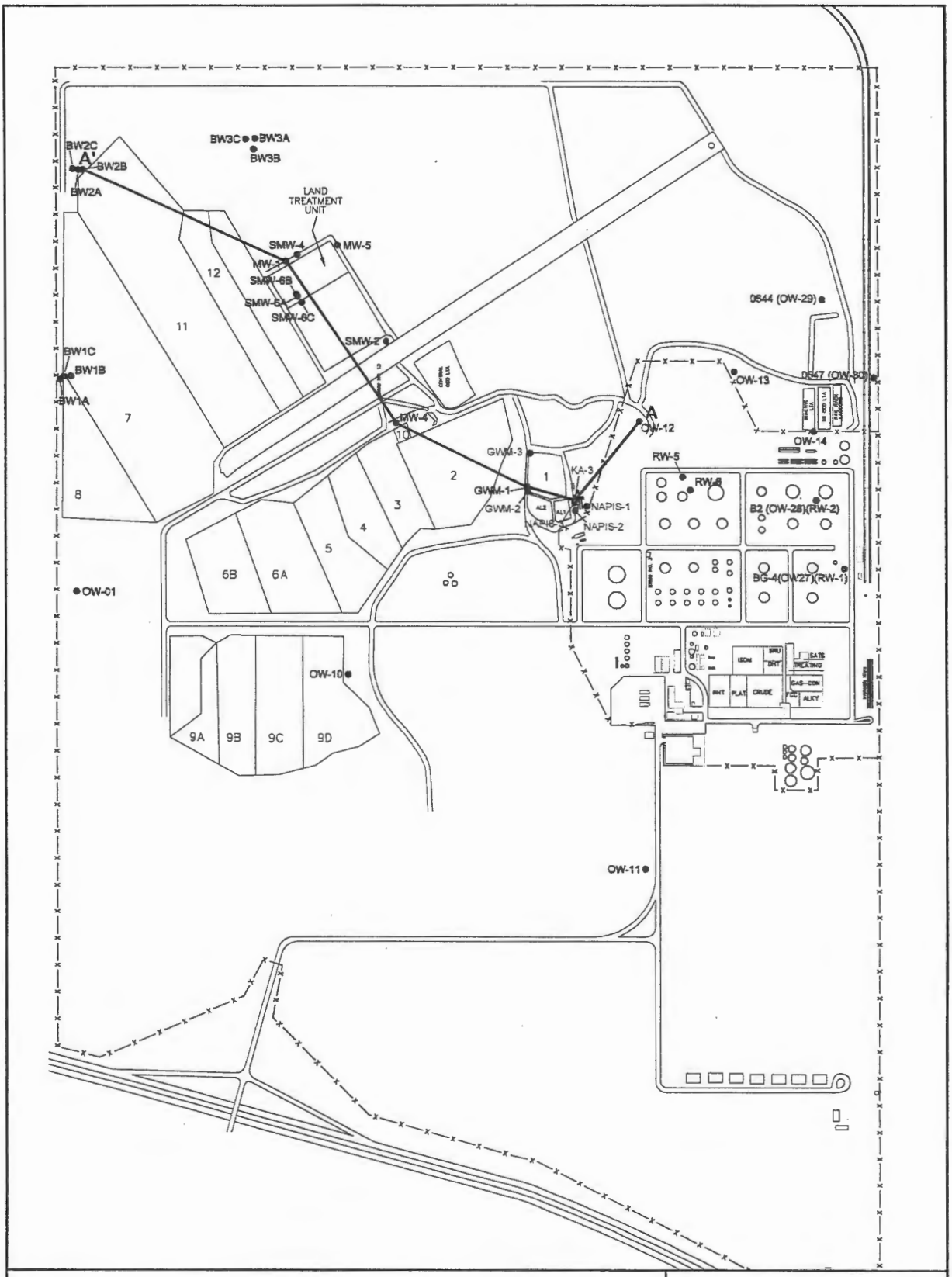


Western Refining
GALLUP REFINERY

PROJ. NO.: Western Refining	DATE: 11/05/09	FILE: WestRef-B45

FIGURE 5
CROSS SECTION A-A'
SOUTHEAST TO NORTHWEST
GALLUP REFINERY

RPS
404 Camp Craft Road
Austin, Texas 78746



Western Refining
GALLUP REFINERY

PROJ. NO.: Western Refining	DATE: 12/14/09	FILE: WestRef-B50

FIGURE 5A
CROSS SECTION LOCATION MAP
GALLUP REFINERY

N

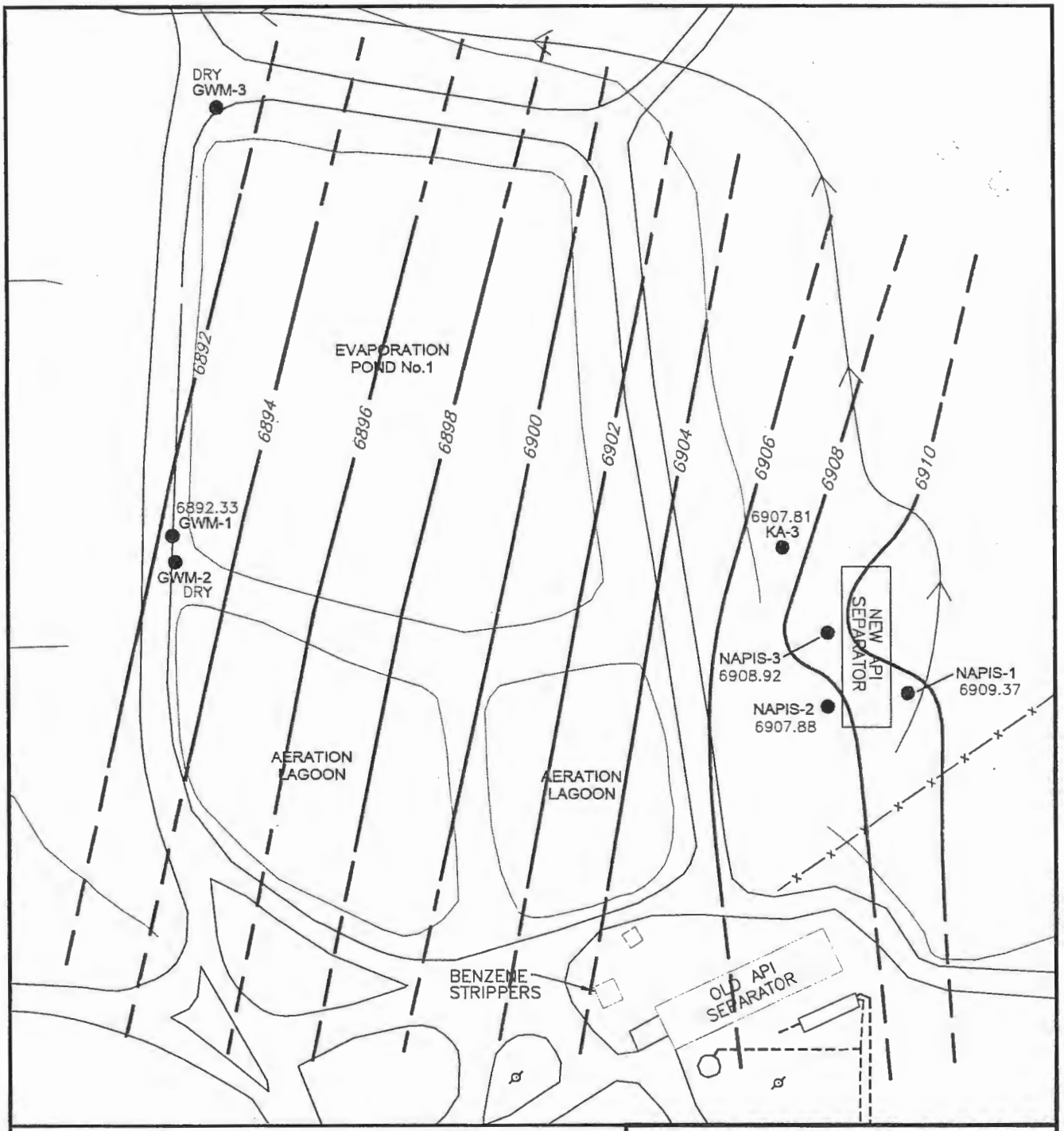
0 600
SCALE IN FEET

LEGEND

GWM-1 ● MONITORING WELL LOCATION

A ——— A' LINE OF CROSS SECTION

RPS 404 Camp Craft Road
Austin, Texas 78746



Map Source: Compiled by Photogrammetric Methods from Photography Acquired on March 1, 1998.

Western Refining
GALLUP REFINERY

PROJ. NO.: Western Refining	DATE: 12/12/09	FILE:WestRef–A40

FIGURE 6
POTENTIOMETRIC SURFACE MAP
GALLUP REFINERY

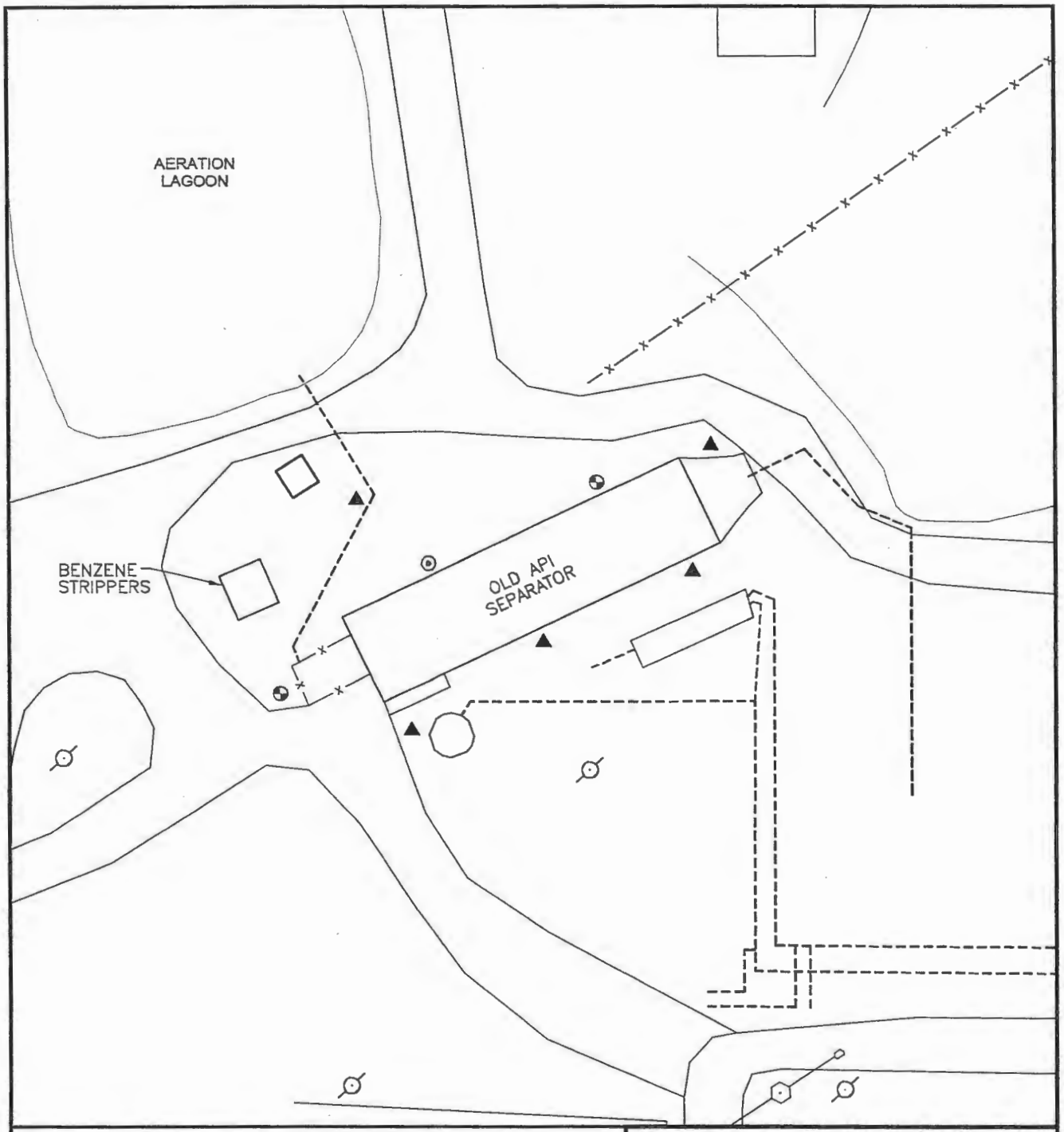
LEGEND

GWM-1 ●	MONITORING WELL LOCATION
—6894—	POTENTIOMETRIC SURFACE CONTOUR (ABOVE MSL)
6907.81	POTENTIOMETRIC SURFACE (MEASURED AUGUST 2009, ABOVE MSL)
- - - - - - - -	PIPELINE

N

0 80
SCALE IN FEET

RPS
404 Camp Craft Road
Austin, Texas 78746



Map Source: Compiled by Photogrammetric Methods from Photography Acquired on March 1, 1998.

LEGEND

- PROPOSED MONITORING WELL LOCATION
- PROPOSED SOIL BORING LOCATION
- HAND AUGER LOCATION
- PIPELINE

N

0 40
SCALE IN FEET

NEW MEXICO

QUADRANGLE LOCATION

Western Refining
GALLUP REFINERY

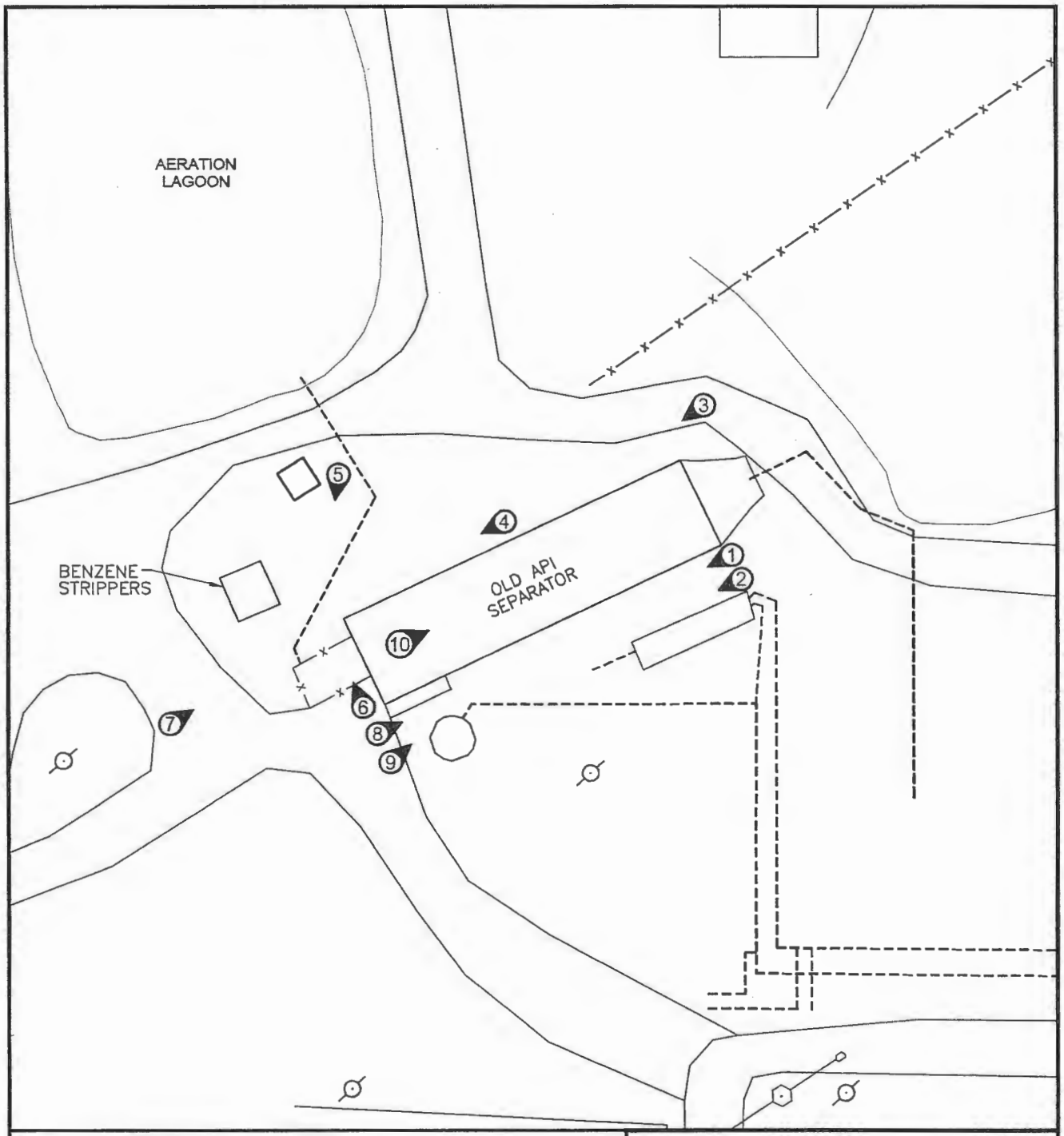
PROJ. NO.: Western Refining	DATE: 11/10/09	FILE: WestRef-A37

FIGURE 7
PROPOSED SAMPLE LOCATIONS
GALLUP REFINERY

RPS
404 Camp Craft Road
Austin, Texas 78746

Appendix A

Photographs



Map Source: Compiled by Photogrammetric Methods from Photography Acquired on March 1, 1998.

LEGEND

1 PHOTO LOCATION AND DIRECTION

PIPELINE

N

0 40

SCALE IN FEET

NEW MEXICO

QUADRANGLE LOCATION

Western Refining

GALLUP REFINERY

PROJ. NO.: Western Refining	DATE: 12/12/09	FILE: WestRef-A39

PHOTO LOCATIONS
GALLUP REFINERY

RPS

404 Camp Craft Road
Austin, Texas 78746

Photo 1
Looking west at south side of OAPIS.

Photo 2
Close-up of the south side of OAPIS, looking west.

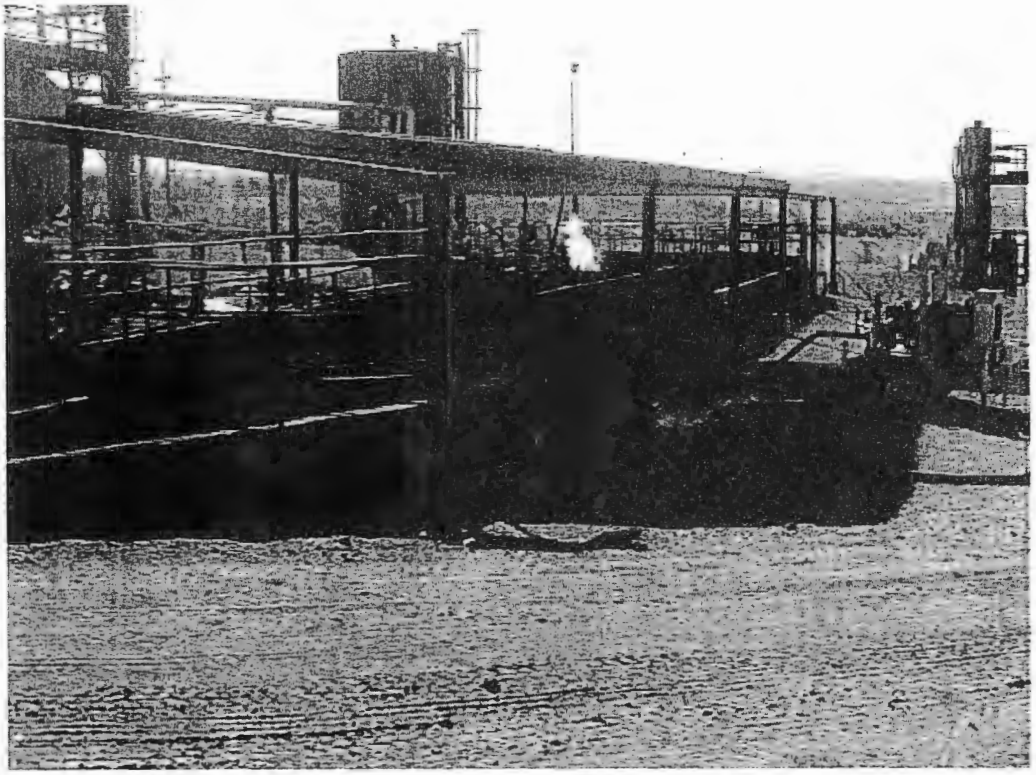


Photo 3
From northwest of OAPIS, looking west.

Photo 4
From north side of OAPIS, looking west at benzene strippers.

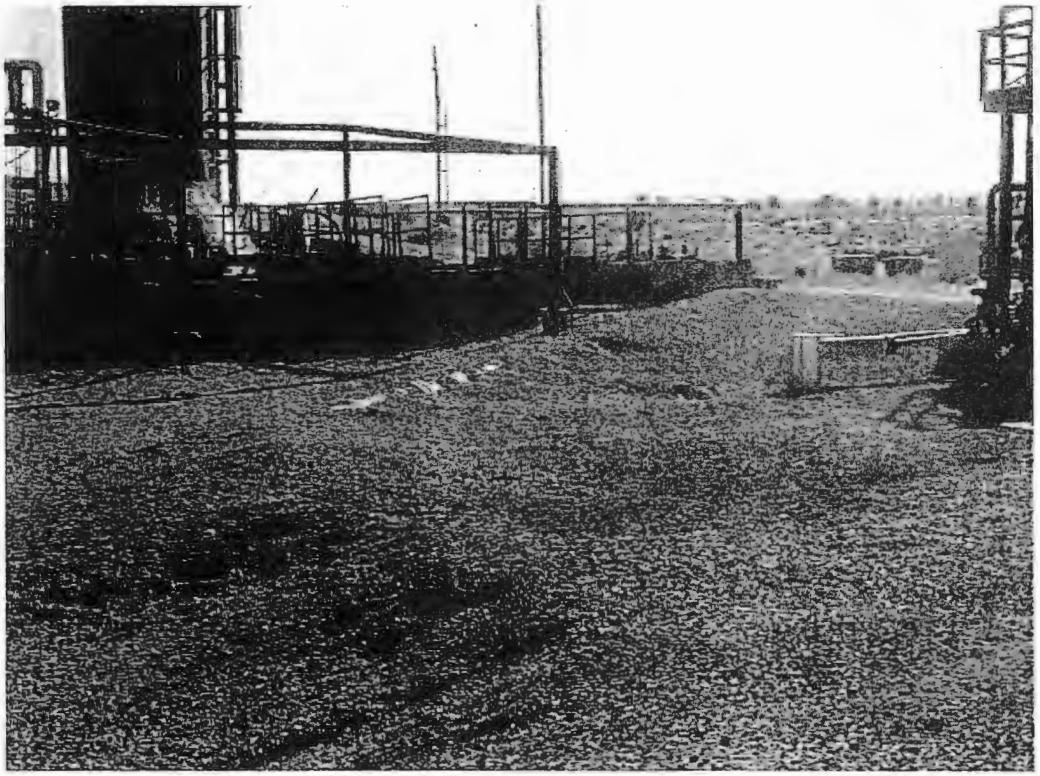


Photo 5
From north side of OAPIS, looking southwest along pipeline from OAPIS to aeration lagoon AL-1.

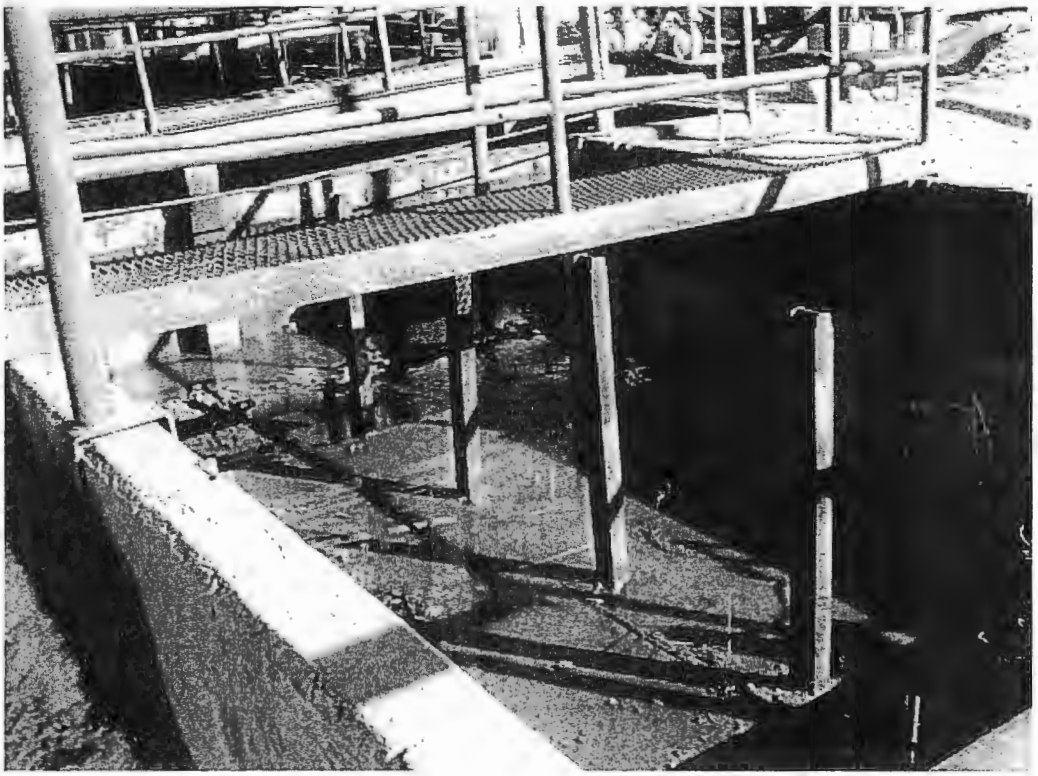


Photo 6
Looking inside western portion of OAPIS.

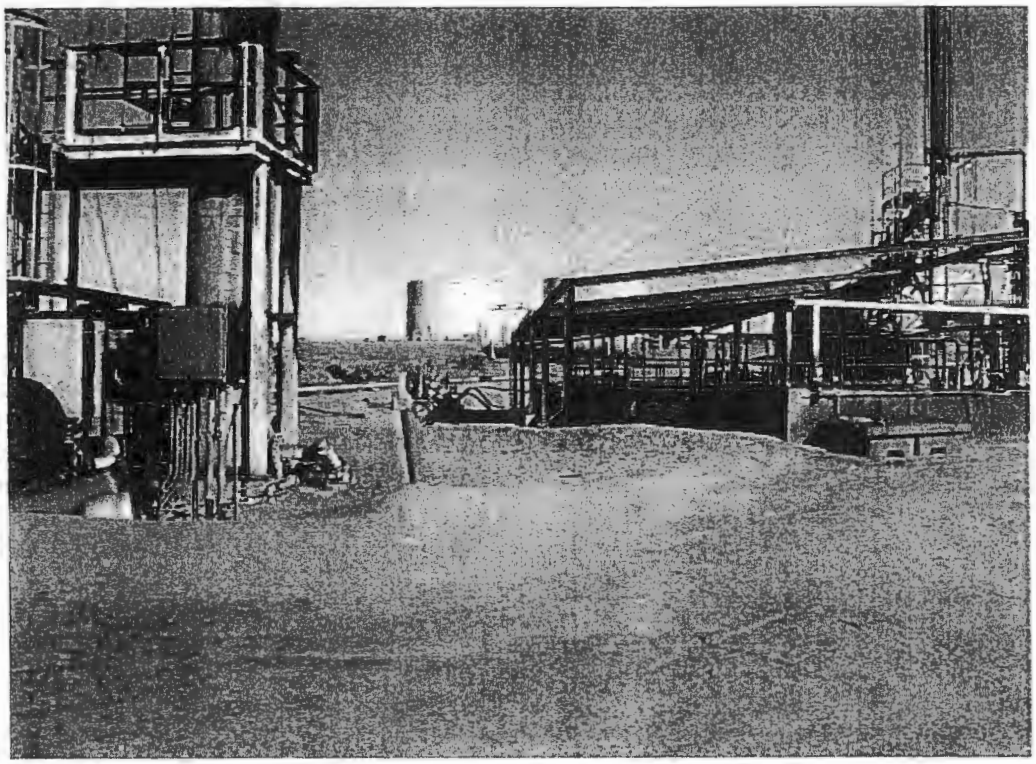


Photo 7
Looking east from west side of OAPIS,
benzene strippers on left.

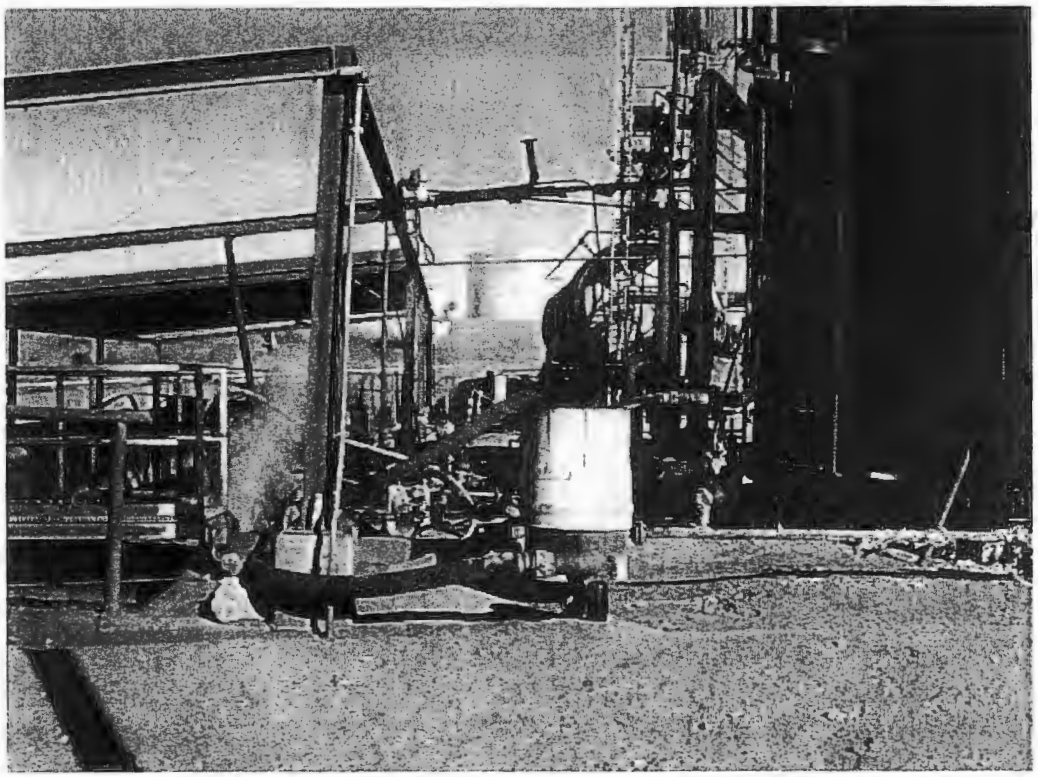


Photo 8
Looking to the east, at southwest corner of OAPIS.

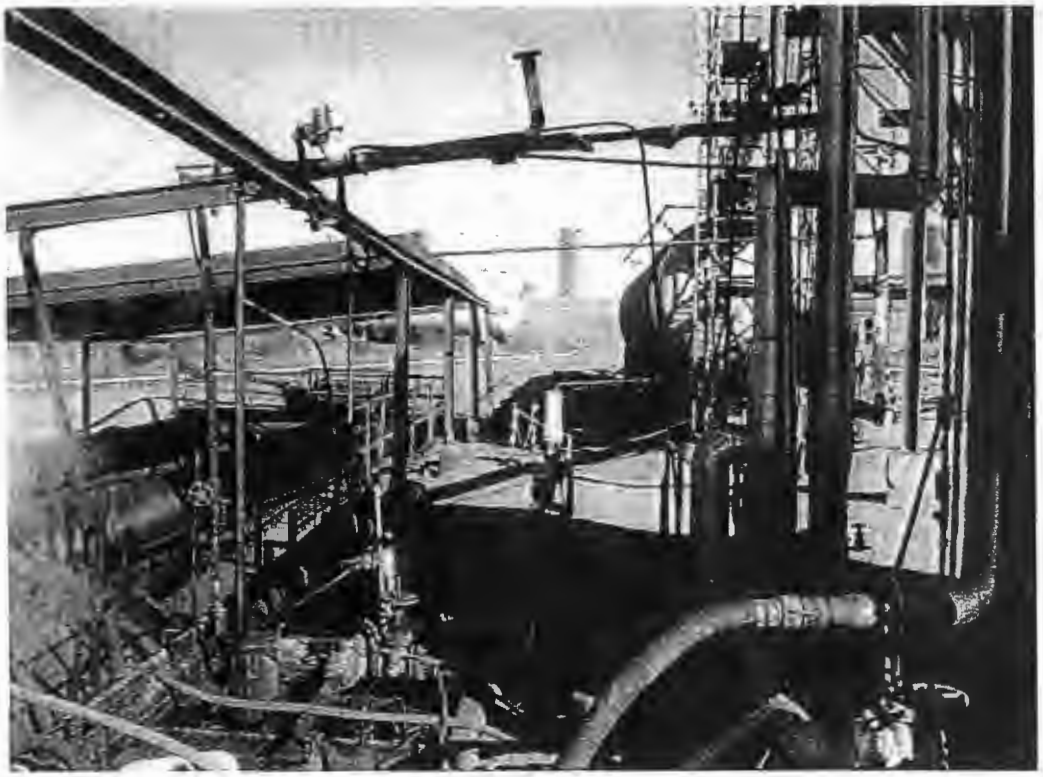


Photo 9
Looking east along south side of OAPIS.

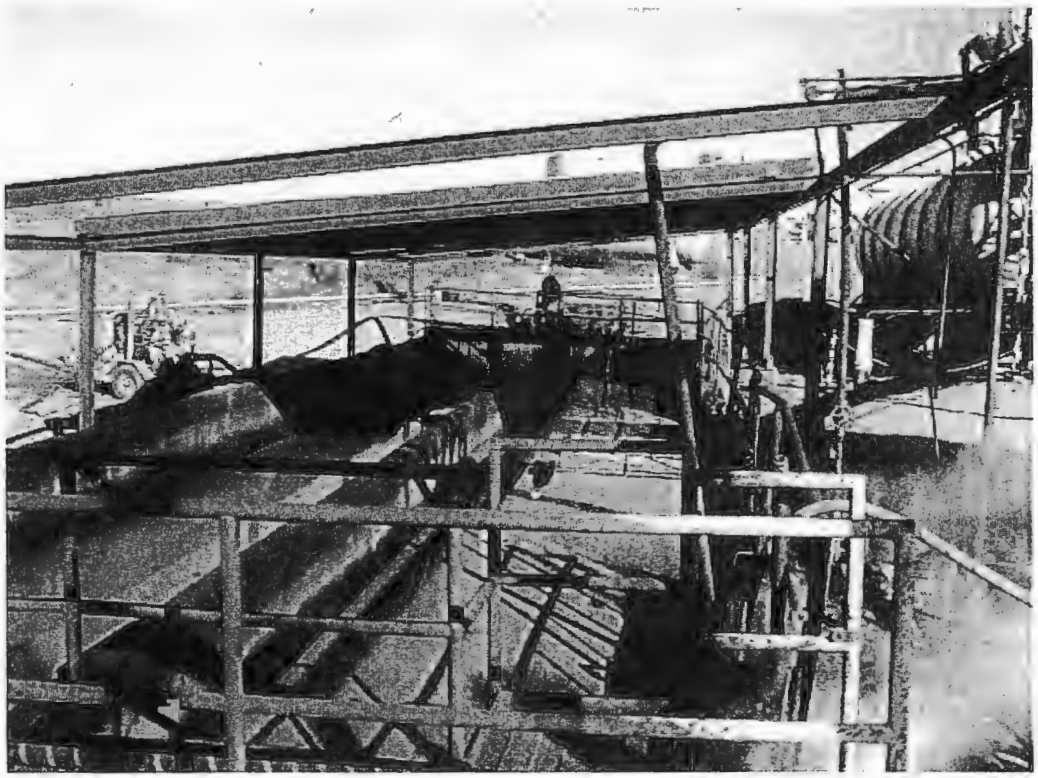


Photo 10
Looking to the east inside the OAPIS.

Sheet: 1 OF 2
Bore Point: SW corner of Pond 1

Water Elevation: Not Encountered
Boring No.: GWM-1

Precision Engineering, Inc.
P.O. Box 422
Las Cruces, NM 88004
505-523-7674

Log of Test Borings

File #: 03-118
Site: Ciniza
Boundry Wells

Elevation: TBD
Date: 7/8/2004

LAB #	DEPTH	BLOW COUNT	PLOT	SCALE	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR,ETC.)	%M	LL	PI	CLASS.
	0-1.5		o/o/o/o/ o/o/o/o/ o/o/o/o/		Clay, gravelly, red-brown, wet				
	1.5-20.0		//////////	2.5 5.0 7.5 10.0 15.0 20.0	Clay, red-brown, wet				
	20-21.5		//////////		Clay, black, wet,				

SIZE & TYPE OF BORING: 4-1/4" ID Hollow Stemmed Auger

LOGGED BY: NS

C:\unzipped\Boundry Well Locations\[GWM-1.xls]Sheet1

Appendix B

Soil Boring/Monitoring Well Completion Logs

Sheet: 2 OF 2
Bore Point: SW corner of Pond 1

Precision Engineering, Inc.
P.O. Box 422
Las Cruces, NM 88004
505-523-7674

File #: 03-118
Site: Ciniza
Boundry Wells

Water Elevation: Not Encountered
Boring No.: GWM-1

Log of Test Borings

Elevation: TBD
Date: 7/8/2004

LAB #	DEPTH	BLOW COUNT	PLOT	SCALE	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR,ETC.)	%M	LL	PI	CLASS.
	21.5-24.0		////////// //////////	22.0	**Sand**, gravelly				
	22.5-24.0		////////// ////////// //////////		**Petrified Forest Formation, Painted Desert Member, Mudstone**, weathered, red-purple, reduction spots, hard, moist, blocky/crumbly				
	24.0			25.0	T.D.				
					Screened interval 18-24'				
				30.0					
				35.0					
				40.0					
					Clay, black, wet,				

SIZE & TYPE OF BORING: 4-1/4" ID Hollow Stemmed Auger **LOGGED BY:** NS

C:\unzipped\Boundry Well Locations\[GWM-1.xls]Sheet2

KLEINFELDER

Monitoring Well Log

Date	Project Number	Project	Well No.
Started: 6/12/2007	84679	Ciniza Refinery Monitor Well Install	KA-1
Completed: 6/12/2007			
Backfilled: 6/12/2007	Rig Type: CME 75	Elevation:	Logged By: B. Lucero
Latitude:	Longitude:	Location:	

Sample Type:
CS - 3.5" I.D. Continuous Sampler
D - Disturbed Sample
G - Grab Sample
SPT - 2" O.D. 1.38" I.D. Tube Sample
ST - 3" O.D. Thin-Walled Shelby Tube
U - 3 " O.D. 2.42" I.D. Ring Sample

Groundwater

Depth (ft)	Hour	Date
9.5	11:10:00 AM	6/12/2007
8.22	9:21:00 AM	6/21/2007

Groundwater Depth (ft.)	Depth (ft.)	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows per foot)	PID Heated Headspace Reading, ppm	Analytical Sample Number	Visual Classification	WELL CONST.
	0					0.6 ppm	KA1@1	CLAYEY SAND (SC) - fine to medium grained, subangular to subrounded, red brown to dark red, dry to moist, poorly cemented, sand content decreasing with depth, no hydrocarbon odor Note: Borehole was hand augered from ground surface to 5 ft bgs.	Vault Bentonite cement grout 2" Sch. 40 PVC casing
				G					
	5					1.9 ppm	KA1@5	5.0' SANDY LEAN CLAY (CL) - fine to medium grained, subangular to subrounded sand, red brown to dark red, moist, poorly cemented, 30-35% sand, no staining or hydrocarbon odor	10/20 Sand
				CS				7.0' SANDY LEAN CLAY (CL) - fine to medium grained, subangular to subrounded sand, dark red, moist, poorly cemented, 10-20% sand, sand content decreasing with depth, no hydrocarbon odor	0.010" Slot Screen (4.5-9.5') End Cap 3/8" Bent. chips
	10					1.2 ppm	KA1@10	10.0'	

Total Depth 10.0'

Additional Groundwater Measurements

Depth (ft)	Hour	Date

Depth (ft)	Hour	Date

Depth (ft)	Hour	Date

KLEINFELDER

Monitoring Well Log

Started: 6/11/2007 Completed: 6/11/2007	Project Number 84679	Project Ciniza Refinery Monitor Well Install	Well No. KA-2
Backfilled: 6/11/2007	Rig Type: CME 75	Elevation:	Logged By: B. Lucero
Latitude:	Longitude:	Location:	

Sample Type:
CS - 3.5" I.D. Continuous Sampler
D - Disturbed Sample
G - Grab Sample
SPT - 2" O.D. 1.38" I.D. Tube Sample
ST - 3" O.D. Thin-Walled Shelby Tube
U - 3" O.D. 2.42" I.D. Ring Sample

Groundwater

Depth (ft)	Hour	Date
9.5	11:10:00 AM	6/12/2007
8.54	9:18:00 AM	6/21/2007

Depth (ft.)	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows per foot)	PID Heated Headspace Rending, ppm	Analytical Sample Number	Visual Classification	WELL CONST.
0					2.5 ppm		SANDY LEAN CLAY (CL) - fine to coarse grained, subangular to subrounded sand, reddish gray, dry to moist, poorly cemented, 30-35% sand, no hydrocarbon odor Note: Borehole was hand augered from ground surface to 5 ft bgs.	Vault 3/8" Bentonite chips 2" Sch 40 PVC Casing
			G					
5					8.4 ppm	KA2@5	5.0' SANDY LEAN CLAY (CL) - fine to coarse grained, subangular to subrounded, reddish gray, dry to moist, poorly cemented, 25-30% sand decreasing with depth, no hydrocarbon odor	0.010" Slot Screen (4.5-9.5)
			CS				6.0' SANDY LEAN CLAY (CL) - dark red, moist to very moist, poorly cemented, 5-15% fine to medium grained sand, substantial hydrocarbon staining at 9 feet bgs, noticable hydrocarbon odor	10/20 Sand
					79.1 ppm	KA2@9		End Cap
10					137.4 ppm	KA2@10	10.0'	3/8" Bentonite chips

Total Depth 10.0'

Additional Groundwater Measurements

Depth (ft)	Hour	Date

Depth (ft)	Hour	Date

Depth (ft)	Hour	Date

KLEINFELDER

Monitoring W Log

Date	Project Number	Project	Well No.
Started: 6/11/2007	84679	Ciniza Refinery Monitor Well Install	KA-3
Completed: 6/11/2007			
Backfilled: 6/11/2007	Rig Type: CME 75	Elevation:	Logged By: B. Lucero
Latitude:	Longitude:	Location:	

Sample Type: CS - 3.5" I.D. Continuous Sampler; D - Disturbed Sample; G - Grab Sample; SPT - 2" O.D. 1.38" I.D. Tube Sample; ST - 3" O.D. Thin-Walled Shelby Tube; U - 3" O.D. 2.42" I.D. Ring Sample

Groundwater

Depth (ft)	Hour	Date
12.5	10:15:00 AM	6/12/2007
8.5	9:15:00 AM	6/21/2007

Groundwater Depth (ft.)	Depth (ft.)	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows per foot)	PID Heated Headspace Reading, ppm	Analytical Sample Number	Visual Classification	WELL CONST.
	0					3.2 ppm		SANDY LEAN CLAY (CL) - fine to coarse grained, subangular to subrounded sand, redish tan to tan, dry to moist, poorly cemented, 30-35% sand, no hydrocarbon odor	Vault
				G				Note: Borehole was hand augered from ground surface to 5 ft bgs. (3.0')	
	5					14.9 ppm		SANDY LEAN CLAY (CL) - fine to coarse grained, subangular to subrounded sand, dark red, dry to moist, poorly cemented, 20-25% sand decreasing with depth, no hydrocarbon odor (6.0')	Bentonite cement grout
				CS				SANDY LEAN CLAY (CL) - fine to medium grained, subangular to subrounded sand, red brown to dark brown with gray hydrocarbon staining, moist, poorly cemented, 10-15% sand, grey hydrocarbon staining at 9 feet bgs, at 9-10 ft bgs noticable hydrocarbon odor	2" Sch 40 PVC Casing
	10					14.9 ppm	KA3@10		
				CS		37.6 ppm	KA3@12.5	(12.5')	3/8" Bentonite chips
								POORLY GRADED SAND WITH CLAY (SP-SC) - fine to medium grained, red brown to dark red, wet, poorly cemented, 10-15% clay and silt, no noticable hydrocarbon odor (14.0')	
	15					13.6 ppm		SANDY LEAN CLAY (CL) - fine to medium grained sand, subangular to subrounded, dark red, moist, poorly cemented, 25-30% sand, no hydrocarbon odor (15.0')	
				CS				SANDY LEAN CLAY (CL) - with intervals of poorly graded sand with clay (SP-SC) at 16 ft bgs and 17.5 ft bgs fine to medium grained sand, red brown to dark red, wet, poorly cemented, 10-15% clay and silt, no hydrocarbon odor (18.0')	
	20					3.2 ppm		MUDSTONE (CHINLE FORMATION) - weathered, highly fractured dark red to reddish gray with light gray reduction spots, wet in fractures, moderately to well cemented, no noticable hydrocarbon odor (22.0')	0.010" Slot Screen (15-25ft)
				CS		1.9 ppm	KA3@22.5	MUDSTONE (CHINLE FORMATION) - minor to trace fractures dark red to reddish gray with light gray reduction spots, dry to moist, moderately to well cemented, no noticable hydrocarbon odor	10/20 Sand
	25					1.2 ppm	KA3@25	(25.0')	End Cap

Total Depth 25.0'

Additional Groundwater Measurements

Depth (ft)	Hour	Date

Depth (ft)	Hour	Date

Depth (ft)	Hour	Date

KLEINFELDER

Soil Boring/Monitoring Well Log

Date			Project	Well No.
Started: 3/14/2008	Rig Type: CME 75		Ciniza Refinery Monitor Well Install	KA-1R
Completed: 3/14/2008	Driller: J. Aguirre, Rodgers			
Backfilled: 3/14/2008	Weather: Sunny, Windy	Top of Casing El.: 6918.43'	Logged By: E. Shannon	NAPTS 1
Northing: 1634587.51	Easting: 2545700.49	Location: East of New API Separator		

Sample Type:
G - Grab Sample
CS - 3.5" I.D. Continuous Sampler
SPT - 2" O.D. 1.38" I.D. Tube Sample
U - 3" O.D. 2.42" I.D. Ring Sample
ST - 3" O.D. Thin-Walled Shelby Tube
NR - No Recovery

Groundwater

Depth (ft)	Hour	Date
8.20	12:19:00 PM	3/15/2008
9.50	9:38:00 AM	3/20/2008

Groundwater Depth (ft.)	Depth (ft.)	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows per foot)	PID Heated Headspace Reading, ppm	Analytical Sample Number	Visual Classification	WELL CONSTRUCTION
	0							SANDY LEAN CLAY (CL) - reddish brown, dry grading to moist, 35 - 50% fine to medium grained sand	Cement bentonite grout
									3/8" bentonite chips
								Note: Boring drilled with hollow stem auger. Soil visually classified from auger cuttings.	2" Sch. 40 PVC casing
									10/20 sand
									3.7' bgs
	5								
									0.010" Slot Screen
	10								
								Wet with increasing sand content from 11.5 ft bgs.	
								14.0' El. 6904.4'	13.7' bgs End Cap

Total Depth 14.0'

Additional Groundwater Measurements

Depth (ft)	Hour	Date

Depth (ft)	Hour	Date

Depth (ft)	Hour	Date

KLEINFELDER

Date			Project	Well No.
Started: 3/14/2008	Rig Type: CME 75		Ciniza Refinery Mo r Well Install	KA-2R
Completed: 3/14/2008	Driller: J. uirre, Rodgers			
Backfilled: 3/14/2008	Weather: Sunny, Windy	Top of Casing El.: 6917.27'	Logged By: E. Shannon	NAPIS 2
Northing: 1634565.05	Easting: 2545647.32	Location: West of New API Separator		

Sample Type: G - Grab Sample; CS - 3.5" I.D. Continuous Sampler; SPT - 2" O.D. 1.38" I.D. Tube Sample; U - 3" O.D. 2.42" I.D. Ring Sample; ST - 3" O.D. Thin-Walled Shelby Tube; NR - No Recovery

Groundwater

Depth (ft)	Hour	Date
8.61	9:28:00 AM	3/15/2008
8.77	9:42:00 AM	3/20/2008

Groundwater Depth (ft.) / Depth (ft.)	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows per foot)	PID Heated Headspace Reading, ppm	Analytical Sample Number	Visual Classification	WELL CONSTRUCTION
0							SANDY LEAN CLAY (CL) - grayish brown, dry to moist, 25 - 30% coarse to fine grained sand	Cement surface completion; 3/8" bentonite chips; 2" Sch. 40 PVC casing; 10/20 sand; 4.2' bgs
5							Grades to reddish-brown in color at 5 ft bgs.	
							Note: Boring drilled with hollow stem auger. Soil visually classified from auger cuttings.	0.010" Slot Screen
10							14.5' El. 6902.8'	14.2' bgs End Cap

Total Depth 14.5'

Additional Groundwater Measurements

Depth (ft)	Hour	Date

Depth (ft)	Hour	Date

Depth (ft)	Hour	Date

Date			Project	Well No.
Started: 3/13/2008	Rig Type: CME 75		Ciniza Refinery Mor · Well Install	KA-3R
Completed: 3/14/2008	Driller: J. . .rre, Rodgers			
Backfilled: 3/14/2008	Weather: Sunny, Windy	Top of Casing El.: 6917.31'	Logged By: E. Shannon	NAPIS 3
Northing: 1634589.8	Easting: 2545645.1	Location: West of New API Separator		

Sample Type: G - Grab Sample; CS - 3.5" I.D. Continuous Sampler; SPT - 2" O.D. 1.38" I.D. Tube Sample; U - 3" O.D. 2.42" I.D. Ring Sample; ST - 3" O.D. Thin-Walled Shelby Tube; NR - No Recovery

Groundwater

Depth (ft)	Hour	Date
Dry	9:40:00 AM	3/14/2008
Dry	11:15:00 AM	3/14/2008

Groundwater Depth (ft.)	Depth (ft.)	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows per foot)	PID Heated Headspace Reading, ppm	Analytical Sample Number	Visual Classification	WELL CONSTRUCTION
	0							SANDY LEAN CLAY (CL) - red, dry to moist, coarse to fine grained sand	Flush mount completion
								Note: Boring drilled with hollow stem auger. Soil visually classified from auger cuttings.	
	5								
								Driller noted easier drilling at 6.5 ft bgs. Soil grades to darker brown in color.	2" Sch. 40 PVC casing
	10								8" Steel conductor casing
								Driller noted change in drilling at 12.5 ft bgs. Auger cuttings increased in sand content and graded moist to wet.	
	15								Cement bentonite grout
								Wet at 17 ft bgs.	
	20								
								22.0' El. 6895.3'	
								BEDROCK - driller noted hard drilling at 22 ft bgs, set conductor casing at 23 ft bgs.	3/8" bentonite chips
	25								10/20 sand
									25.4' bgs
									0.010" Slot Screen
	30								
								30.7' El. 6886.6'	30.4' bgs End Cap

Total Depth 30.7'

Additional Groundwater Measurements

Depth (ft)	Hour	Date
30.68	9:54:00 AM	3/15/2008
30.68	12:08:00 PM	3/15/2008

Depth (ft)	Hour	Date
30.70	9:40:00 AM	3/20/2008

Depth (ft)	Hour	Date

Appendix C

Investigation Derived Waste (IDW) Management Plan

IDW Management Plan

All IDW will be properly characterized and disposed of in accordance with all federal, State, and local rules and regulations for storage, labeling, handling, transport, and disposal of waste. The IDW may be characterized for disposal based on the known or suspected contaminants potentially present in the waste. It is assumed that there are no listed wastes present in environmental media at any of the planned investigation areas.

A dedicated decontamination area will be setup prior to any sample collection activities. The decontamination pad will be constructed so as to capture and contain all decontamination fluids (e.g., wash water and rinse water) and foreign materials washed off the sampling equipment. The fluids will be pumped directly into suitable storage containers (e.g., labeled 55-gallon drums), which will be located at satellite accumulation areas until the fluids are disposed in the refinery wastewater treatment system upstream of the API separator. The solids captured in the decontamination pad will be shoveled into 55-gallon drums and stored at the designated satellite accumulation area pending proper waste characterization for off-site disposal.

Drill cuttings generated during installation of soil borings and monitoring wells will be placed directly into 55-gallon drums and staged in the satellite accumulation area pending results of the waste characterization sampling. The portion of soil cores, which are not retained for analytical testing, will be placed into the same 55-gallon drums used to store the associated drill cuttings.

The solids (e.g., drill cuttings and used soil cores) will be characterized by testing to determine if there are any hazardous characteristics in accordance with 40 Code of Federal Regulations (CFR) Part 261. This includes tests for ignitability, corrosivity, reactivity, and toxicity. If the materials are not characteristically hazardous, then further testing will be performed pursuant to the requirements of the facility to which the materials will be transported. Depending upon the results of analyses for individual investigation soil samples, additional analyses may include TPH and polynuclear aromatic hydrocarbons.

Purge water generated during ground water sampling activities will be containerized in 55-gallons drums and then disposed in the refinery wastewater treatment system upstream of the API separator. All miscellaneous waste materials (e.g., discarded gloves, packing materials, etc.) will be placed into the refinery's solid waste storage containers for off-site disposal.