1R - 273

REPORTS

DATE:

1998

Highlander Environmental Corp.

Midland, Texas

May 1, 1998

Mr. Wayne Price
Environmental Engineer
State of New Mexico
Oil Conservation Division
Energy, Minerals and Natural Resources Department
100 W. Broadway
Hobbs, New Mexico 88240

Re: Report on the Investigation of the Former Greenhill Petroleum Landfarm, Lovington Paddock / San Andres Unit, Lea County, New Mexico.

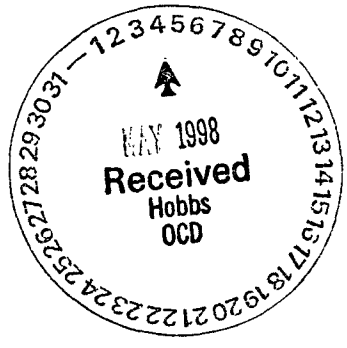
Dear Mr. Price:

The enclosed report details the findings of the above-mentioned investigation. If you have any questions or require any additional information, please advise. Thank you for your assistance in this matter.

Very truly yours,

Tim Reed

Timothy M. Reed, REM
Vice President

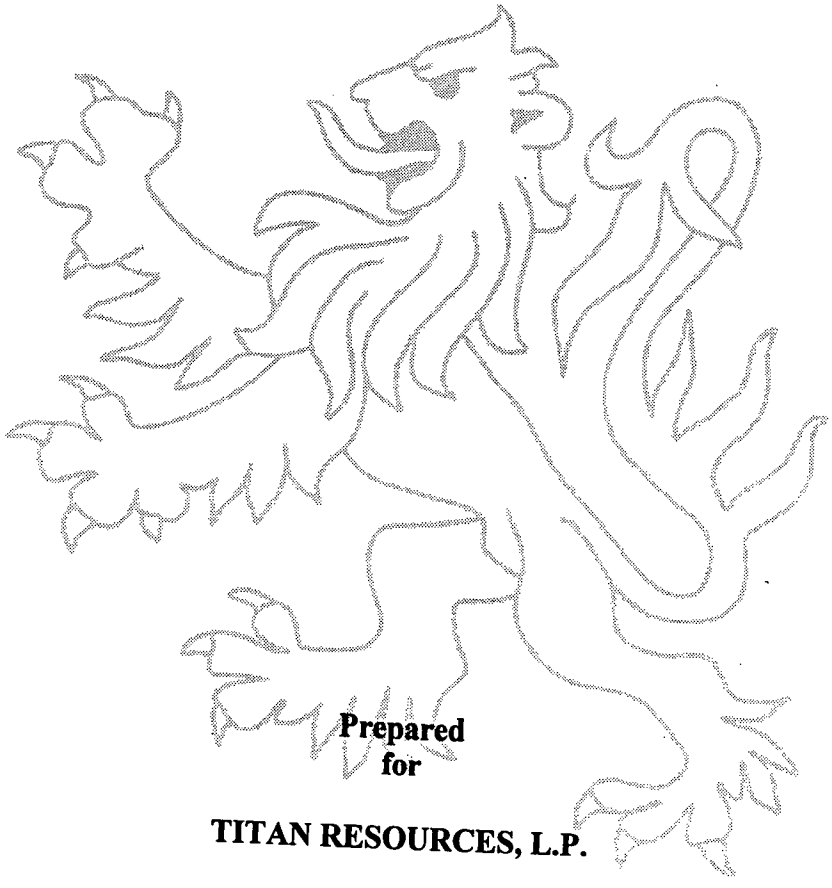


1910 N. Big Spring • Midland, Texas 79705 • (915) 682-4559 • Fax (915) 682-3946

INVESTIGATION OF FORMER GREENHILL PETROLEUM LANDFARM

LOVINGTON PADDOCK / SAN ANDRES UNIT

LEA COUNTY, NEW MEXICO



Prepared
for

TITAN RESOURCES, L.P.

April, 1998

Tim Reed

Timothy M. Reed

Highlander Environmental Corp.

Midland, Texas

INVESTIGATION OF FORMER GREENHILL PETROLEUM LANDFARM LOVINGTON PADDOCK / SAN ANDRES UNIT LEA COUNTY, NEW MEXICO

Prepared For

TITAN RESOURCES, L.P.

1.0 INTRODUCTION

The purpose of this report is to detail the findings of an investigation on a landfarm located in the Lovington Paddock / San Andres Unit in the NE/4 of Section 1, T-17-S, R-36-E, Lea County, New Mexico. This landfarm was previously installed and operated by Greenhill Petroleum. This investigation was performed for Titan Resources, L.P. (Titan).

2.0 BACKGROUND

Titan purchased production in the Lovington Paddock / San Andres Field in December 1997 from Pioneer Natural Resources. Pioneer had acquired this property from Greenhill Petroleum in early 1997. Conveyed along with this production was an ongoing bioremediation (landfarm) area at the Central Production Facility, which Greenhill had operated since 1994. This landfarm had been approved by the New Mexico Oil Conservation Division (NMOCD) to treat sludges and sediments from two open topped tanks and one unlined pit. The two tanks, labeled North Pit and South Pit, were being taken out of service at the Central Tank Battery. The North and South Pits were both polyethelene lined steel tanks, measuring 4' tall by 100' in diameter. The open unlined pit was designated the Getty-Walker Pit. Highlander personnel had sampled the North, South and Getty-Walker pits in 1992 and the results showed elevated lead levels of 137 mg/kg, 64 mg/kg and 32 mg/kg respectively. A copy of Highlander's original report is included in Appendix B.

1910 N. Big Spring • Midland, Texas 79705 • (915) 682-4559 • Fax (915) 682-3946

On October 11, 1994, Safety and Environmental Solutions, Inc., submitted a closure request to the New Mexico Oil Conservation Division (NMOCD). However, the question of elevated lead and insufficient sampling were apparently causes for the denial of the closure request. The analysis of a composite sample for total lead had been submitted with the closure request and indicated a total lead level in composite of 37.3 mg/kg at the 3.0' depth. Toxicity Characteristic Leachate Procedure (TCLP) testing previously submitted did not indicate any leachability for the lead contained within this landfarm. Titan, upon closing the purchase of this property, retained Highlander Environmental Corp. to assist in closing this landfarm.

Highlander personnel Tim Reed and Gary Miller met with Wayne Price of the NMOCD at the site on February 27, 1998. Also present for the meeting were Ron Lechwar and Bill Hearne with Titan. At that time, it was agreed that additional profiling of the landfarm would be performed to determine if additional work and/or a risk assessment needed to be performed at this facility. It was agreed that the site would be gridded into six areas and samples taken with a backhoe at depths of 0-1.0', 3.0' and 5.0'. Additionally, samples were to be taken at a depth of 5.0' below the surface in the areas where the old tanks had been to confirm that no residual lead contamination existed.

2.0 INVESTIGATION

On March 9, 1998, Lynn Ward with Highlander supervised the investigation of the landfarm area. The site was segregated into six areas as shown on the attached Figure 2. Discrete soil samples were taken with a backhoe at depths of 0-1.0', 3.0' and 5.0' in each of the six areas (18 samples in all). The prior location of the removed north and south pits (tanks) were ascertained and it was determined that only the north pit area was accessible. The south pit area is currently the site of a 5000-barrel storage tank. A backhoe trench was excavated in the area of the removed north pit, and samples were taken at 0-1.0', 3.0' and 5.0' below surface.

All of the samples were placed in laboratory prepared containers and chilled to 4°C. The samples were shipped under standard Chain of Custody control to TraceAnalysis, Inc. in Lubbock, Texas. The samples were analyzed for total petroleum hydrocarbons (TPH), by EPA method 418.1, benzene, toluene, ethylbenzene and xylene (BTEX), by EPA method 8020 and total lead (Pb), by EPA SW 846-3015, 6010B.

3.0 SAMPLE RESULTS

The following table lists the analytical results for the landfarm area:

Table 1.

(All results in mg/kg)

Location	0-1.0'	3.0'	5.0'
Area 1	Pb 7.0 BTEX <0.050 TPH 11,900	Pb 5.2 BTEX <0.050 TPH 96.9	Pb <5.0 BTEX <0.050 TPH 38.5
Area 2	Pb 13.0 BTEX 0.435 TPH 21,900	Pb <5.0 BTEX 1.66 TPH 14,100	Pb <5.0 BTEX <0.050 TPH 139
Area 3	Pb 15.0 BTEX <0.050 TPH 8,200	Pb <5.0 BTEX <0.050 TPH 161	Pb <5.0 BTEX <0.050 TPH 139
Area 4	Pb 15.0 BTEX <0.050 TPH 7,120	Pb <5.0 BTEX <0.050 TPH 916	Pb <5.0 BTEX <0.050 TPH 235
Area 5	Pb 22.0 BTEX <0.050 TPH 16,900	Pb <5.0 BTEX <0.050 TPH 121	Pb <5.0 BTEX <0.050 TPH 12.5

Location	0-1.0'	3.0'	5.0'
Area 6	Pb 7.6 BTEX <0.050 TPH 4,240	Pb <5.0 BTEX <0.050 TPH 133	Pb <5.0 BTEX <0.050 TPH <10

Referring to the table, the highest total lead level found was in the 0-1.0' sample in Area 5 at 22 mg/kg. With the exception of Area 1 (5.2 mg/kg at 3.0'), no lead levels above the method detection limits were found in the deeper soils. BTEX levels were below method detection limits for all samples except the 0-1.0' and 3.0' samples in Area 2, which exhibited total BTEX levels of 0.435 and 1.66 mg/kg respectively. No benzene was detected in either sample. The total BTEX levels were well below the NMOCD recommended remedial action level (RRAL) of 50 mg/kg. TPH levels were high in the 0-1.0' samples, ranging from 4,240 mg/kg to 21,900 mg/kg, however, all samples were below 100 mg/kg in the 3.0' sample with the exception of Area 2. The TPH levels in Area 2 decreased dramatically from 14,100 mg/kg in the 3.0' sample to 139 mg/kg in the 5.0' sample. Previous reports indicate that the depth to groundwater in this area is approximately 85' below the surface. With this groundwater depth, the NMOCD guidelines specify a clean up level for TPH of 1,000 mg/kg.

The samples taken from the test trench in the area of the removed North Pit were analyzed for total lead. The samples were taken from 0-1.0', 3.0' and 5.0' below surface. The reported total lead levels were 4.2 mg/kg, <2.0 mg/kg and <2.0 mg/kg respectively, indicating no residual lead contamination of soils. Copies of the laboratory reports are included in Appendix A.

4.0 CONCLUSIONS

1. The highest total lead level found in the landfarm was in the 0-1.0' sample in Area 5 at 22 mg/kg.

2. With the exception of Area 1 (5.2 mg/kg at 3.0'), no lead levels above the method detection limits were found in the deeper soils.

3. BTEX levels were below method detection limits for all samples except the 0-1. ' and 3.0' samples in Area 2, which exhibited total BTEX levels of 0.435 and 1.66 mg/kg respectively. No benzene was detected in either sample. These levels are well below the NMOCD RRAL level of 50 mg/kg total BTEX.

4. TPH levels were high in the 0-1.0' samples, ranging from 4,240 mg/kg to 21,900 mg/kg, however all samples were below 100 mg/kg in the 3.0' sample with the exception of Area 2. The TPH levels in this area did decrease dramatically from 14,100 mg/kg in the 3.0' sample to 139 mg/kg in the 5.0' sample.

5. Previous reports indicate that the depth to groundwater in this area is approximately 85' below the surface. With this groundwater depth, the NMOCD guidelines specify a clean up level for TPH of 1,000 mg/kg.

6. The samples taken from the test trench in the area of the removed North Pit were analyzed for total lead. The samples were taken from 0-1.0', 3.0' and 5.0' below surface. The reported total lead levels were 4.2 mg/kg, <2.0 mg/kg and <2.0 mg/kg respectively, indicating no residual lead contamination of soils.

5.0 RECOMMENDATIONS

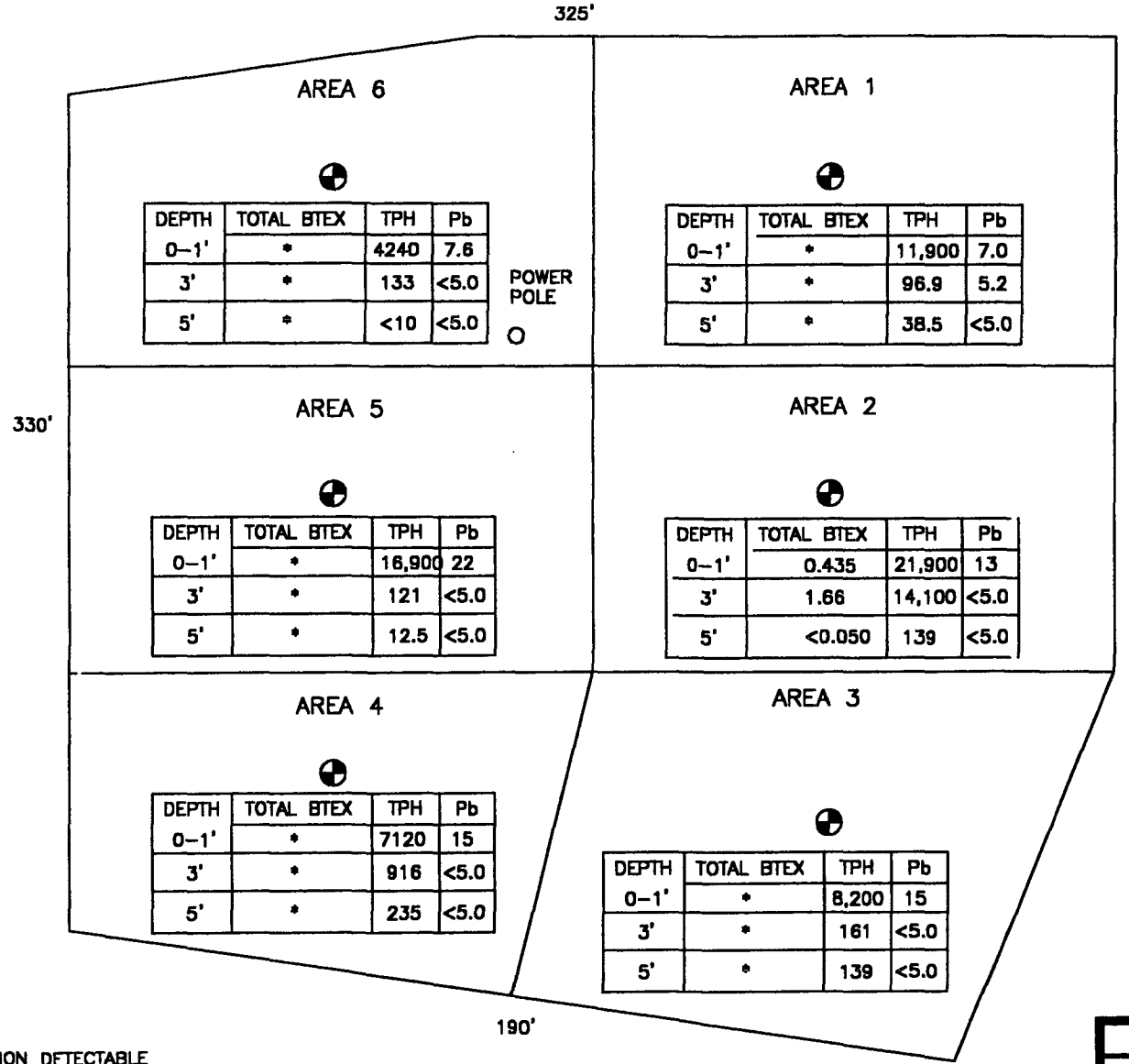
1. The shallow surface soils across the entire landfarm should be turned to a depth of approximately 18".

2. The soils in Area 2 should be turned to a depth of approximately 36" to 42" to address in order to bring the deeper contamination to the surface for treatment.

3. All of the soils should be treated with a high nitrogen fertilizer and the area watered.

4. The soils should continue to be turned and watered on a monthly basis to promote natural attenuation of hydrocarbons.

5. The surface soils should be re-sampled and analyzed to total petroleum hydrocarbons (TPH) at the end of six months of treatment to assess if further actions are necessary to close this site.



DEPTH	TOTAL BTEX	TPH	Pb
0–1'	*	4240	7.6
3'	*	133	<5.0
5'	*	<10	<5.0

DEPTH	TOTAL BTEX	TPH	Pb
0–1'	*	11,900	7.0
3'	*	96.9	5.2
5'	*	38.5	<5.0

DEPTH	TOTAL BTEX	TPH	Pb
0–1'	*	16,900	22
3'	*	121	<5.0
5'	*	12.5	<5.0

DEPTH	TOTAL BTEX	TPH	Pb
0–1'	0.435	21,900	13
3'	1.66	14,100	<5.0
5'	<0.050	139	<5.0

DEPTH	TOTAL BTEX	TPH	Pb
0–1'	*	7120	15
3'	*	916	<5.0
5'	*	235	<5.0

DEPTH	TOTAL BTEX	TPH	Pb
0–1'	*	8,200	15
3'	*	161	<5.0
5'	*	139	<5.0

* = NON DETECTABLE

NOT TO SCALE

DATE: 4/2/98
DWN. BY: JDA
FILE:

LEA COUNTY, NEW MEXICO

TITAN RESOURCES, L.P.

GREENHILL LANDFARM
LOVINGTON PADDOCK/SAN ANDRES

HIGHLANDER ENVIRONMENTAL CORP.
MIDLAND, TEXAS

TRACE ANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

ANALYTICAL RESULTS FOR
Highlander Environmental Services
Attention Lynn Ward
1910 N. Big Spirng St.
Midland TX 79705

Date: Mar 23, 1998
Date Rec: 3/11/98
Project: 1084
Proj Name: Greenhill Landfarm
Proj Loc: N/A

Lab Receiving # : 9803000189
Sampling Date: 3/9/98
Sample Condition: Intact and Cool
Sample Received By: VW

TA#	Field Code	MATRIX	TRPHC (mg/Kg)
T 93179	Area 1 @ Surface	Soil	11,900
T 93180	Area 1 @ 3'	Soil	96.9
T 93181	Area 1 @ 5'	Soil	38.5
T 93182	Area 2 @ Surface	Soil	21,900
T 93183	Area 2 @ 3'	Soil	14,100
T 93184	Area 2 @ 5'	Soil	139
T 93185	Area 3 @ Surface	Soil	8,200
T 93186	Area 3 @ 3'	Soil	161
T 93187	Area 3 @ 5'	Soil	139
T 93188	Area 4 @ Surface	Soil	7,120
T 93189	Area 4 @ 3'	Soil	916
T 93190	Area 4 @ 5'	Soil	235
T 93191	Area 5 @ Surface	Soil	16,900
T 93192	Area 5 @ 3'	Soil	121
T 93193	Area 5 @ 5'	Soil	12.5
T 93194	Area 6 @ Surface	Soil	4,240
T 93195	Area 6 @ 3'	Soil	133
T 93196	Area 6 @ 5'	Soil	<10.0
Method Blank			<10.0
Reporting Limit			10
QC			99
RPD			15
% Extraction Accuracy			112
% Instrument Accuracy			99

TEST	PREP METHOD	PREP DATE	ANALYSIS METHOD	ANALYSIS COMPLETED	CHEMIST	QC: (mg/L)	SPIKE: (mg/Kg)
TRPHC	EPA 3550	3/18/98	EPA 418.1	3/18/98	MS	100	250

Director, Dr. Blair Leftwich

3-23-98
Date

TRACE ANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
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E-Mail: lab@traceanalysis.com

ANALYTICAL RESULTS FOR
Highlander Environmental Services
Attention Lynn Ward
1910 N. Big Spirng St.
Midland TX 79705

Lab Receiving # : 9803000189
Sampling Date: 3/9/98
Sample Condition: Intact and Cool
Sample Received By: VW

Date: Mar 19, 1998
Date Rec: 3/11/98
Project: 1084
Proj Name: Greenhill Landfarm
Proj Loc: N/A

TA#	Field Code	MATRIX	BENZENE (mg/Kg)	TOLUENE (mg/Kg)	ETHYL-BENZENE (mg/Kg)	M,P,O XYLENE (mg/Kg)	TOTAL BTEX mg/Kg)
T 93179	Area 1 @ Surface	Soil	<0.050	<0.050	<0.050	<0.050	<0.050
T 93180	Area 1 @ 3'	Soil	<0.050	<0.050	<0.050	<0.050	<0.050
T 93181	Area 1 @ 5'	Soil	<0.050	<0.050	<0.050	<0.050	<0.050
T 93182	Area 2 @ Surface	Soil	<0.050	<0.050	0.058	0.377	0.435
T 93183	Area 2 @ 3'	Soil	<0.050	<0.050	0.276	1.38	1.66
T 93184	Area 2 @ 5'	Soil	<0.050	<0.050	<0.050	<0.050	<0.050
T 93185	Area 3 @ Surface	Soil	<0.050	<0.050	<0.050	<0.050	<0.050
T 93186	Area 3 @ 3'	Soil	<0.050	<0.050	<0.050	<0.050	<0.050
T 93187	Area 3 @ 5'	Soil	<0.050	<0.050	<0.050	<0.050	<0.050
Method Blank			<0.050	<0.050	<0.050	<0.050	
Reporting Limit			0.05	0.05	0.05	0.05	
QC			0.093	0.086	0.085	0.260	
RPD			1	2	3	3	
% Extraction Accuracy			102	95	93	97	
% Instrument Accuracy			93	86	85	87	

TEST	PREP METHOD	PREP DATE	ANALYSIS METHOD	ANALYSIS COMPLETED	CHEMIST	QC: (mg/L)	SPIKE: mg/Kg)
BTEX	EPA 5030	3/14/98	EPA 8021B	3/14/98	JG	0.100 ea	5 ea

BZ

3-15-98

TRACE ANALYSIS, INC.

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4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

ANALYTICAL RESULTS FOR
Highlander Environmental Services
Attention Lynn Ward
1910 N. Big Spirng St.
Midland TX 79705

Lab Receiving # : 9803000189
Sampling Date: 3/9/98
Sample Condition: Intact and Cool
Sample Received By: VW

Date: Mar 19, 1998
Date Rec: 3/11/98
Project: 1084
Proj Name: Greenhill Landfarm
Proj Loc: N/A

TA#	Field Code	MATRIX	BENZENE (mg/Kg)	TOLUENE (mg/Kg)	ETHYL-BENZENE (mg/Kg)	M,P,O XYLENE (mg/Kg)	TOTAL BTEX mg/Kg)
T 93188	Area 4 @ Surface	Soil	<0.050	<0.050	<0.050	<0.050	<0.050
T 93189	Area 4 @ 3'	Soil	<0.050	<0.050	<0.050	<0.050	<0.050
T 93190	Area 4 @ 5'	Soil	<0.050	<0.050	<0.050	<0.050	<0.050
T 93191	Area 5 @ Surface	Soil	<0.050	<0.050	<0.050	<0.050	<0.050
T 93192	Area 5 @ 3'	Soil	<0.050	<0.050	<0.050	<0.050	<0.050
T 93193	Area 5 @ 5'	Soil	<0.050	<0.050	<0.050	<0.050	<0.050
T 93194	Area 6 @ Surface	Soil	<0.050	<0.050	<0.050	<0.050	<0.050
T 93195	Area 6 @ 3'	Soil	<0.050	<0.050	<0.050	<0.050	<0.050
T 93196	Area 6 @ 5'	Soil	<0.050	<0.050	<0.050	<0.050	<0.050
Method Blank			<0.050	<0.050	<0.050	<0.050	
Reporting Limit			0.05	0.05	0.05	0.05	
QC			0.093	0.086	0.085	0.260	
RPD			1	2	3	3	
% Extraction Accuracy			102	95	93	97	
% Instrument Accuracy			93	86	85	87	

TEST	PREP METHOD	PREP DATE	ANALYSIS METHOD	ANALYSIS COMPLETED	CHEMIST	QC: (mg/L)	SPIKE: mg/Kg)
BTEX	EPA 5030	3/14/98	EPA 8021B	3/14/98	JG	0.100 ea	5 ea

BR

3-19-98

TRACEANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES
Attention: Lynn Ward
1910 N. Big Spring St.
Midland, TX 79705

March 20, 1998
Receiving Date: 03/11/98
Sample Type: Soil
Project No: 1084
Project Location: NA

Prep Date: 03/12/98
Analysis Date: 03/13/98
Sampling Date: 03/09/98
Sample Condition: Intact & Cool
Sample Received by: VW
Client Name: Titan
Project Name: Greenhill Landfarm (Bio Cell)

TA#	FIELD CODE	TOTAL Pb (mg/kg)
T93179	Area 1 @ Surface	7.0
T93180	Area 1 @ 3'	5.2
T93181	Area 1 2 5'	<5.0
T93182	Area 2 @ Surface	13
T93183	Area 2 @ 3'	<5.0
T93184	Area 2 @ 5'	<5.0
T93185	Area 3 @ Surface	15
T93186	Area 3 @ 3'	<5.0
T93187	Area 3 @ 5'	<5.0
T93188	Area 4 @ Surface	15
T93189	Area 4 @ 3'	<5.0
T93190	Area 4 @ 5'	<5.0
T93191	Area 5 @ Surface	22
T93192	Area 5 @ 3'	<5.0
T93193	Area 5 @ 5'	<5.0
T93194	Area 6 @ Surface	7.6
T93195	Area 6 @ 3'	<5.0
T93196	Area 6 @ 5'	<5.0
ICV		1.06
CCV		1.03
Reporting Limit		5.0
RPD		3
% Extraction Accuracy		95
% Instrument Accuracy		105

METHODS: EPA SW 846-3051, 6010B.
CHEMIST: RR
TOTAL Pb SPIKE: 200 mg/kg TOTAL Pb.
TOTAL Pb CV: 1.0 mg/L TOTAL Pb.

Director, Dr. Blair Leftwich

3-20-98
DATE

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Analysis Request and Chain of Custody Record

HIGHLANDER ENVIRONMENTAL CORP.

1910 N. Big Spring St.
Midland, Texas 79705
(915) 682-4559 Fax (915) 682-3946

PAGE: 1 OF: 2

ANALYSIS REQUEST (Circle or Specify Method No.)

CLIENT NAME: Titan
SITE MANAGER: Lynn Ward
PROJECT NO.: 1084
PROJECT NAME: Greenhill Landfarm (Bio Cell)

LAB I.D. NUMBER	DATE	TIME	MATRIX	COMP.	GRAB	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS	FILTERED (Y/N)	HCL	HNO3	ICE	NONE	BTEX 8020/602	MTBE 8020/602	TPH 418.1	PAH 8270	RCRA Metals Ag As Ba Cd Cr (Pb) Hg Se	TCLP Metals Ag As Ba Cd Cr Pd Hg Se	TCLP Volatiles	TCLP Semi Volatiles	RCI	GC.MS Vol. 8240/8260/624	GC.MS Semi. Vol. 8270/625	PCB's 8080/608	Pest. 808/608	BOD, TSS, pH, TDS, Chloride	Gamma Spec.	Alpha Beta (Air)	PLM (Asbestos)
93179	3/9/98		S		X	Area 1 @ surface	1				X		X		X		X												
80	3/9/98		S		X	Area 1 @ 3'	1				X		X		X		X												
81	3/9/98		S		X	Area 1 @ 5'	1				X		X		X		X												
82	3/9/98		S		X	Area 2 @ surface	1				X		X		X		X												
83	3/9/98		S		X	Area 2 @ 3'	1				X		X		X		X												
84	3/9/98		S		X	Area 2 @ 5'	1				X		X		X		X												
85	3/9/98		S		X	Area 3 @ surface	1				X		X		X		X												
86	3/9/98		S		X	Area 3 @ 3'	1				X		X		X		X												
87	3/9/98		S		X	Area 3 @ 5'	1				X		X		X		X												

3-20 3/24

RELINQUISHED BY: (Signature) Lynn Ward Date: 3/10/98 Time: 11:40
RECEIVED BY: (Signature) Helen Shelton Date: 3/10/98 Time: 11:40 AM

RELINQUISHED BY: (Signature) Helen Shelton Date: 3/10/98 Time: 6:00 PM
RECEIVED BY: (Signature) Date: Time:

RELINQUISHED BY: (Signature) Date: Time:
RECEIVED BY: (Signature) Date: Time:

RECEIVING LABORATORY: Trace Analysis
ADDRESS:
CITY: Lubbock STATE: TX ZIP:
CONTACT: PHONE: 800/378-1296
RECEIVED BY: (Signature) Vicki Windham
DATE: 3-11-98 TIME: 9:30 am

SAMPLED BY: (Print & Sign) Lynn Ward Date: 3/9/98 Time:
SAMPLE SHIPPED BY: (Circle) FEDEX HAND DELIVERED (BUS) UPS AIRBILL # 155758884 OTHER:

HIGHLANDER CONTACT PERSON: Lynn Ward
Results by:
RUSH Charges Authorized: Yes (No)

SAMPLE CONDITION WHEN RECEIVED:
MATRIX: W-Water (S-Soil) A-Air SL-Sludge SD-Solid O-Other

REMARKS: Please hold samples for possible TCLP

Please fill out all copies - Laboratory retains yellow copy - Return original copy to Highlander Environmental Corp. - Project Manager retains pink copy - Accounting receives Gold copy.

189

Analysis Request and Chain of Custody Record

HIGHLANDER ENVIRONMENTAL CORP.

1910 N. Big Spring St.
Midland, Texas 79705

(915) 682-4559 Fax (915) 682-3946

PAGE: 2 OF: 2

CLIENT NAME: Titan | SITE MANAGER: Lynn Ward

PROJECT NO.: 1084 | PROJECT NAME: Grunhill Landfarm (Bio Cell)

ANALYSIS REQUEST (Circle or Specify Method No.)

LAB I.D. NUMBER	DATE	TIME	MATRIX	COMP.	GRAB	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS	FILTERED (Y/N)	PRESERVATIVE METHOD: HCL	HNO3	ICE	NONE	BTEX 8020/602	MTBE 8020/602	TPH	PAH 8270	RCRA Metals Ag As Ba Cd Cr Pb Hg Se	TCLP Metals Ag As Ba Cd Cr Pd Hg Se	TCLP Volatiles	TCLP Semi Volatiles	RCI	GC.MS Vol. 8240/8260/624	GC.MS Semi. Vol. 8270/625	PCB's 8080/608	Pest. 808/608	BOD, TSS, pH, TDS, Chloride	Gamma Spec.	Alpha Beta (Air)	PLM (Asbestos)
93188	3/9/98		S		X	Area 4 @ Surface	1				X		X		X	X	X												
89	3/9/98		S		X	Area 4 @ 3'	1				X		X		X	X	X												
90	3/9/98		S		X	Area 4 @ 5'	1				X		X		X	X	X												
91	3/9/98		S		X	Area 5 @ Surface	1				X		X		X	X	X												
92	3/9/98		S		X	Area 5 @ 3'	1				X		X		X	X	X												
93	3/9/98		S		X	Area 5 @ 5'	1				X		X		X	X	X												
94	3/9/98		S		X	Area 6 @ Surface	1				X		X		X	X	X												
95	3/9/98		S		X	Area 6 @ 3'	1				X		X		X	X	X												
96	3/9/98		S		X	Area 6 @ 5'	1				X		X		X	X	X												

RELINQUISHED BY: (Signature) Lynn Ward — Date: 3/10/98 Time: 11:40

RECEIVED BY: (Signature) Helen Shelton — Date: 3/10/98 Time: 11:40 AM

RELINQUISHED BY: (Signature) Helen Shelton — Date: 3/10/98 Time: 6:00 PM

RECEIVED BY: (Signature) — Date: Time:

RELINQUISHED BY: (Signature) — Date: Time:

RECEIVED BY: (Signature) — Date: Time:

SAMPLED BY: (Print & Sign) Lynn Ward — Date: 3/9/98 Time:

SAMPLE SHIPPED BY: (Circle) FEDEX (BUS) UPS HAND DELIVERED OTHER:

AIRBILL # 155 758884 6

RECEIVING LABORATORY: Trace Analysis

ADDRESS:

CITY: Lubbock STATE: TX ZIP:

CONTACT: PHONE: 800/378-1296

RECEIVED BY: (Signature) Patty Windham

DATE: 3-11-98 TIME: 9:20 AM

HIGHLANDER CONTACT PERSON: Lynn Ward

Results by:

RUSH Charges Authorized: Yes (No)

SAMPLE CONDITION WHEN RECEIVED:

MATRIX: W-Water (S-Soil) A-Air SL-Sludge SD-Solid O-Other

REMARKS: Please hold samples for possible TCLP WS

Please Fill out all copies - Laboratory retains yellow copy - Return original copy to Highlander Environmental Corp. - Project Manager retains pink copy - Accounting receives Gold copy.

TRACEANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES
Attention: Lynn Ward
1910 N. Big Spring St.
Midland, TX 79705

March 18, 1998
Receiving Date: 03/11/98
Sample Type: Soil
Project No: 1084
Project Location: NA

Prep Date: 03/12/98
Analysis Date: 03/17/98
Sampling Date: 03/09/98
Sample Condition: Intact & Cool
Sample Received by: VW
Client Name: Titan
Project Name: Greenhill Landfarm

TA#	FIELD CODE	TOTAL Pb (mg/kg)
T93164	N. Pit Area @ Surface	4.2
T93165	N. Pit Area @ 3'	<2.0
T93166	N. Pit Area @ 5.0'-5.4'	<2.0
ICV		0.98
CCV		0.99
Reporting Limit		2.0
RPD		1
% Extraction Accuracy		70*
% Instrument Accuracy		98

***NOTE: Extraction Accuracy out of accepted limits of 75-125% because of matrix effects. LCS shows that the test was in range.**

METHODS: EPA SW 846-3051, 6010B.
CHEMIST: RR
TOTAL Pb SPIKE: 200 mg/kg TOTAL Pb.
TOTAL Pb CV: 1.0 mg/L TOTAL Pb.

Director, Dr. Blair Leftwich

3-18-98
DATE

93164-66

178

Analysis Request and Chain of Custody Record

PAGE: 1 OF: 1

HIGHLANDER ENVIRONMENTAL CORP.

1910 N. Big Spring St.
Midland, Texas 79705
(915) 682-4559
Fax (915) 682-3946

CLIENT NAME: Titan
SITE MANAGER: Lynn Ward
PROJECT NO.: 1084
PROJECT NAME: Greenhill Landfarm

ANALYSIS REQUEST (Circle or Specify Method No.)

LAB I.D. NUMBER	DATE	TIME	MATRIX	COMP.	GRAB	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS	FILTERED (Y/N)	HCL	HNO3	ICE	NONE	BTEX 8020/602	MTBE 8020/602	TPH	PAH 8270	RCRA Metals Ag As Ba Cd Cr (Pb) Hg Se	TCLP Metals Ag As Ba Cd Cr Pd Hg Se	TCLP Volatiles	TCLP Semi Volatiles	RCI	GC.MS Vol. 8240/8260/624	GC.MS Semi. Vol. 8270/625	PCB's 8080/608	Pest. 808/608	BOD, TSS, pH, TDS, Chloride	Gamma Spec.	Alpha Beta (Air)	PLM (Asbestos)
93164	3/9/98	2:45	S		X	N. Pit Area @ surface						X					X												
65	3/9/98	3:30	S		X	N. Pit Area @ 3'						X					X												
66	3/9/98	3:50	S		X	N. Pit Area @ 5.0'-5.4'						X					X												

RELINQUISHED BY: (Signature) Lynn Ward Date: 3/10/98 Time: 11:40
RECEIVED BY: (Signature) Helen Shelton Date: 3/10/98 Time: 11:40 AM

RELINQUISHED BY: (Signature) Helen Shelton Date: 3/10/98 Time: 6:00 PM
RECEIVED BY: (Signature) Date: Time:

RELINQUISHED BY: (Signature) Date: Time:
RECEIVED BY: (Signature) Date: Time:

RECEIVING LABORATORY:
ADDRESS:
CITY: STATE: ZIP:
CONTACT: PHONE:

RECEIVED BY: (Signature) [signature]
DATE: 3-11-98 TIME: 9:00 AM

SAMPLED BY: (Print & Sign) Lynn Ward Date: 3/9/98 Time:

SAMPLE SHIPPED BY: (Circle)
FEDEX BUS (circled) AIRBILL # 155 758 884
HAND DELIVERED UPS OTHER:

HIGHLANDER CONTACT PERSON: Lynn Ward

Results by:

RUSH Charges Authorized: Yes No (circled)

SAMPLE CONDITION WHEN RECEIVED:

MATRIX: W-Water A-Air SD-Solid S-Soil (circled) SL-Sludge O-Other

REMARKS: 4° 3/11

Project Manager retains pink copy - Accounting receives Gold copy

Highlander Environmental

Midland • Corpus Christi • San Angelo, Texas

September 22, 1992

Mr. Richard R. Myers
Greenhill Petroleum
11490 Westheimer, Suite 200
Houston, TX 77077

RE: Tank Bottom Material Reclamation and Treatment, Lovington, New Mexico

Dear Mr. Myers,

This report details the findings of the Greenhill Petroleum waste disposal pit sampling performed on July 28, 1992 by Highlander Services personnel Tim Reed and Vijay Kurki. The three pits are on leases near Lovington, New Mexico, and all three pits contained B. S. & W. materials.

The North Pond and South Pond are located on one lease approximately 200 feet apart. The third pit, the Getty/Walker, is located two to three miles east of the North and South Ponds. The North and South Ponds are polyethylene-lined steel tanks 100 feet in diameter and four feet tall, open-topped but netted. The Getty/Walker is an unlined earth pit approximately 40 x 60 feet and four feet deep.

The North Pond and South Pond both had chloride and pH levels within acceptable levels. The TPH levels in these two ponds were high--596,000 mg/kg in the North Pond and 626,000 mg/kg in the South Pond.

The lead levels in the North Pond, 137 mg/kg, and in the South Pond, 64 mg/kg, are above the regulatory levels specified for landfill disposal, which is 50 mg/kg. However, the TCLP levels may be below the 5 mg/kg regulatory level. Typically, the reduction from total level to TCLP levels is anywhere from 10 to 20 times the total level. Also, the North Pond high level of 137 mg/kg may be partially due to lead in the fluid. The North Pond has more fluid than the South Pond. The lead levels may be lowered once the fluid is extracted from the pits, as discussed later in this report. All other metals tested were below detection limits.

The third pit, the Getty/Walker, also had high TPH of 334,000 mg/kg with high volatile organic compounds, the organic compounds being benzene, toluene, ethylbenzene, and xylene (BTEX). Arsenic was detected at 5 mg/kg and lead at 32 mg/kg, but neither should present any problems. No other metals or semi-volatile organics were detected. As with the other two pits, the chloride and pH levels were within acceptable limits. Copies of the laboratory reports and the chain of custody are enclosed in Appendix A.

All three of the pits are open-topped, allowing rainwater to enter, and requiring that any free water be pumped into a storage tank before any method of treatment can begin. Removing free water will reduce the overall volume of material to be treated and, consequently, the cost of treatment. Pumping the free water may also reduce the pit lead level, which will be especially important in the North Pond and South Pond, which have high lead levels.

The bottom of the North Pond is a loosely packed layer of sludge about 1 1/2 feet thick and 440 cubic yards volume, with a high water content. The middle layer of the pit is free water, about 1 to 1 1/2 feet thick and about 360 cubic yards in volume. The top is a hard paraffin layer 4 to 6 inches thick with a volume of 120 cubic yards and low water content.

The South Pond contains a single sludge layer of 1 1/2 feet with a volume of about 440 cubic yards.

The Getty/Walker pit has three layers, the bottom of which was about 2 1/2 feet of loose sludge approximately 223 cubic yards volume. The middle layer is about 6 inches of free water and 44 cubic yards volume. The top paraffin layer is four inches thick and has a volume of 30 cubic yards. The estimation of these volumes is presented in Table 1.

Table 1
Estimated Volume of Sludge Components
North Tank (100 feet diameter)

Description	Layer Thickness (average)	Volume (cubic yards)
Top paraffin layer	5 in.	121.00
Free water	1.25 ft.	363.00
Bottom loose sludge	1.50 ft.	436.00

South Tank (100 feet diameter)

Description	Layer Thickness (average)	Volume (cubic yards)
Total sludge	1.5 ft.	436.00

Getty/Walker Pit (40 feet x 60 feet)

Description	Layer Thickness (average)	Volume (cubic yards)
Top paraffin layer	4 in.	30.00
Free water	0.5 ft.	44.00
Bottom sludge	2.5 ft.	223.00

Based on the contamination findings of these three pits, the following remedial alternatives are proposed:

1. Transportation of sludge from all pits to an off-site disposal
2. Enhanced in-situ bio-remediation with micro-organisms
3. In-situ bio-remediation with indigenous bacteria

1. Transportation of the sludge to an off-site disposal facility will require moving the sludge either in barrels or a viscuine lined truck to the nearest disposal facility. The nearest disposal facility is CRI, between Hobbs, New Mexico and Carlsbad, New Mexico. The estimated cost for this transportation and disposal is $30,308, and does not include loading and unloading expenses. Another factor in considering off-site disposal is that the generator is liable for cleanup should problems occur at the disposal facility in the future. A cost estimate sheet is given in Attachment 1.

2. Enhanced in-situ bio-remediation involves adding micro-organisms and biocatalyst to the sludge while it remains in the tank. Inoculation fees for bacteria range from $15 to $20 per cubic yard. Enclosed in Appendix A is the Alpha West Inc. proposal concerning the cost of treating 2500 cubic yards. The actual sludge volume for three pits is about 1250 cubic yards, and based

on this estimated volume, this method of treatment would cost about $29,900. After in-situ treatment, the waste must either be landfarmed or backfilled, which results in additional cost and is explained further in the next paragraph.

3. Natural biodegradation is the most common method of treatment. After removal of the free water in the tank, the residual sludge would be treated by land farming. The sludge would be sampled for Toxicity Characteristic Leaching Procedures (TCLP) before landfarming operations began. Landfarming involves thorough blending of the top soil at the site with the sludge and added nutrients. Every 30 days the blended soil and sludge would be tilled for aeration. The nutrients are added in calculated quantities during tilling to provide favorable conditions for indigenous bacteria. While biological degradation of hydrocarbon wastes has been used extensively by the petroleum industries, it is a slower process than enhanced bioremediation.

An evaluation assessment of the history, geology and hydrology of the site is required for the implementation of a successful bioremediation design plan. The necessity and amount of nutrients added to subsurface microorganisms for in-situ remediation is dependent upon the site hydrology. Sites with low permeability, such as those with clay, may not allow a successful introduction of nutrients.

A thorough laboratory assessment of the microbiology of the site also provides indicative information as to whether natural bioremediation will be successful. Some components of this laboratory assessment are:

* Evaluate the presence of requisite microorganisms
* Assess potential toxicity to the microorganisms
* Evaluate nutrient requirements to enhance degradation activity
* Evaluate the compatibility of the site geochemistry with the nutrient solution proposed for addition.

Natural biodegradation may be used based on the results of the laboratory assessment.

If the Oil Conservation Division of Santa Fe, New Mexico will not allow land farming, then the sludge can be treated by bio-venting with the use of a bio-cell. The bio-cell would

consist of a layer of one foot thick porous soil, or top soil available at the site, laid over a plastic sheet. It is strongly recommended that drainage pipes be installed for every 20 feet of the bio-cell. For this project, the bio-cell dimensions would be 150 feet by 150 feet. Bio-venting works on the same principles as natural biodegradation, but instead of the sludge being mixed with soil, the sludge is laid out over the bio-cell. The drainage pipes would be used for sludge venting after any water present in the sludge is drained out by gravity.

The Getty/Walker pit can be treated in-situ by adding micro-organisms to enhance the bioremediation and blending of the soil, or the sludge may be moved to the North Pond for treatment. If the sludge is moved from one lease to another, the New Mexico Oil Conservation Division (OCD) has to be notified for approval. Therefore, treatment of the Getty/Walker sludge in-situ might be more favorable. A sample form for the New Mexico OCD is attached at the end of this report.

The natural biodegradation method appears to be the most cost-effective method treatment for the North Pond and South Pond tank sludge. Highlander Services Corp. recommends drainage of any free water from the pits and subsequent injection of the free water into the deep injection wells operated by Greenhill Petroleum.

If you have any further questions involving the investigation or this report, please do not hesitate to call on us at once.

HIGHLANDER ENVIRONMENTAL CORP.

Tim Reed
Vice President, Environmental Services

Vijay Kurki
Hydrologist

SwL SOUTHWESTERN LABORATORIES

Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services
1703 West Industrial Avenue • P.O. Box 2150 • Midland, Texas 79702

Report of tests on	Waste	**File No.**	6581000
Client	Highlander Services Corp.	**Report No.**	78575
Delivered by	Tim Reed	**Report Date**	8-18-92
		Date Received	7-29-92

Identification Project No. 294, Greenhill Petroleum, Lovington, Tank Bottoms Sampling, North Pond, Sampled 7-28-92 @ 1145 by Tim Reed.

REPORT OF CHEMICAL ANALYSIS

Parameters	Results	Date Performed	Analyst	Test Method
Chloride, mg/kg (1:1 Water Extract)	284	8-3-92	W. Jaycox	SM 4500-Cl,
pH (1:1)	6.97	8-3-92	W. Jaycox	SW846, 9040
Total Petroleum Hydrocarbons, mg/kg	596000	7-30-92	S. Stovall	EPA 418.1

* Denotes "less than"

Copies: Highlander Services Corp.
Attn: Tim Reed

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Report of tests on	Waste	**File No.**	6581000
Client	Highlander Services Corp.	**Report No.**	78575
Delivered by	Tim Reed	**Report Date**	8-18-92
		Date Received	7-29-92

Identification Project No. 294, Greenhill Petroleum, Lovington, Tank Bottoms Sampling, North Pond, Sampled 7-28-92 @ 1145 by Tim Reed.

REPORT OF TOTAL METALS

Parameters	Results mg/kg	Date Performed	Analyst	Test Method
Arsenic	* 5.0	8-11-92	G. Bunch	SW846, 7061
Barium	* 20	8-17-92	G. Bunch	SW846, 7080
Cadmium	* 2.0	8-17-92	G. Bunch	SW846, 7130
Chromium	* 4.0	8-17-92	G. Bunch	SW846, 7190
Lead	137	8-17-92	G. Bunch	SW846, 7420
Mercury	* 0.40	8-12-92	G. Bunch	SW846, 7470
Selenium	* 1.5	8-11-92	G. Bunch	SW846, 7741
Silver	* 2.5	8-17-92	G. Bunch	SW846, 7760

*Denotes "less than"

Copies: Highlander Services Corp.
Attn: Tim Reed

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Report of tests on	Waste	**File No.**	6581000
Client	Highlander Services Corp.	**Report No.**	78576
Delivered by	Tim Reed	**Report Date**	8-18-92
		Date Received	7-29-92

Identification Project No. 294, Greenhill Petroleum, Lovington, Tank Bottoms Sampling, South Pond, Sampled 7-28-92 @ 1230 by Tim Reed.

REPORT OF CHEMICAL ANALYSIS

Parameters	Results	Date Performed	Analyst	Test Method
Chloride, mg/kg (1:1 Water Extract)	284	8-3-92	W. Jaycox	SM 4500-Cl,
pH (1:1)	6.69	8-3-92	W. Jaycox	SW846, 9040
Total Petroleum Hydrocarbons, mg/kg	626000	7-30-92	S. Stovall	EPA 418.1

* Denotes "less than"

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Report of tests on	Waste	**File No.**	6581000
Client	Highlander Services Corp.	**Report No.**	78576
Delivered by	Tim Reed	**Report Date**	8-18-92
		Date Received	7-29-92

Identification Project No. 294, Greenhill Petroleum, Lovington, Tank Bottoms Sampling, South Pond, Sampled 7-28-92 @ 1230 by Tim Reed.

REPORT OF TOTAL METALS

Parameters	Results mg/kg	Date Performed	Analyst	Test Method
Arsenic	* 5.0	8-11-92	G. Bunch	SW846, 7061
Barium	* 20	8-17-92	G. Bunch	SW846, 7080
Cadmium	* 2.0	8-17-92	G. Bunch	SW846, 7130
Chromium	* 4.0	8-17-92	G. Bunch	SW846, 7190
Lead	64	8-17-92	G. Bunch	SW846, 7420
Mercury	* 0.40	8-12-92	G. Bunch	SW846, 7470
Selenium	* 1.5	8-11-92	G. Bunch	SW846, 7741
Silver	* 2.5	8-17-92	G. Bunch	SW846, 7760

*Denotes "less than"

Copies: Highlander Services Corp.
Attn: Tim Reed

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1703 West Industrial Avenue • P.O. Box 2150 • Midland, Texas 79702

Report of tests on	Waste	**File No.**	6581000
Client	Highlander Services Corp.	**Report No.**	78577
Delive ɔd by	Tim Reed	**Report Date**	8-18-92
		Date Received	7-29-92

Identification Project No. 294, Greenhill Petroleum, Lovington, Tank Bottoms Sampling, Getty/Walker, Sampled 7-28-92 @ 1430 by Tim Reed.

REPORT OF CHEMICAL ANALYSIS

Parameters	Results	Date Performed	Analyst	Test Method
Chloride, mg/kg (1:1 Water Extract)	248	8-3-92	W. Jaycox	SM 4500-Cl,
pH (1:1)	6.41	8-3-92	W. Jaycox	SW846, 9040
Total Petroleum Hydrocarbons, mg/kg	334000	7-30-92	S. Stovall	EPA 418.1

* Denotes "less than"

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Attn: Tim Reed

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Report of tests on	Waste	**File No.**	6581000
Client	Highlander Services Corp.	**Report No.**	78577
Delivered by	Tim Reed	**Report Date**	8-18-92
		Date Received	7-29-92

Identification Project No. 294, Greenhill Petroleum, Lovington, Tank Bottoms Sampling, Getty/Walker, Sampled 7-28-92 @ 1430 by Tim Reed.

REPORT OF VOLATILE ORGANICS ANALYSIS

Date of Analysis 7-31-92 **Method** SW846, 5030/8240
Technique Purge and Trap GC/MS **Analyst** R. Wright

Compound	ug/kg
Chloromethane	* 10900
Bromomethane	* 10900
Vinyl Chloride	* 10900
Chloroethane	* 10900
Methylene Chloride	* 5430
1,1-Dichloroethene	* 5430
1,1-Dichloroethane	* 5430
1,2-Dichloroethene (total)	* 5430
trans-1,2-Dichloroethene	* 5430
Chloroform	* 5430
1,2-Dichloroethane	* 5430
1,1,1-Trichloroethane	* 5430
Carbon Tetrachloride	* 5430
Bromodichloromethane	* 5430
1,2-Dichloropropane	* 5430
trans-1,3-Dichloropropene	* 5430
Trichloroethene	* 5430
Dibromochloromethane	* 5430
1,1,2-Trichloroethane	* 5430
Benzene	62000
cis-1,3-Dichloropropene	* 5430
2-Chloroethylvinylether	* 10900
Bromoform	* 5430
Tetrachloroethene	* 5430
1,1,2,2-Tetrachloroethane	* 5430
Toluene	165000
Chlorobenzene	* 5430
Ethylbenzene	126000
Total Xylenes	172000
Acrolein	* 54300
Acrylonitrile	* 54300

*Denotes "less than"

Copies: Highlander Services Corp.
Attn: Tim Reed

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1703 West Industrial Avenue • P.O. Box 2150 • Midland, Texas 79702

Report of tests on	Waste	**File No.**	6581000
Client	Highlander Services Corp.	**Report No.**	78577
Delivered by	Tim Reed	**Report Date**	8-18-92
		Date Received	7-29-92

Identification Project No. 294, Greenhill Petroleum, Lovington, Tank Bottoms Sampling, Getty/Walker, Sampled 7-28-92 @ 1145 by Tim Reed.

REPORT OF ORGANICS ANALYSIS

Date of Analysis 8-4-92 **Method** SW846, 3550/8270
Analyst L. Jones

Compound	ug/kg
Phenol	* 280000
bis(2-Chloroethyl)Ether	* 280000
2-Chlorophenol phenol	* 280000
1,3-Dichlorobenzene	* 280000
1,4-Dichlorobenzene	* 280000
Benzyl Alcohol	* 280000
1,2-Dichlorobenzene	* 280000
2-Methylphenol	* 280000
bis(2-Chloroisopropyl)Ether	* 280000
4-Methylphenol	* 280000
N-Nitroso-Di-n-Propylamine	* 280000
Hexachloroethane	* 280000
Nitrobenzene	* 280000
Isophorone	* 280000
2-Nitrophenol	* 280000
2,4-Dimethylphenol	* 280000
Benzoic Acid	*1360000
bis(2-Chloroethoxy)Methane	* 280000
2,4-Dichlorophenol	* 280000
1,2,4-Trichlorobenzene	* 280000
Naphthalene	* 280000
4-Chloroaniline	* 280000
Hexachlorobutadiene	* 280000
4-Chloro-3-Methylphenol	* 280000
2-Methylnaphthalene	* 280000
Hexachlorocyclopentadiene	* 280000
2,4,6-Trichlorophenol	* 280000
2,4,5-Trichlorophenol	* 280000
2-Chloronaphthalene	* 280000
2,Nitroaniline	*1360000

*Denotes "less than"

Copies: Highlander Services Corp.
Attn: Tim Reed

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Delivered by	Tim Reed	**Report Date**	8-18-92
		Date Received	7-29-92

Identification Project No. 294, Greenhill Petroleum, Lovington, Tank Bottoms Sampling, Getty/Walker, Sampled 7-28-92 @ 1145 by Tim Reed.

REPORT OF ORGANICS ANALYSIS

Compound	ug/kg
Dimethyl Phthalate	* 280000
Acenaphthylene	* 280000
2,6-Dinitrotoluene	* 280000
3-Nitroaniline	*1360000
Acenaphthene	* 280000
2,4-Dinitrophenol	*1360000
4-Nitrophenol	*1360000
Dibenzofuran	* 280000
2,4-Dinitrotoluene	* 280000
Diethyl Phthalate	* 280000
4-Chlorophenyl-phenylether	* 280000
Fluorene	* 280000
4-Nitroaniline	*1360000
4,6-Dinitro-2-Methylphenol	*1360000
N-Nitrosodiphenylamine (1)	* 280000
4-Bromophenyl-phenylether	* 280000
Hexachlorobenzene	* 280000
Pentachlorophenol	*1360000
Phenanthrene	* 280000
Anthracene	* 280000
Di-n-Butylphthalate	* 280000
Fluoranthene	* 280000
Pyrene	* 280000
Butylbenzylphthalate	* 280000
3,3'-Dichlorobenzidine	* 561000
Benzo(a)Anthracene	* 280000
Chrysene	* 280000
bis(2-Ethylhexyl)Phthalate	* 280000

*Denotes "less than"

Copies: *Highlander Services Corp.*
Attn: Tim Reed

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		Date Received	7-29-92

Identification Project No. 294, Greenhill Petroleum, Lovington, Tank Bottoms Sampling, Getty/Walker, Sampled 7-28-92 @ 1145 by Tim Reed.

REPORT OF ORGANICS ANALYSIS

Compound	ug/kg
Di-n-Octyl Phthalate	* 280000
Benzo(b)Fluoranthene	* 280000
Benzo(k)Fluoranthene	* 280000
Benzo(a)Pyrene	* 280000
Indeno(1,2,3-cd)Pyrene	* 280000
Dibenz(a,h)Anthracene	* 280000
Benzo(g,h,i)Perylene	* 280000

* Denotes "less than"

Copies: Highlander Services Corp.
Attn: Tim Reed

Reviewed by

SOUTHWESTERN LABORATORIES

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Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services
1703 West Industrial Avenue • P.O. Box 2150 • Midland, Texas 79702

Report of tests on	Waste	**File No.**	6581000
Client	Highlander Services Corp.	**Report No.**	78577
Delivered by	Tim Reed	**Report Date**	8-18-92
		Date Received	7-29-92

Identification Project No. 294, Greenhill Petroleum, Lovington, Tank Bottoms Sampling, Getty/Walker, Sampled 7-28-92 @ 1430 by Tim Reed.

REPORT OF TOTAL METALS

Parameters	Results mg/kg	Date Performed	Analyst	Test Method
Arsenic	5.0	8-11-92	G. Bunch	SW846, 7061
Barium	* 20	8-17-92	G. Bunch	SW846, 7080
Cadmium	* 2.0	8-17-92	G. Bunch	SW846, 7130
Chromium	* 4.0	8-17-92	G. Bunch	SW846, 7190
Lead	32	8-17-92	G. Bunch	SW846, 7420
Mercury	* 0.40	8-12-92	G. Bunch	SW846, 7470
Selenium	* 1.5	8-11-92	G. Bunch	SW846, 7741
Silver	* 2.5	8-17-92	G. Bunch	SW846, 7760

*Denotes "less than"

Copies: Highlander Services Corp.
Attn: Tim Reed

KXC
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Highlander Services Corp.

306 W. Wall • Suite 320 • Midland, TX 79701 • (915)682-4559

Analysis Request and Chain of Custody Record

Page ___ of ___

Project No.	Client/Project
294	Greenhill Petroleum Lovington Tank Bottoms Sampling

Field Sample No./ Identification	Date and Time	Grab	Comp	Sample Type(Liquid Sludge,Ect.)	Preser-vative	ANALYSIS REQUESTED
North Pond 2 kerr	[illegible]		X	Sludge	ice	415.1, pH, Total metals, Chloride
South Pond 2 kerr	[illegible]		X	Sludge	ice	" " " " "
Getty/Walker 3 Jars 2 kerr 1 small	[illegible]		X	Sludge	ice	415.1, pH, Total metals, chloride, Volatile organics, Semi-volatile

Samplers: (Print) Tim Reed, Vijay Kurki

Tim Reed

Relinquished by: (Signature) Tim Reed — Date: 7/29/92 Time: 10:50

Relinquished by: (Signature) — Date: Time:

Relinquished by: (Signature) — Date: Time:

Recieved by: (Signature) — Date: Time:

Recieved by: (Signature) [illegible] — Date: 7/29/92 Time: 10:50

Data Results To:
1.
2.

Results by: ________

Rush Charges Authorized Yes ___ No X

Delivered To: Southwestern Laboratories Midland

REMARKS: Save additional sample for further testing

Please Fill out all copies – Deliverer retains White copy for file – Lab retains Yellow copy & Return Pink copy to Highlander Services Corp. at above address