1R - 426-117

REPORTS

DATE:

April 7, 2009

L. Peter Galusky, Jr. Ph.D., P.G.
Texerra
505 N Big Spring, Suite 404 Midland, Texas 79701
Tel: 432-634-9257 E-mail: lpg@texerra.com

April 8th, 2009

Mr. Brad Jones
New Mexico Energy, Minerals, & Natural Resources
Oil Conservation Division, Environmental Bureau
1220 S. St. Francis Drive
Santa Fe, New Mexico 87504

RE: Submittal of **ICP Reports and Termination Requests** for **NMOCD Case Nos. 1R426-117** (BD Oxy Owen A), **1R426-150** (BD P-35-1), **1R427-181** (EME Phillips B EOL) and **1R427-06** (EME O-19 Jct)

Sent via E-mail and Certified Mail/Return Receipt No. 7006 0100 0001 2438 3951

Dear Mr. Jones:

Please find enclosed Investigation and Characterization Reports and Termination Requests for the above-referenced projects.

ROC is the service provider (agent) for the EME and BD Salt Water Disposal (SWD) Systems and has no ownership of any portion of pipeline, well or facility. The EME and BD SWD Systems are owned by a consortium of oil producers, System Partners, who provide all operating capital on a percentage ownership/usage basis.

We appreciate your review consideration of these remediation termination requests.

Sincerely,

L. Peter Galusky, Jr. Ph.D.
Principal

Cc: Rice Operating Company, Edward Hansen (NMOCD)

Investigation and Characterization Report and Termination Request
Rice Operating Company – BD SWD System
BD Oxy Owen "A"
UL P Sec 35 T 21S R 37E
NMOCD Case Number: 1R426-117

April 7th, 2009

Prepared by:

L. Peter Galusky, Jr. Ph.D.
Texerra
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Midland, Texas 79701
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Investigation and Characterization Report and Termination Request

BD Oxy Owen A
UL P Sec 35 T 21S R 37E
NMOCD Case Number: 1R426-117

Executive Summary

This report summarizes the findings of investigative work prescribed in the NMOCD approved Investigation and Characterization Plan for this site.

Rice Operating Company removed three junction boxes from this location, all located within close proximity of each other, in March of 2006 as part of its facility maintenance and upgrade program. Preliminary site investigation associated with the junction box replacement indicated significant soil chloride concentrations and high petroleum hydrocarbon concentrations.

The field investigation was completed on September 9th, 2008. A single soil boring was advanced at/near the location of the former junction boxes to a depth of 45 ft bgs where the water table capillary fringe was encountered. Soil chloride concentrations averaged 223 ppm throughout the depth of drilling. Soil petroleum hydrocarbons were found in significant concentrations throughout the soil profile, averaging 314 by PID measurement and testing 3,280 ppm DRO at 15 ft bgs and 2,400 ppm DRO at 45 ft bgs.

The low levels of residual soil chlorides found during this investigation indicate a minor degree of leakage from the former junction boxes. It is likely, therefore, that the residual soil petroleum hydrocarbons were not caused by leakage from Rice Operating Company facilities but have migrated onto this location from an up-gradient source.

A simple soil chloride transport and groundwater dilution model was developed to estimate the potential effect of residual soil chloride leaching into groundwater. The model predicted that maximum anticipated elevation of groundwater chlorides caused by the movement of residual soil chlorides is less than 250 ppm, indicating that residual soil chlorides do not represent a hazard to groundwater quality.

The question of whether residual soil petroleum hydrocarbons at this location pose a potential threat to groundwater quality does not belong to Rice Operating Company, as their operations and facilities apparently did not cause this soil contamination.

It is therefore requested that NMOCD grant Rice Operating Company a "remediation termination" or similar closure status for this project.

Investigation and Characterization Report and Termination Request

BD Oxy Owen A
UL P Sec 35 T 21S R 37E
NMOCD Case Number: 1R426-117

Contents

Background

This report summarizes the findings of investigative work prescribed in the Investigation and Characterization Plan (ICP) for this site, which was approved by NMOCD on July 17th, 2008 (a copy of e-mail approval is given in the Appendix).

The site is located approximately one mile east/southeast of Eunice, New Mexico (Figures 1 & 2). The topography is gently sloping toward the southeast. Soils on the site are described in the Lea County Soil Survey as moderately deep to deep sandy material which is underlain by caliche of variable thickness and hardness. NM OSE records indicate that groundwater is likely to be encountered at a depth of 50+/- feet in unconsolidated Tertiary alluvium of the Ogallala Formation.

Rice Operating Company removed three junction boxes from this site, all located within close proximity of each other, in March of 2006 as part of its facility maintenance and upgrade program. The wood junction boxes were removed and soils were sampled using a backhoe, creating a 45 by 35 by 12 ft deep excavation. The excavation bottom and sidewalls were sampled for chlorides and petroleum hydrocarbons, and the excavated soil was then backfilled to ground level.

Significant concentrations (approx. 4,000 +/- ppm) of total hydrocarbons were encountered in the excavated soil with a lower concentration found (394 ppm) at 12 ft below ground surface (bgs). Chloride concentrations were 818 ppm at the bottom of the excavation. Petroleum hydrocarbons and chlorides thus represent the constituents of concern. The surface (ecological) impact of this release was relatively small.

Objective, Scope and Methodology

The objective of the ICP is to: **a**- quantify the magnitude and extent of residual soil chlorides and petroleum hydrocarbons; **b**- determine if these pose a threat to groundwater quality under present conditions and **c**- develop a Corrective Action Plan (CAP) to protect groundwater if this is warranted.

The scope of the ICP encompasses the measured effects of past operations of the facility on soil and groundwater in the affected vicinity.

The methodology of the ICP entailed: **a**- drilling to obtain subsurface soil samples; **b**- analyzing these for chlorides using field titration procedures and for petroleum hydrocarbons using a Photo-ionization Detector (PID); **c**- verifying (QA/QC) the field methods against a subset of samples analyzed by a commercial laboratory; **d**- analyzing the data using graphical and statistical methods and **e**- interpreting the data using a simple mass-balance dilution model.

The field investigation was completed on September 9th, 2008. Harrison and Cooper, Inc. provided drilling services and Rice Operating Company personnel performed field chloride titrations and PID analyses. L. Peter Galusky, Jr. of Texerra supervised field activities. Confirmatory laboratory analyses were subsequently performed by Cardinal Laboratories.

Figure 1 – BD Oxy Owen location map on USGS topo base.

Figure 2 – BD Oxy Owen A location on Google aerial photograph (date unknown).

Results and Discussion

A single soil boring was advanced at/near the location of the former junction boxes to a depth of 45 ft bgs where the water table capillary fringe was encountered (Figure 3). Soil chloride concentrations averaged 223 ppm throughout the depth of drilling. The total mass of residual soil chlorides at this location was estimated to be 6,690 lbs (Figure 4). Soil petroleum hydrocarbons were found in significant concentrations throughout the soil profile, averaging 314 by PID measurement and testing 3,280 ppm DRO at 15 ft bgs and 2,400 ppm DRO at 45 ft bgs.

The low levels of residual soil chlorides found during this investigation indicate a minor degree of leakage from the former junction boxes. It is likely, therefore, that the residual soil petroleum hydrocarbons were not caused by leakage from Rice Operating Company facilities but have migrated onto this location from an up-gradient source.

In order to determine if the residual soil chlorides represent a potential hazard to down gradient groundwater quality, a simple soil chloride transport and groundwater dilution model (Figures 5 & 6) was developed to estimate the potential effect of this residual soil chloride leaching into groundwater over time given the following assumptions:

1. The center of mass of residual chlorides moves downward at a rate of 2.0 ft/yr.
2. It is assumed that these chlorides mix uniformly within an elliptical groundwater plume of dimensions 200 ft maximum length by 100 ft maximum width through a depth of 15 ft of the water table aquifer.
3. Natural dilution of the plume occurs at a rate of 10% per year.

The model predicted that maximum anticipated elevation of groundwater chlorides caused by the movement of residual soil chlorides is under 250 ppm (Figure 7), indicating that residual soil chlorides do not represent a hazard to groundwater quality.

The question of whether residual soil petroleum hydrocarbons at this location pose a potential threat to groundwater quality does not belong to Rice Operating Company, as their operations and facilities apparently did not cause this soil contamination.

It is therefore requested that NMOCD grant Rice Operating Company a "remediation termination" or similar closure status for this project.

Rice Operating Company is the service provider (agent) for the BD Salt Water Disposal (SWD) System and has no ownership of any portion of pipeline, well or facility. The BD SWD System is owned by a consortium of oil producers, System Partners, who provide all operating capital on a percentage ownership/usage basis.

Soil Boring Log
Rice Operating Company **BD SWD System**
BD Oxy Owen A **Identification:** **SB-1**

Location: Approx. 5 ft W of Rice marker
Date: 9/9/2008
Driller: Harrison & Cooper, Inc. (Ken Cooper supervising)
Drill method: Air rotary
Logged by: L. Peter Galusky, Jr., Texerra
Total depth: 50 ft below ground surface
Screened interval: n/a (no well installed)
Pipe diameter: "

Depth (ft below ground surface)	Field Chloride Test (ppm)	Lab Chloride Test (ppm)	Field PID test (ppm)	Lab GRO test (ppm)	Lab DRO test (ppm)	Cutting Description
-5	261		99			oil stained sandy loam
-10	305		207			"
-15	177	192	594	1,210	3,280	"
-20	233		265			oil stained reddish brown coarse sandy loam
-25	155		147			light olive loamy sand, common small gravels
-30	168		229			"
-35	149		429			variegated olive brown and grayish white fine gravelly sandy loam
-40	167		504			"
-45	396	464	356	515	2,400	"
-50						oil stained olive brown coarse loamy sand, moist
avg	223		314			

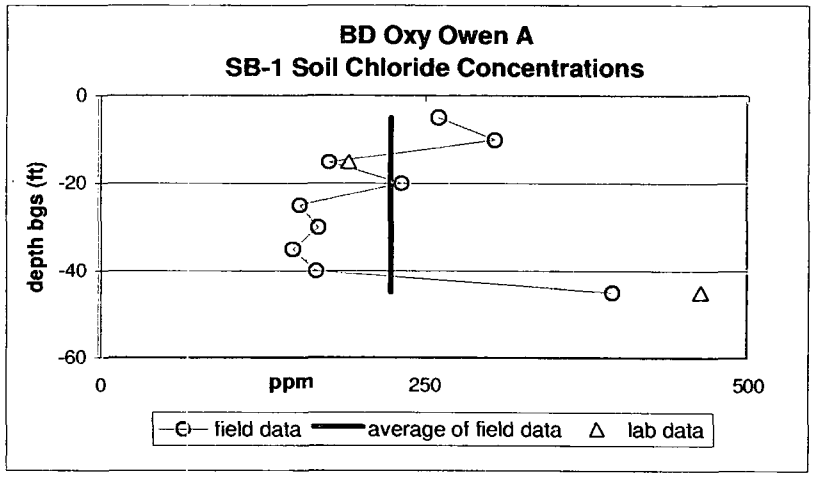

Figure 3 – Soil chloride and petroleum hydrocarbon concentrations from a soil boring taken at/near the former junction box locations.

Soil Chloride Calculator	
Estimates Mass of Soil Chloride, based upon Soil Chloride Concentration	
Rice Operating Company	
Site:	**BD Oxy Owen A**
This estimate prepared by:	L. Peter Galusky, Jr.
Date:	4/1/2009
Inputs in **Blue** Font	
length of affected area (ft)	**75**
width of affected area (ft)	**75**
affected area (sq ft)	**5,625**
affected depth (ft)	**48**
depth to water table (ft)	**48**
avg Cl- conc of affected soil (ppm)	**223**
unsat zone mass density (lbs/cu yd)	**3,000**
volume of affected soil (cu yds)	**10,000**
total mass of affected soils (lbs)	**30,000,000**
mass of residual soil chloride (lbs)	**6,690**

Figure 4 - Estimation of residual soil chloride mass.

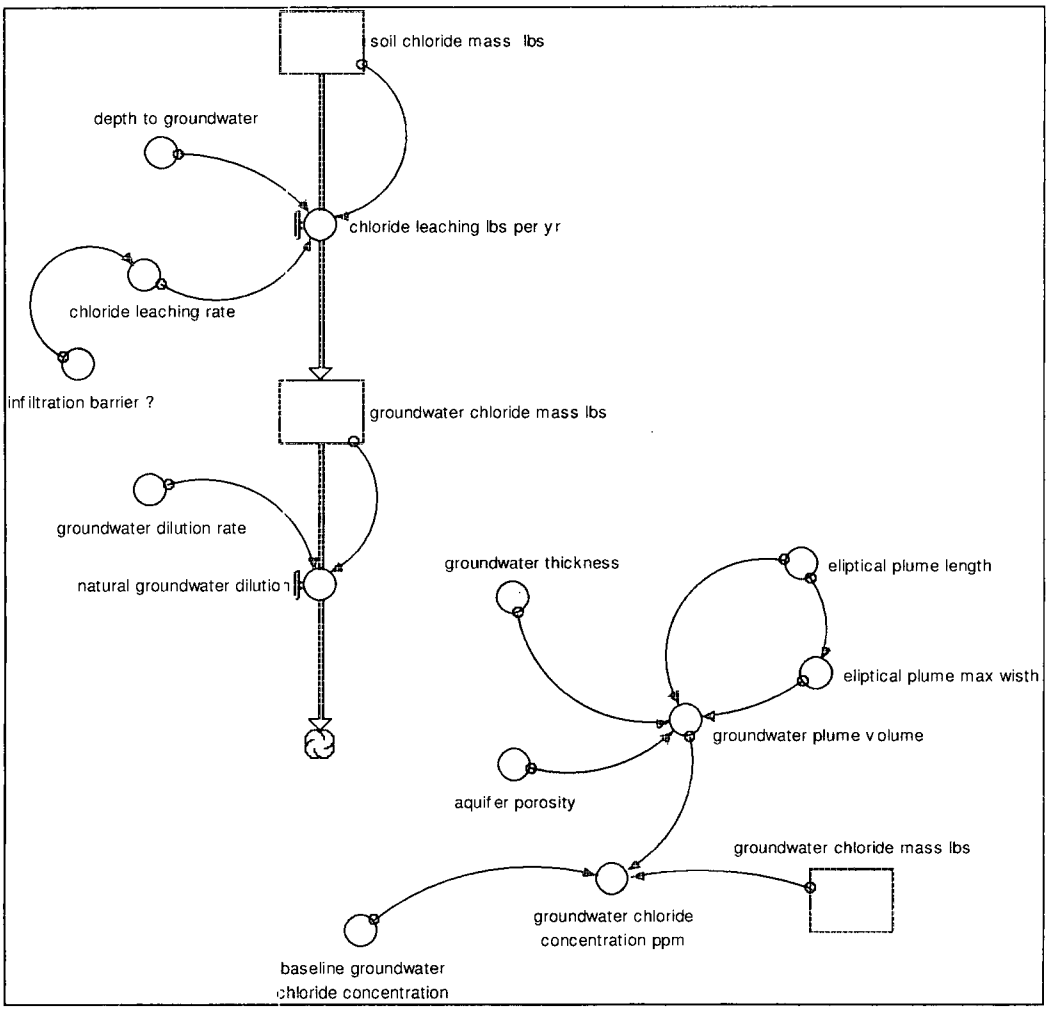

Figure 5- Schematic diagram of soil chloride – groundwater dilution model.

groundwater_chloride_mass_lbs(t) = groundwater_chloride_mass_lbs(t - dt) + (chloride_leaching_lbs_per_yr - natural_groundwater_dilution) * dt
INIT groundwater_chloride_mass_lbs = 0

INFLOWS:
chloride_leaching_lbs_per_yr = (chloride_leaching_rate/depth_to_groundwater)*soil_chloride_mass__lbs
OUTFLOWS:
natural_groundwater_dilution = groundwater_chloride_mass_lbs*groundwater_dilution_rate
soil_chloride_mass__lbs(t) = soil_chloride_mass__lbs(t - dt) + (-chloride_leaching_lbs_per_yr) * dt
INIT soil_chloride_mass__lbs = 6690

OUTFLOWS:
chloride_leaching_lbs_per_yr = (chloride_leaching_rate/depth_to_groundwater)*soil_chloride_mass__lbs
aquifer_porosity = 0.33
baseline_groundwater_chloride_concentration = 0
chloride_leaching_rate = IF(infiltration_barrier_?=0) THEN 2.0 ELSE 2.0/20
depth_to_groundwater = 48
eliptical_plume_length = 250
eliptical_plume_max_wisth = eliptical_plume_length/2.5
groundwater_chloride_concentration_ppm = 119962*(groundwater_chloride_mass_lbs)/(groundwater_plume_volume*7.5)+baseline_groundwater_chloride_concentration
groundwater_dilution_rate = 0.1
groundwater_plume_volume = (3.14*(eliptical_plume_length/2)*(eliptical_plume_max_wisth/2)*groundwater_thickness)*aquifer_porosity
groundwater_thickness = 15
infiltration_barrier_? = 0

Figure 6 – Model equations and parameter values for soil chloride – groundwater dilution model.

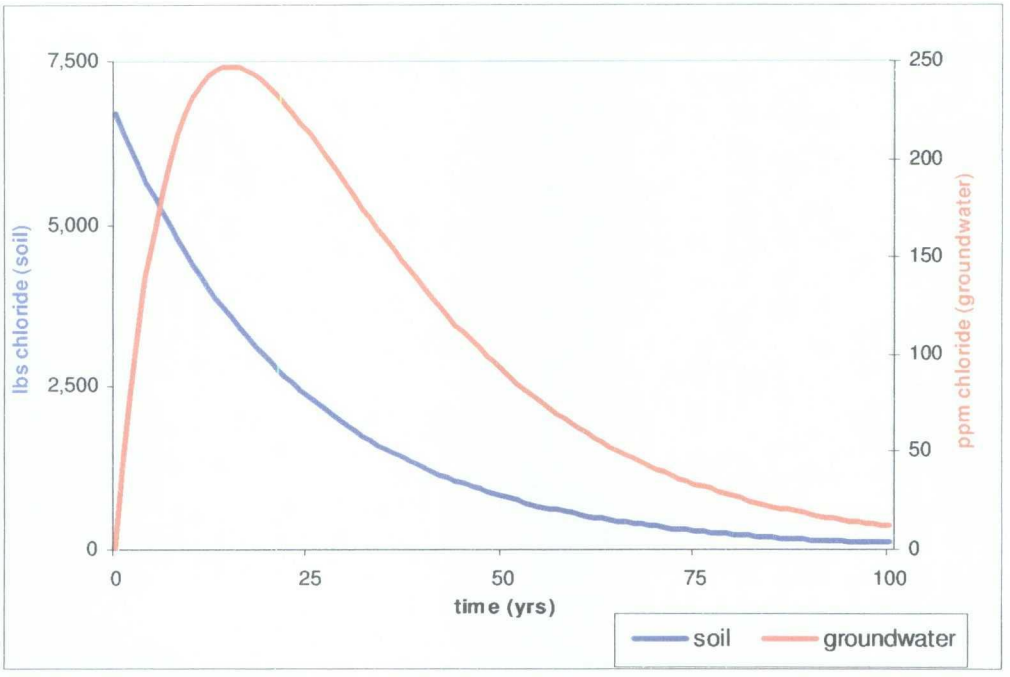

Figure 7 – Estimated change in baseline groundwater chloride concentration (right axes) over time.

APPENDICES

- Appendix A - NMOCD approval of Investigation and Characterization Plan
- Appendix B - Laboratory data
- Appendix C - Photograph

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Subject: ICP Approvals: #1R427-06; #1R427-181; #1R426-117; #1R426-150

Date: Thu, 17 Jul 2008 17:01:24 -0600

From: "Hansen, Edward J., EMNRD" <edwardj.hansen@state.nm.us>

To: "Mack Conder" <hconder@riceswd.com>

CC: "Price, Wayne, EMNRD" <wayne.price@state.nm.us>, mburrows@valornet.com, lpg@texerra.com

Dear Mr. Conder:

The New Mexico Oil Conservation Division (NMOCD) has reviewed the submitted Investigation Characterization Plans (ICPs), dated May 30, 2008 and June 3, 2008, for the above referenced sites. The NMOCD hereby conditionally approves the following ICPs for the Rice Operating Company sites:

1. EME SWD Jct. O-19 submitted by Texerra on 6/6/2008 #1R427-06
2. EME SWD Phillips 'B' EOL submitted by Texerra on 6/6/2008 #1R427-181
3. BD SWD Oxy Owen 'A' submitted by Texerra on 6/6/2008 #1R426-117
4. BD SWD Jct. P-35-1 submitted by Texerra on 6/6/2008 #1R426-150

In the proposed work elements for all ICPs please include that the delineation of chlorides will be to 250 mg/Kg.

In the proposed work elements for EME SWD Phillips 'B' EOL (#1R427-181) and BD SWD Oxy Owen 'A' (#1R426-117) please include that the delineation of petroleum hydrocarbons will be to 100 ppm using a PID (or equivalent).

Also, for BD SWD Oxy Owen 'A' (#1R426-117) please include re-sampling of the backfill material for petroleum hydrocarbons.

In the proposed work elements for all ICPs please include the analyses for "general chemistry" (including chloride, TDS, and sulfate) and BTEX for potential groundwater sampling.

Also, please be advised that NMOCD approval of these plans does not relieve the owner/operator of responsibility should operations pose a threat to ground water, surface water, human health or the environment. In addition, NMOCD approval does not relieve the owner/operator of responsibility for compliance with any OCD, federal, state, or local laws and/or regulations.

Appendix A – NMOCD approval of Investigation and Characterization Plan.

CARDINAL LABORATORIES

PHONE (575) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
RICE OPERATING COMPANY
ATTN: HACK CONDER
122 W. TAYLOR
HOBBS, NM 88240
FAX TO: (575) 397-1471

Receiving Date: 09/11/08
Reporting Date: 09/12/08
Project Number: NOT GIVEN
Project Name: BD OXY OWEN 'A' EOL
Project Location: BD OXY OWEN 'A' EOL

Sampling Date: 09/09/08
Sample Type: SOIL
Sample Condition: COOL & INTACT
Sample Received By: ML
Analyzed By: ZL

LAB NUMBER	SAMPLE ID	BENZENE (mg/kg)	TOLUENE (mg/kg)	ETHYL BENZENE (mg/kg)	TOTAL XYLENES (mg/kg)
ANALYSIS DATE		09/15/08	09/15/08	09/15/08	09/15/08
H15909-1	SB #1 @ 15'	1.62	1.45	18.6	35.9
H15909-2	SB #1 @ 45'	0.258	0.676	6.79	18.7
Quality Control		0.054	0.050	0.050	0.159
True Value QC		0.050	0.050	0.050	0.150
% Recovery		108	100	100	106
Relative Percent Difference		6.1	1.0	1.4	3.0

METHOD: EPA SW-846 8021B

TEXAS RELAP CERTIFICATION T104704398-08-TX FOR BENZENE, TOLUENE, ETHYL BENZENE, AND TOTAL XYLENES.

Chemist

Date

PLEASE NOTE: Liability and Damages. Cardinal's liability and client's exclusive remedy for any claim arising, whether based in contract or tort, shall be limited to the amount paid by client for analyses. All claims including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by Cardinal within thirty days after completion of the applicable service. In no event shall Cardinal be liable for incidental or consequential damages, including, without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries, affiliates or successors arising out of or related to the performance of services hereunder by Cardinal, regardless of whether such claim is based upon any of the above-stated reasons or otherwise. Results relate only to the samples identified above. This report shall not be reproduced except in full with written approval of Cardinal Laboratories.

Appendix B1 – Cardinal Laboratories data

CARDINAL LABORATORIES

PHONE (575) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
RICE OPERATING COMPANY
ATTN: HACK CONDER
122 W. TAYLOR
HOBBS, NM 88240
FAX TO: (575) 397-1471

Receiving Date: 09/11/08
Reporting Date: 09/15/08
Project Number: NOT GIVEN
Project Name: BD OXY OWEN 'A' EOL
Project Location: BD OXY OWEN 'A' EOL

Sampling Date: 09/09/08
Sample Type: SOIL
Sample Condition: COOL & INTACT
Sample Received By: ML
Analyzed By: ZL

LAB NUMBER	SAMPLE ID	BENZENE (mg/kg)	TOLUENE (mg/kg)	ETHYL BENZENE (mg/kg)	TOTAL XYLENES (mg/kg)
ANALYSIS DATE		09/15/08	09/15/08	09/15/08	09/15/08
H15909-1	SB #1 @ 15'	1.62	1.45	16.6	35.9
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Quality Control		0.054	0.050	0.050	0.159
True Value QC		0.050	0.050	0.050	0.150
% Recovery		108	100	100	106
Relative Percent Difference		6.1	1.0	1.4	3.0

METHOD: EPA SW-546 8021B

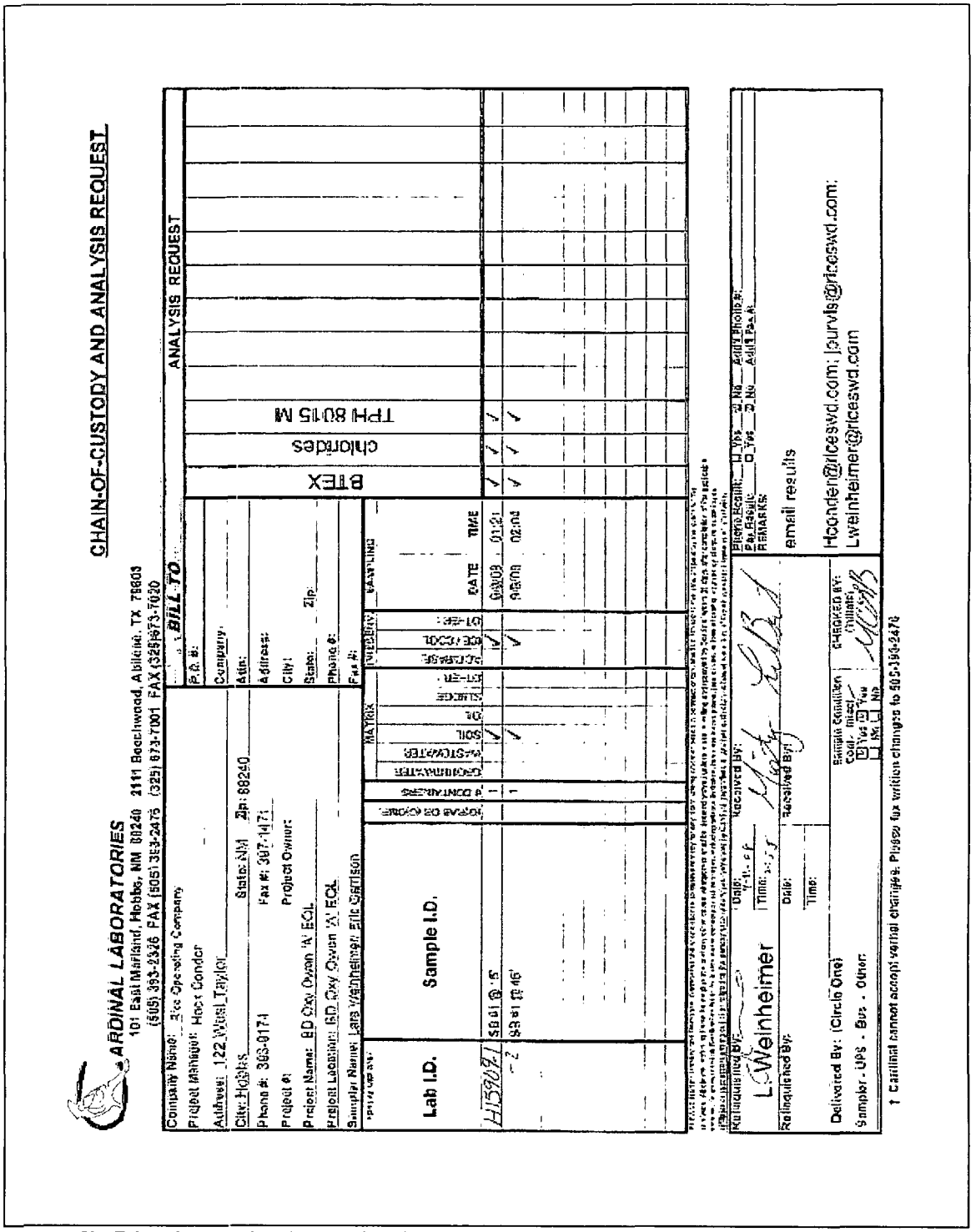
TEXAS RELAP CERTIFICATION T104704398-08-TX FOR BENZENE, TOLUENE, ETHYL BENZENE, AND TOTAL XYLENES.

Chemist

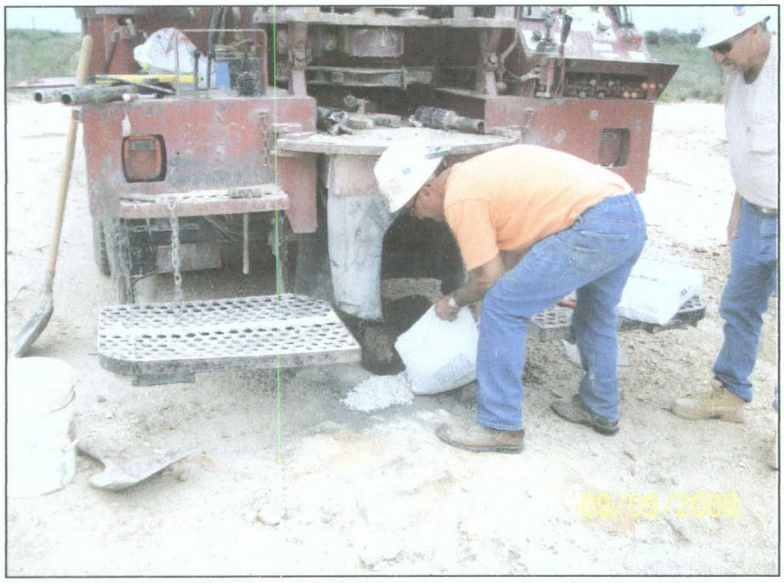
09/16/08
Date

PLEASE NOTE: Liability and Damages. Cardinal's liability and client's exclusive remedy for any claim arising, whether based in contract or tort, shall be limited to the amount paid by client for analyses. All claims, including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by Cardinal within thirty (30) days after completion of the applicable service. In no event shall Cardinal be liable for incidental or consequential damages including, without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries, affiliates or successors arising out of or related to the performance of services hereunder by Cardinal, regardless of whether such claim is based upon any of the above-stated reasons or otherwise. Results relate only to the samples identified above. This report shall not be reproduced except in full with the written approval of Cardinal Laboratories.

Appendix B2 – Cardinal Laboratories data



Appendix B3 – Cardinal Laboratories Chain of Custody form.



Appendix C – Harrison and Cooper plugging SB-1 with bentonite after completion of drilling.

BD Oxy Owen 'A' EOL (1R426-117)