1R - 425-62

REPORTS

DATE:

6-10-10

Texerra

75 Wuthering Hts Drive Colorado Springs, Colorado 80921
Tel: 719-339-6791 E-mail: lpg@texerra.com

July 23rd, 2010

RECEIVED
AUG - 2 2010
Environmental Bureau
Oil Conservation Division

Mr. Edward Hansen
New Mexico Energy, Minerals, & Natural Resources
Oil Conservation Division, Environmental Bureau
1220 S. St. Francis Drive
Santa Fe, New Mexico 87505

RE: **Addendum to ICP Report and Termination Request**
Rice Operating Company – Vacuum SWD System
Vacuum L-34 Vent (1R425-62) UL L, Sect 34, Township 17S, Range 35E

Sent via E-mail & U.S. Certified Mail w/ Return Receipt 7007 0710 0003 0305 3897

Mr. Hansen:

This report and attached documentation are to supplement Texerra's ICP Report and Termination Request of June 10th, 2010 and are submitted in reply to NMOCD's June 29th, 2010 response to this document. The particular concerns addressed in this Addendum are: a- the surface, ecological restoration of the site, and b- the potential fate and transport of residual soil hydrocarbons.

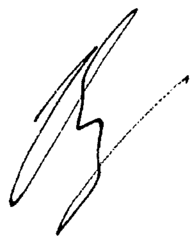
Surface ecological restoration of the site was addressed during July 2010 by ROC personnel through the preparation of the soil and reseeding of the site. Please refer to the Surface Ecological Restoration Report (attached). An objective and consequence of surface ecological restoration is to increase evapo-transpiration, which will substantially delay and reduce deep soil infiltration and thus the potential for the downward migration of residual soil chlorides and hydrocarbons. The restored surface vegetation will thus serve as a natural "infiltration/percolation barrier". The delay in deep soil infiltration (and thus groundwater recharge) increases the residence time of residual soil hydrocarbons in the unsaturated zone, thereby increasing the magnitude of their decomposition through natural attenuation and thus reducing the potential for groundwater impacts. The reduction in deep soil infiltration spreads out over time the mass of chloride loading into the groundwater, thus allowing natural dilution to have significant effect in keeping the resulting groundwater chloride concentrations at lower levels.

The potential fate and transport of residual soil hydrocarbons is addressed here through the use of a simple, spreadsheet model. Please refer to the BTEX Fate and Transport Model Report (attached). The objective of this modeling exercise was to estimate the likely fate of soluble, residual hydrocarbons (BTEX) in the soil (unsaturated zone) profile and in the groundwater immediately beneath the site and a short distance down-gradient from it. The rationale and key assumptions of the model are described in the attached report. The results are summarized below.

Total residual soil BTEX mass was estimated to be 12.1 kg over the upper 50 ft of the unsaturated zone. The depth to groundwater was estimated to be 65 ft bgs. The spreadsheet model, predicts that this total residual soil BTEX mass will decline (primarily through natural attenuation) to less than 1 kg over ten years. As this residual BTEX is attenuating in place, a small but progressively declining amount is projected to enter the groundwater, where natural attenuation and dilution in the saturated zone will occur. The model predicts that total BTEX in the groundwater immediately beneath the site will decline from approximately 1.6 mg/kg to less than 0.1 mg/kg over ten years and that benzene will similarly decline from approximately 0.11 mg/kg to less than 0.005 mg/kg over two years. When we consider a larger "reference plume", where the BTEX in the groundwater is mixed over a down-gradient distance of 100 meters from the site, the model predicts groundwater BTEX to decline from an estimated peak of 0.3 mg/kg to less than 0.1 mg/kg over ten years and benzene to decline from an estimated peak of 0.002 to less than 0.001 mg/kg over the same period. This work suggests that this site does not pose a significant risk of BTEX contamination to groundwater.

I would be happy to go over this work with you, to discuss in more detail the rationale and model structure as well as the assumptions and parameterization of the model. Ahead of this, we appreciate your consideration of this report.

Sincerely,



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

Copy: Rice Operating Company

VAC L-34

Surface Ecological Restoration Report

Vacuum L-34 vent (1R 425-62)

site prior to soil restoration 6/08/2010

blending amendments with imported soil 7/6/2010

seeding the backfilled site 7/6/2010

site complete 7/9/2010

Figure 1- Photo documentation of reseeding.

112 West Taylor
Hobbs, NM 88240
Phone: (575) 393-9174
Fax: (575) 393-0293

REVEGETATION FORM

1. General Information

Site name: **Vacuum L-34 vent**						
U/L	Section	Township	Range	County	Latitude	Longitude
L	**34**	**17S**	**35E**	**LEA**	**N32°47.276**	**W103°26.976**
Contact Name: **Bruce Baker**						
Email: **bbaker@riceswd.com**						
Site size: **500** square feet	Map detail of site attached ☐					
Additional information:						

2. Soils **Do not rip caliche subsoils; caliche rocks brought to the surface by ripping shall be removed.*

Salvaged from site ☐	Bioremediated ☐	Imported ☒	Blended ☐	Depth (in):
Texture: **Sandy**	Describe soil & subsoil: **Sand over Caliche**			
Soil prep methods:	Rip ☐ Depth(in):	Disc ☐ Depth (in):	Rollerpack ☐	
Date completed: 7/06/2010				

3. Bioremediation

Fertilizer ☐	Hay ☒	Other ☒
Type:		Describe: Organic compost and Peat Moss
Lbs/acre:		

4. Seeding **Attach seed bag tags to this form. Seed bag tags shall contain the site name and S-T-R.*

Custom seed mix ☒	Prescribed mix ☐	Seed mix name: **Pecos Mix**	Seeding date: **7/6/2010**
Broadcast ☒			
Method: **Broadcast by hand**			
Soil conditions during seeding:	Dry ☐	Damp ☒	Wet ☐
Photos attached ☒	Observations: **3 lbs Pecos mix, 3 lbs Racehorse oats, ½ lbs blue grama.**		
Number of photos:			

5. Certification I hereby certify that the information in this form and attachments is true and complete to the best of my knowledge and belief.

Name: **Joe Gatts**	Title: **Environmental Tech**	Date: **7/9/2010**
Signature: (signed)		

Figure 2 – Reseeding documentation and specifications.

VAC L-34

BTEX Fate and Transport Model Report

Model Rationale

The modeling exercise may be briefly summarized in following steps:

1. Residual unsaturated zone BTEX concentrations were estimated from field evaluation and the total unsaturated zone BTEX mass was calculated.
2. BTEX loading (percolation through the unsaturated zone) was estimated by ascribing an average annual rate of BTEX downward leaching (0.5 ft/yr) and adjusting for natural bio-attenuation (microbial decomposition) of the residual BTEX.
3. BTEX concentrations were estimated in the saturated zone (water table aquifer) immediately beneath the site and extending a moderate distance (100 m) down-gradient. The processes affecting groundwater BTEX concentrations were: BTEX loading from the unsaturated zone, natural bio-attenuation of BTEX in groundwater and natural dilution.

Characterization of Residual Unsaturated Zone BTEX Concentration and Mass

Residual soil hydrocarbons were measured in the field using a PID meter from a soil bore taken through the center of the former junction box to a depth of 60 ft (Figure 1). The depth to the water table is estimated to occur at approximately 65 ft bgs. Laboratory analysis of a sample taken where the PID reading was the highest provided a speciation of BTEX (into its constituents benzene, toluene, ethylbenzene and xylene) that was then proportioned and applied to the PID measurements from the other soil depths to estimate BTEX concentration throughout the depth of the soil bore (Table 1).

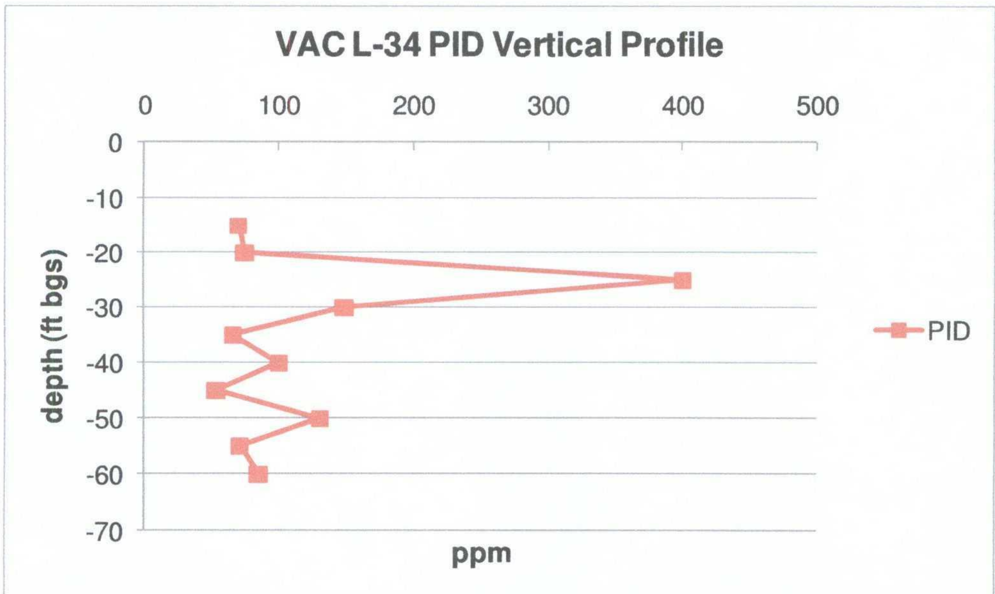


Figure 1 – Field (PID) measured residual soil hydrocarbons concentrations.

PID and BTEX Concentrations						
BTEX was speciated (only) for the 25 ft depth sample and proportioned						
to other depths exhiting a PID measurement of 100 ppm or greater.						
Depth	Cl-	PID	B	T	E	X
-15	319	70	n/a	n/a	n/a	n/a
-20	420	75	n/a	n/a	n/a	n/a
-25	376	400	0.146	0.568	6.470	13.900
-30	448	149	0.054	0.211	2.404	5.165
-35	448	66	n/a	n/a	n/a	n/a
-40	357	100	0.037	0.142	1.623	3.486
-45	228	54	n/a	n/a	n/a	n/a
-50	228	131	0.048	0.185	2.113	4.539
-55	242	72	n/a	n/a	n/a	n/a
-60	254	85	n/a	n/a	n/a	n/a
avg	**332**	**120**	**0.071**	**0.277**	**3.152**	**6.773**
Fractional composition of BTEX:						
... as estimated from the 25 ft sample, noted above.						
Benzene	0.69%					
Toluene	2.69%					
Ethylbenzene	30.69%					
Xylene	65.93%					
Sum	100.00%					

Table 1 – Estimated unsaturated zone residual BTEX concentrations.

<u>Movement of BTEX downward in the Unsaturated Zone and BTEX Loading of Groundwater</u>

The residual unsaturated zone BTEX <u>mass</u> was estimated to be 12.1 kg, and was determined based on the average BTEX concentrations for zones within 50 ft of the (estimated) water table depth of 65 ft bgs having a PID reading of 100 ppm or greater.

The unsaturated zone component of the model assumed that the center of mass of residual BTEX moved downward at a rate of 0.5 ft/yr and that the intrinsic rate of natural attenuation was 25% per year. Predicted loading of BTEX (in kg/yr) to the groundwater is given in Figure 2.

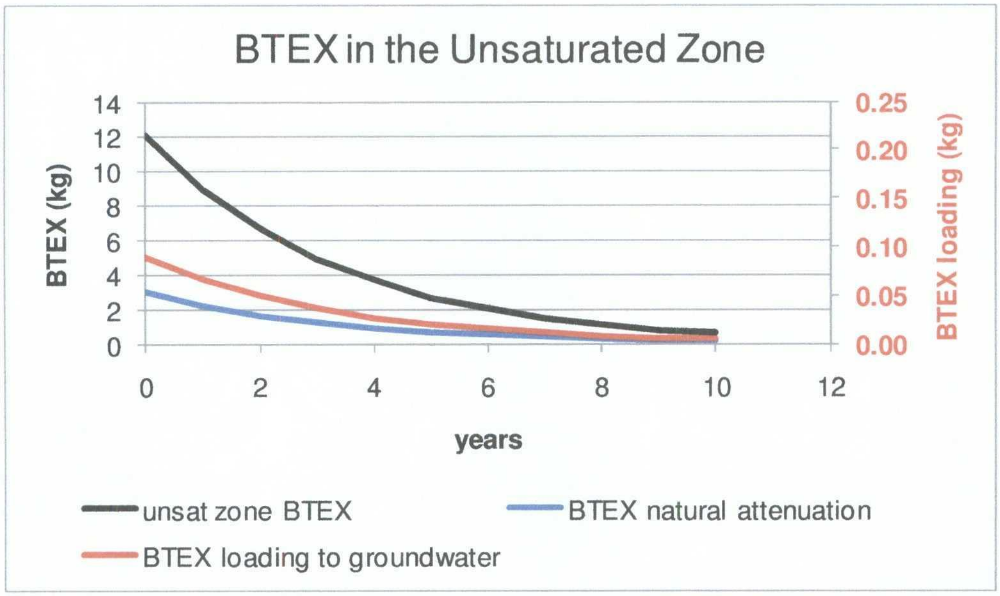


Figure 2- Model predicted loading of **BTEX (red line, right axis)** to groundwater. The gradual decline in unsaturated zone BTEX and consequent natural attenuation are also shown (right axis).

<u>BTEX in Groundwater</u>

The percolation of BTEX from the unsaturated zone, as described above, is the contributing source of BTEX in the groundwater model. Natural attenuation and dilution represent "sinks" that remove BTEX. Model predicted groundwater concentrations of total BTEX and benzene are given in Figures 3a and 3b, below. These are given for groundwater immediately beneath the site and for a "reference" plume of the same width but extended in length to 100 m from the source. The purpose of the reference plume is to illustrate the effect of BTEX dilution as the plume reaches a reasonable distance from the source.

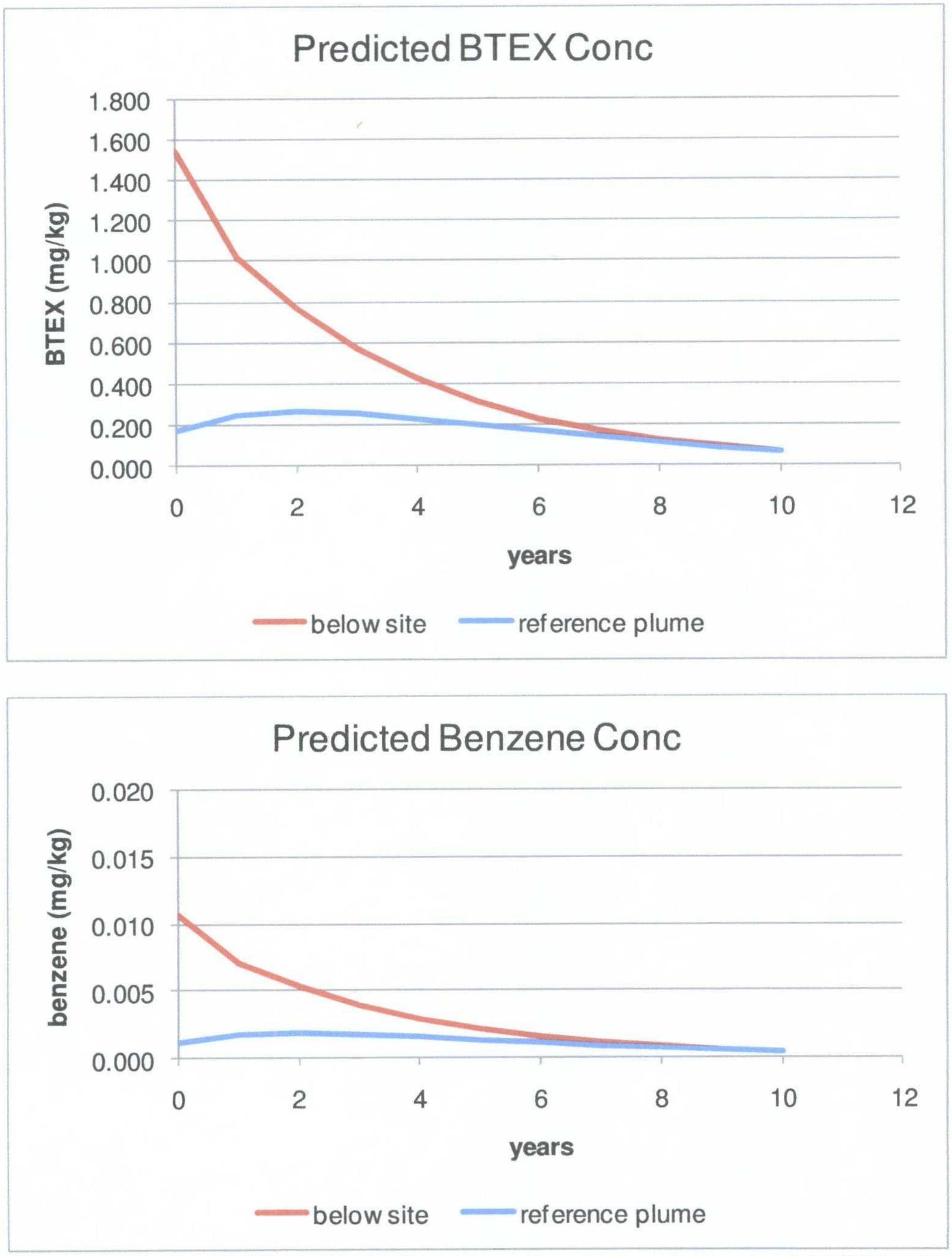


Figure 3a(above) and **b** (below) – Model predicted groundwater total BTEX and benzene concentrations below the site and for a prescribed reference plume.

Conclusions

The spreadsheet model predicts that total BTEX immediately beneath the subject site will decline rapidly from an initial value of approximately 1.6 mg/kg to less than 1.0 mg/kg by the second year and that benzene concentrations will decline from approximately 0.1 mg/kg to 0.5 mg/kg over the same period. Predicted concentrations of BTEX and benzene in the expanded reference plume are several fold lower, corresponding to the increased effect of dilution as additional groundwater is encompassed.

This work suggests that this site does not pose a significant risk of BTEX contamination to groundwater.

Soil Residual Petroleum Hydrocarbon Calculator			
Estimated Mass of Contributed, Residual Petroleum Hydrocarbons			
Copyright- June 28th, 2010. L. Peter Galusky, Jr.			
Site:	**VAC L-34 Vent**		
(Inputs in Blue Font)			
Unsaturated Zone Parameters	Unit		Notes
length of affected area	**ft**	**20**	measured/estimated
width of affected area	**ft**	**16**	measured/estimated
depth to water table	**ft**	**65**	estimated
unsat zone thickness contributing BTEX	**ft**	**50**	prescribed by NMOCD
unsat zone layers contributing BTEX	**ft**	**15**	depth intervals w/in 50 ft of water table w/ PID reading > 100 ppm
avg benzene conc of affected soil	**mg/kg**	**0.071**	measured/estimated
avg toluene conc of affected soil	**mg/kg**	**0.277**	measured/estimated
avg ethylbenzene conc of affected soil	**mg/kg**	**3.152**	measured/estimated
avg xylene conc of affected soil	**mg/kg**	**6.773**	measured/estimated
est. natural background Cl- conc	**mg/kg**	**250**	estimated
unsat zone mass density	**lbs/cu yd**	**3,000**	estimated
benzene conc attributed to natural background	**mg/kg**	**0**	estimated
toluene conc attributed to natural background	**mg/kg**	**0**	estimated
ethylbenzene conc attributed to natural background	**mg/kg**	**0**	estimated
xylene conc attributed to natural background	**mg/kg**	**0**	estimated
annual rate of solute percolation	**ft/yr**	**0.5**	assumed
annual percolation of residual soil BTEX to groundwater		**1%**	estimated/calculated
rate of natural attenuation of BTEX in unsaturated zone		**25%**	assumed
Saturated Zone Parameters			
thickness of affected aquifer	**ft**	**10**	prescribed by NMOCD
surface area of affected aquifer	**ft**	**320**	surface area of affected
porosity of affected aquifer		**30%**	estimated
rate of natural attenuation of BTEX in saturated zone		**25%**	assumed

Calculated/Intermediary Parameters			
affected area	**sq ft**	**320**	calculated
volume of affected soil	**cu yds**	**178**	calculated
total mass of affected soils	**lbs**	**533,333**	calculated
mass of contributed residual soil benzene	**lbs**	**0.04**	calculated
mass of contributed residual soil toluene	**lbs**	**0.15**	calculated
mass of contributed residual soil ethylbenzene	**lbs**	**1.68**	calculated
mass of contributed residual soil xylene	**lbs**	**3.61**	calculated
mass of contributed residual soil total BTEX	**lbs**	**5.5**	calculated
mass of contributed residual soil total BTEX	**kg**	**12.1**	calculated
volume of affected aquifer	cu ft	960	calculated
"	m 3	27.2	"
mass of water in affected aquifer	kg	27,183	calculated
rate of groundwater movement	m/yr	5.0	assumed
annual dilution attenuation factor (**DAF**)		83%	calculated

Texerra

505 N Big Spring, Suite 404 Midland, Texas 79701
Tel: 432-634-9257 E-mail: lpg@texerra.com

June 10th, 2010

Mr. Edward Hansen
New Mexico Energy, Minerals, & Natural Resources
Oil Conservation Division, Environmental Bureau
1220 S. St. Francis Drive
Santa Fe, New Mexico 87505

RECEIVED
JUN 16 2010
Environmental Bureau
Oil Conservation Division

RE: **Investigation and Characterization Plan Report & Termination Request**
Rice Operating Company – Vacuum SWD System
Vacuum L-34 Vent (1R425-62) UL L, Sect 34, Township 17S, Range 35E

Sent via E-mail & U.S. Certified Mail w/ Return Receipt 7007 0710 0003 0305 3859

Mr. Hansen:

Texerra has directed and supervised work outlined in the NMOCD approved Investigation and Characterization Plan of October 5th, 2009 for this project. A soil boring was advanced to 60 ft bgs through the center of the former junction box vent location. Soil cuttings were described and residual soil chlorides and hydrocarbons were measured using field methods, which were subsequently corroborated by laboratory analysis. A brief summary of the key findings is given below.

- The site is located down-gradient from the Buckeye oil field (Figure 1).

- The depth to groundwater is greater than 60 ft below ground surface. (Soil cuttings did not show moisture to the limit of drilling at 60 ft bgs, Figure 2).

- Residual soil chloride concentrations were moderate (below 450 ppm) from the surface to 35 ft bgs, then declined to below 250 ppm at 60 ft bgs (Figures 2 & 3).

- Elevated residual petroleum hydrocarbon concentrations (100 ppm or greater as measured by field PID meter) were found from 25 to 50 ft bgs, but declined below 100 ppm from 50 to 60 ft bgs (Figures 2 & 3).

- The site is located within an active truck lane and turnaround area. Vegetative cover is thus sparse (Figure 4).

The risk of groundwater contamination from residual soil chlorides or petroleum hydrocarbons from this location is believed to be exceedingly low due to the groundwater depth and the low concentrations found as the water table was approached. Texerra therefore respectfully requests that NMOCD grant this project "remediation termination" or a similar closure status.

Rice Operating Company – VAC L-34 Vent

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

We greatly appreciate your consideration of this request.

Thank you for your consideration.

Sincerely,

L. Peter (**Pete**) Galusky, Jr. Ph.D., P.G.
Principal

copy: Rice Operating Company

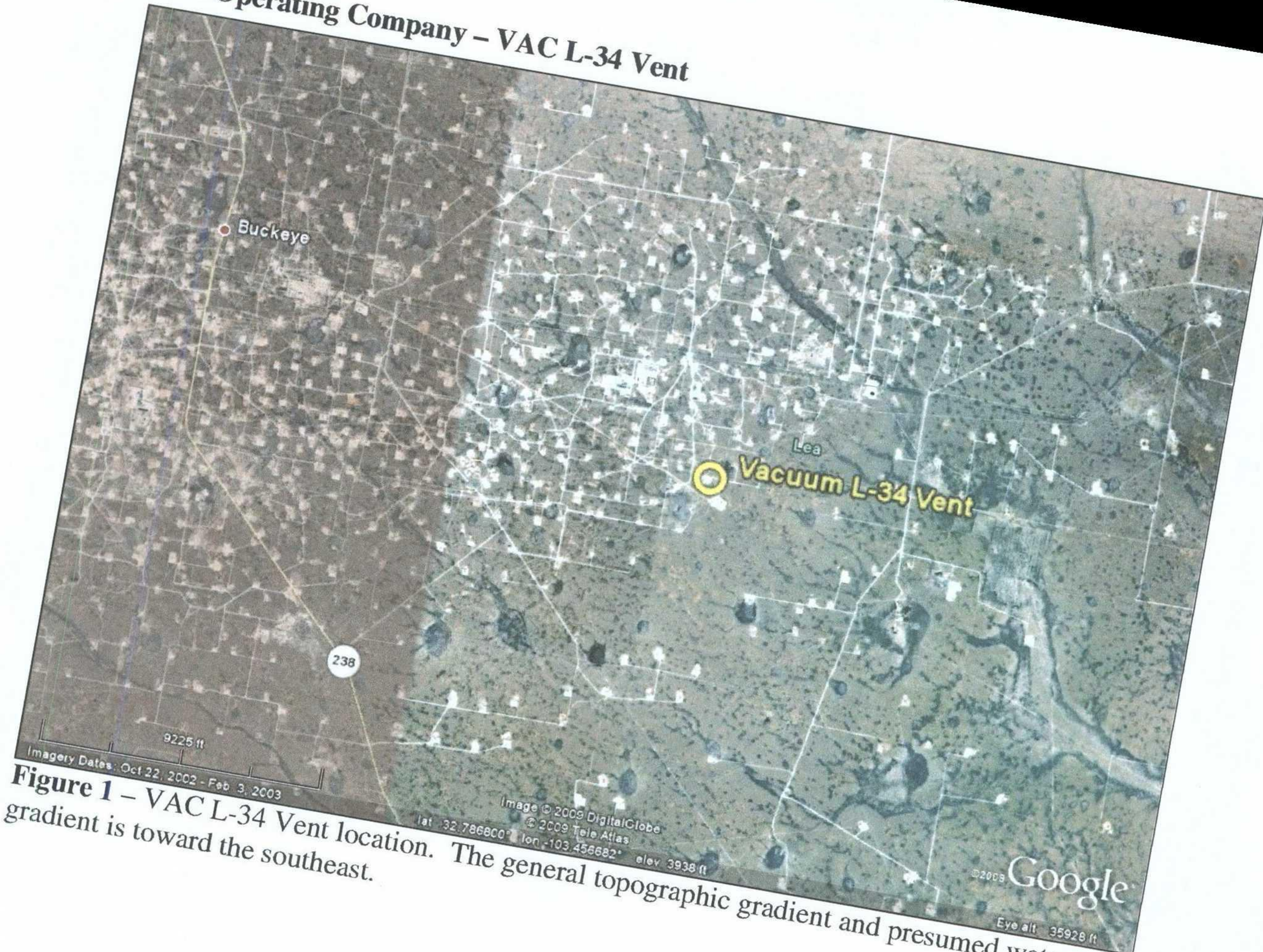


Figure 1 – VAC L-34 Vent location. The general topographic gradient and presumed water table gradient is toward the southeast.

Logger:	Pete Galusky
Driller:	Harrison & Cooper, Inc. Drilling
Consultant:	Texerra
Drilling Method:	Air rotary
Start Date:	4/20/2010
End Date:	4/20/2010

Comments: All samples from cuttings. Located at the source of the former junction box site.

Drafted by: Lara Weinheimer

TD = 60 ft   GW = 75 ft

Project Name: Vacuum L-34 vent	Well ID: SB-1
Location: UL/L sec. 34 T17S R35E	
Lat: 32°47'16.965"N	County: Lea
Long: 103°26'59.59" W	State: NM

Depth (feet)	chloride field tests (ppm)	LAB	PID	Description
5				0 - 10 ft CALICHE caliche rubble overburden
10				
15	319		70.3	10 - 25 ft SAND; CALICHE gray loamy sand with caliche fragments, oily
20	420		74.7	
25	376	Cl- 320	400	
	B 0.146 T 0.568	GRO 454		25 - 45 ft SAND gray loamy sand, oily smell
	E 6.47 X 13.9	DRO 4610		
30	448		149	
35	448		65.9	
40	357		100	
45	228		53.6	
50	228		131	45 - 55 ft SAND grayish brown loamy sand, oily smell
55	242		71.7	
60	254	Cl- 112	85.1	55 - 60 ft SAND pale brown loamy sand, no oily smell evident
		GRO 47.3		
		DRO 2780		

Lithology

Bore Construction

bentonite seal

Figure 2 – VAC L-34 Vent soil boring log, residual chloride and hydrocarbon concentrations.

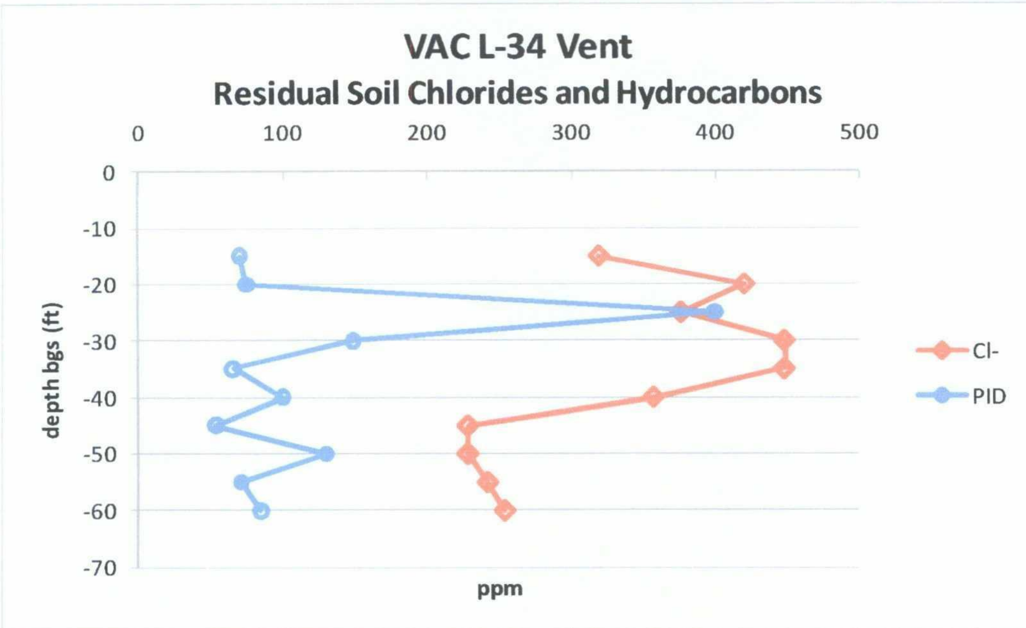


Figure 3 – VAC L-34 Vent plot of residual chlorides and hydrocarbons versus depth.

Figure 4 – VAC L-34 Vent location.