1R - 478

REPORTS

DATE:

2007

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

2007 MAR 9 AM 11 22

March 2nd, 2007

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

RE: Investigation and Characterization (ICP) Report and Closure Request
Vacuum M-26 Produced Water Discharge, UL C Sec 35 T17S R35E
NM OCD Case Number: 1R0478

Certified Mail/Return Receipt No. 7005 0390 0002 2709

Dear Mr. Hansen:

We have completed our characterization and analysis of this site per the ICP that that was approved by OCD last May. Key findings are summarized in the following points:

- Soil chloride concentrations were exceedingly low (< 150 ppm and declining with depth) as close as we could safely drill (approximately 30 ft) around the release.
- Groundwater has not been affected, as evidenced by negligible (< 30ppm) soil chlorides in the water table capillary fringe 30 ft. down gradient from the release.
- Natural vegetation has become re-established across the release area.

During a field visit with NMOCD staff to this site on February 21st, it was discussed whether there would be any merit in installing a monitoring well near (and slightly down gradient of) the release to determine if groundwater has been impacted. In the absence of other data, this would generally be a prudent measure. However, our sampling of soil chlorides at the water table capillary fringe just down gradient of the release provides a surrogate for data that could only otherwise be obtained from a monitor well. Given that soil chloride levels here were negligible 3 years after the release indicates that any residual soil chlorides are not affecting groundwater. Therefore, it would seem prudent in this case to forego the installation of an unnecessary monitor well.

Taken together, these lines of evidence indicate that the effects of this release were of small and localized extent. There has been negligible impact on soils and vegetation, and groundwater quality is not threatened. We therefore believe that it would be reasonable for OCD to grant closure status to this release, and we respectfully request such action.

Vacuum M-26
NMOCD Case Number 1R0478

I would be happy to answer any questions or address any concerns that you have regarding this work. I appreciate your consideration of this request.

Sincerely,

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

Copies: Wayne Price, NMOCD Santa Fe
Patricia Caperton , NM OCD District I office
Kristin Pope, Rice Operating Company

Enclosures: C-141 (final)
ICP report

Investigation Characterization Report & Closure Request

Vacuum M-26 Produced Water Discharge
UL C Sec 35 T17S R35E
NMOCD Case No. 1R0478

Prepared: March 2nd, 2007

Prepared by:

L. Peter Galusky, Jr. Ph.D.
Texerra
505 N. Big Spring, Suite 404
Midland, Texas 79701
Web: www.texerra.com
E-mail: lpg@texerra.com

Investigation Characterization Report & Closure Request

Vacuum M-26 Produced Water Discharge
UL C Sec 35 T17S R35E

Contents

Investigation Characterization Report & Closure Request

Vacuum M-26 Produced Water Discharge
UL C Sec 35 T17S R35E

Background

This report presents the findings and recommendations of an evaluation of soil chloride levels associated with a small (approx. 15 bbl) release of produced water, affecting an estimated 225 sq ft, which occurred in August, 2003. This work was completed pursuant to an Investigation Characterization Plan of December 12th, 2005 (included in Appendix D).

The release site is located near Buckeye immediately south of CR-50, a few hundred feet east of a large Conoco-Phillips battery (Figure 1). The topography is gently sloping toward the southeast (Figure 2). Soils at the location are mapped as Kimbrough gravelly loam soil series, characterized by gravelly loam to a depth of approximately 6 inches, and underlain by calcium indurated caliche[1]. Vegetation is open range grassland and desert scrub. Groundwater is estimated to occur at a depth of approximately 51 feet[2], occurring in unconsolidated Tertiary alluvium of the Ogallala Formation[3], where the saturated thickness is estimated to be 100 ft[4].

Soil samples were taken on June 23rd, 2006 from the cuttings of an air-rotary drill rig, operated by Harrison and Cooper of Lubbock, Texas. Samples were taken from the surface to a depth of approximately 55 ft below ground surface. Borings were located as close to the release site as possible, limited by the presence of an active underground petroleum pipeline and an overhead power line.

Findings

Soil chloride concentrations were exceedingly low (< 150 ppm) at all depths sampled, and diminished rapidly with depth in each of three borings, indicating that the released chloride did not measurably affect soils in close proximity to the release; (Figures 3 and 4, and Tables 1 to 3). The effects of this spill were thus found to be highly localized and of minimal areal extent. Moreover, soil chloride concentrations in the water table capillary fringe close to the release (50 to 55 ft depth at SB-3, which is 30 ft down gradient) were negligible (< 30 ppm), indicating that groundwater has not been affected.

Natural vegetation has become reestablished across the area disturbed during the initial incident investigation and pipeline repair (Figure 5). The effective reestablishment of vegetation across the release area additionally provides a natural evapotranspiration "cap". It was also observed that soils that were backfilled following the repair of the leak were mounded at the surface to

[1] 2004 SSURGO USDA Soils Map. Lea County, New Mexico Soil Survey.
[2] NM State Engineer Office. Water well records.
[3] USGS Geologica Map. Open File Report OF-97-82. Green & Jones, 1997.
[4] Musharrafieh, G. and Chudnoff, M. 2003. Numerical simulation of groundwater flow for water rights administration in the Lea County underground water basin New Mexico. N.M. Symposium on Hydrologic Modeling

shed rainwater, thus minimizing the likelihood of infiltration. It is therefore highly probable that: a) significant infiltration of water will not be concentrated through the release area; and b) water which does infiltrate into the rooting zone will be consumed via transpiration. It is thus highly improbable that any significant quantities of residual salts will leach into the groundwater, which is approximately 50 ft below the surface.

Modeling of the likely rate of movement of chlorides from the release to the groundwater further indicates that the small mass of residual chloride at this location does not pose a threat to groundwater quality (Figure 6 and Appendix C).

During a field visit with NMOCD staff to this site on February 21st, it was discussed whether there would be any merit in installing a monitoring well near (and slightly down gradient of) the release to determine if groundwater has been impacted. In the absence of other data, this would generally be a prudent measure. However, our sampling of soil chlorides at the water table capillary fringe just down gradient of the release provides a surrogate for data that could only otherwise be obtained from a monitor well. Given that soil chloride levels here were negligible 3 years after the release indicates that any residual soil chlorides are not affecting groundwater. Therefore, it would seem prudent in this case to forego the installation of an unnecessary monitor well.

Taken together, these findings indicate that neither soils, vegetation nor groundwater have been impaired or is threatened by this small release. We believe that these conclusions stand based on facts and observed site conditions. Although not an essential part of this analysis, the modeling work simply tested our logic, providing further support that groundwater is not threatened.

Therefore, no further actions are recommended with respect to this release. It is thus requested that OCD grant this release "closure" status and approve the enclosed C-141 (final) form.

Appendix A – Figures and Photographs

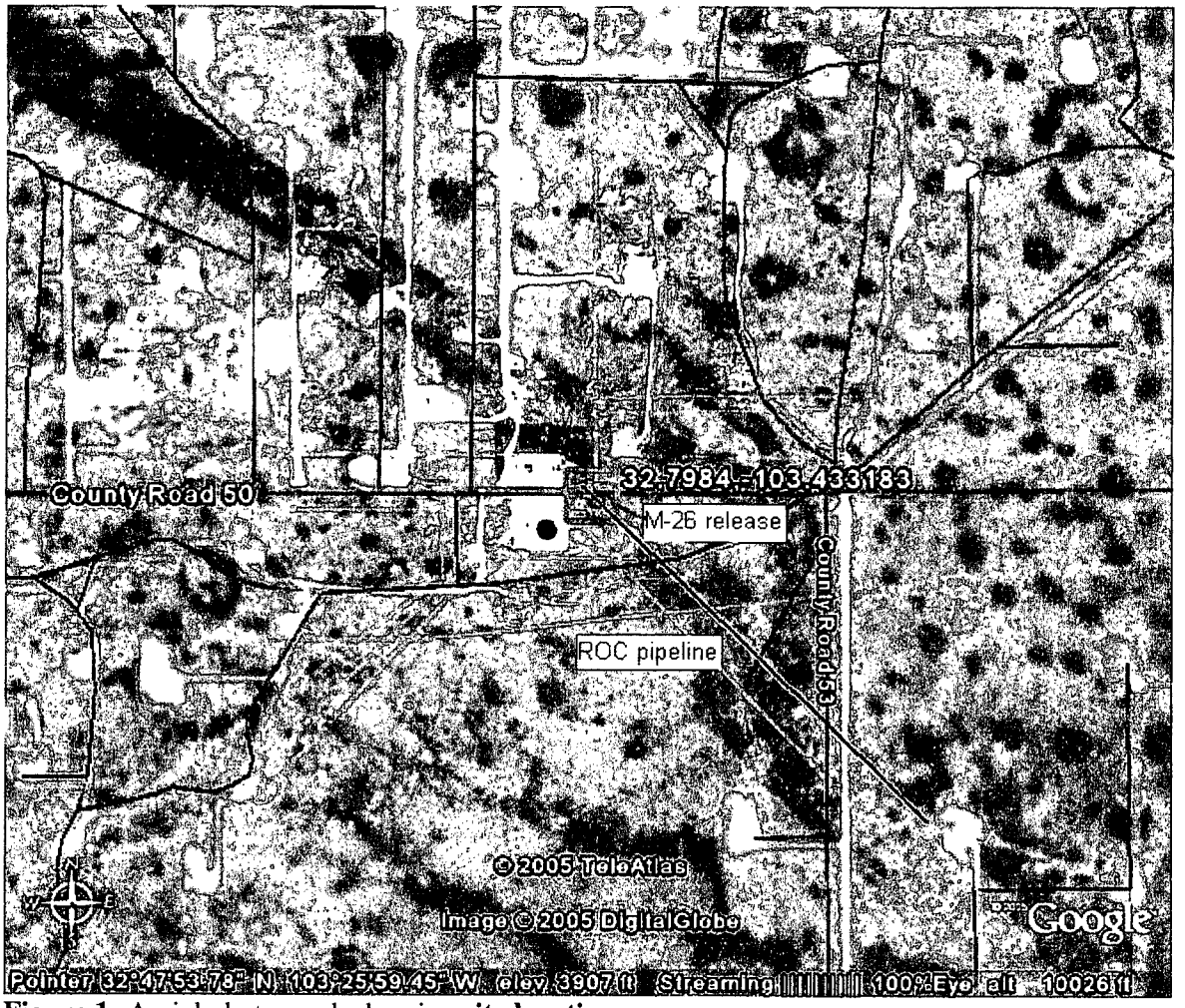


Figure 1- Aerial photograph showing **site location**.

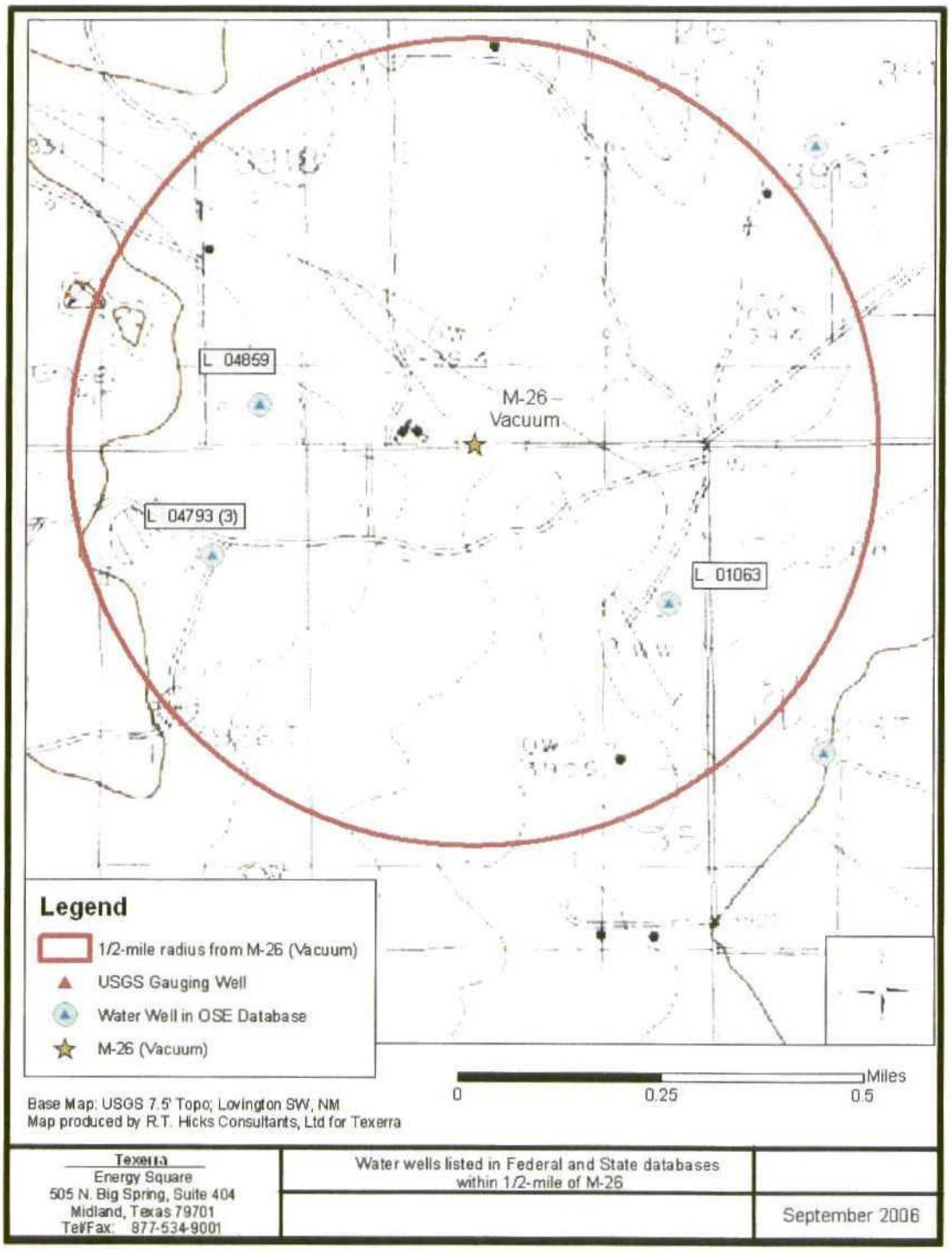


Figure 2 – Topographic map, showing locations of water wells in NM State Engineer database. The presumed direction of groundwater flow is toward the southeast.

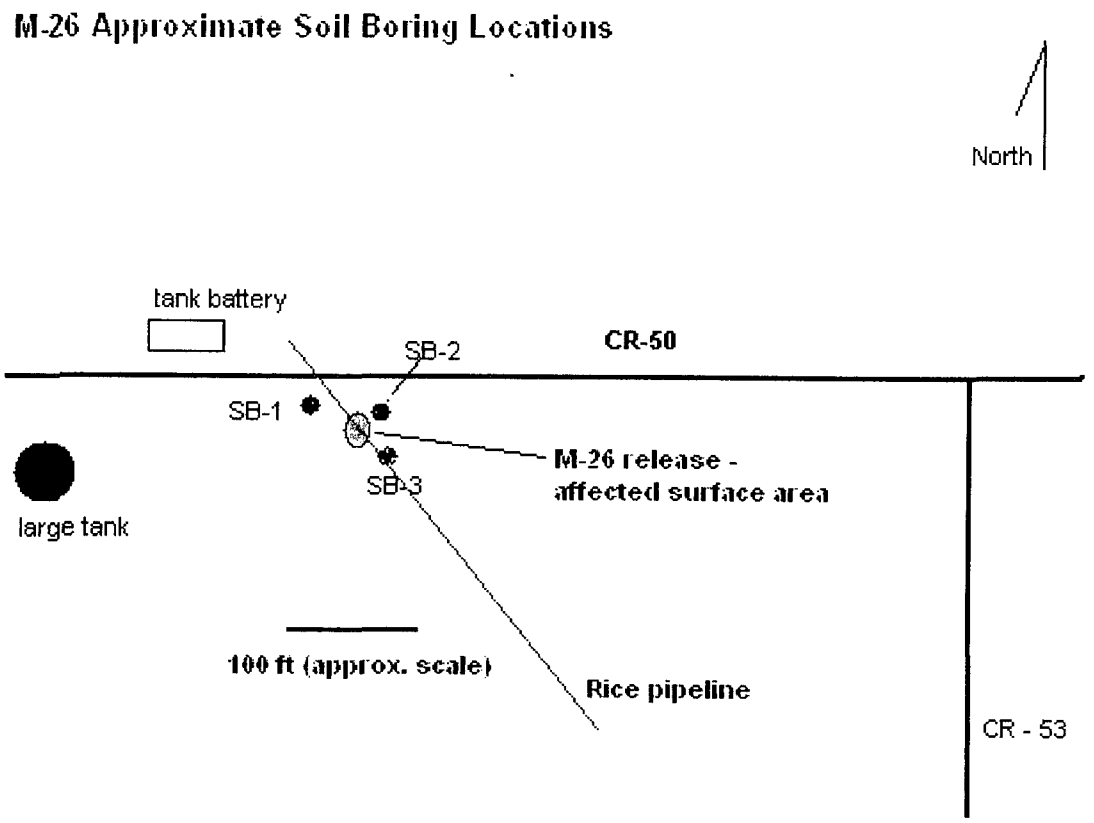


Figure 3 – Approximate soil boring locations. The water table gradient is believed to be toward the southeast, following surface topography, in the general direction of the Rice pipeline.

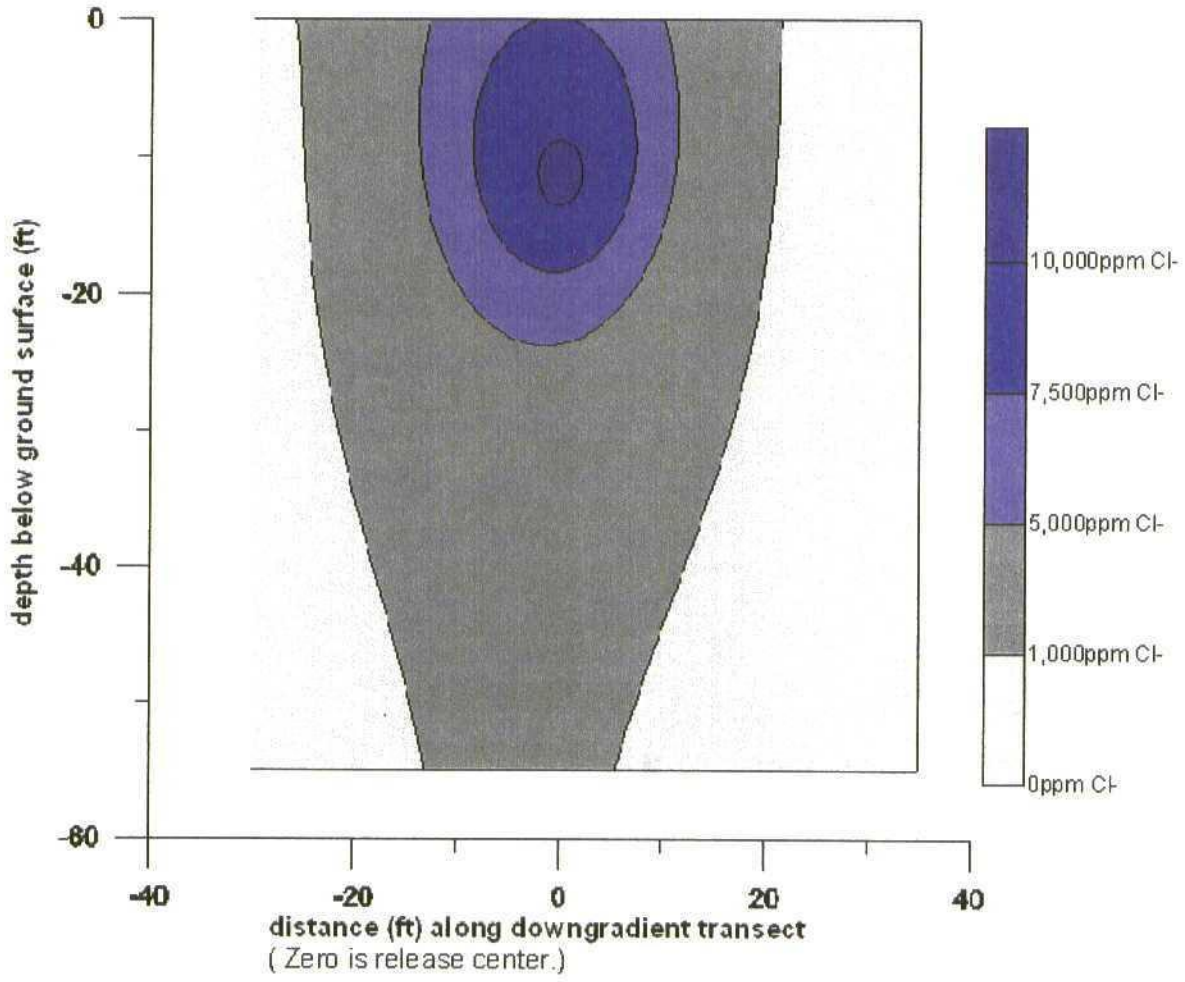
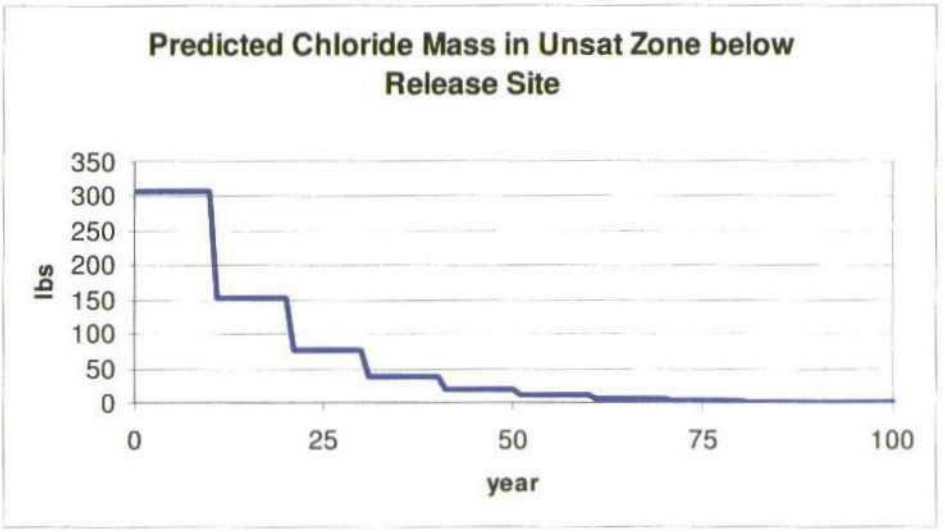


Figure 4- Interpolated soil chloride concentrations in a vertical slice along an up gradient to down gradient transect across the release center (from SB-1 to SB-3).

Figure 5- View of release site looking west. Photograph taken September 22nd, 2006



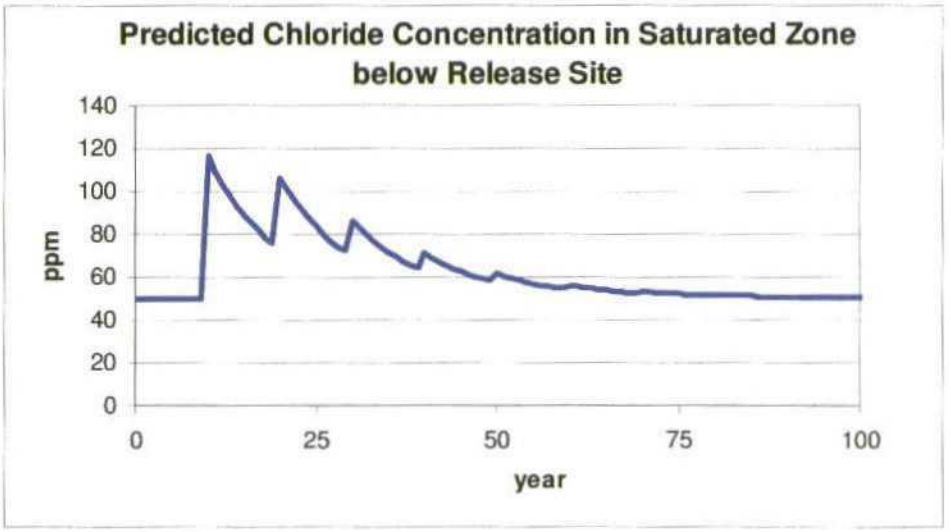


Figure 6 – Predicted loading of chloride to groundwater and subsequent dilution over a 100 year time frame, using the model **SCl-lpg**, described in Appendix C. **Figure 6**a (above) - Predicted attenuation of residual soil chloride mass over time. **Figure 6b** (below) - Predicted course of groundwater chloride concentrations over time, in response to periodic recharge and subsequent dilution. The presumed baseline groundwater chloride concentration is 50 ppm.

APPENDIX B – Soil Boring Logs and Chloride Concentrations

Soil Boring Log
Rice Operating Company
Vacuum Field SWD System
M-26 vent

Identification: **SB-1**
Location: approx. 40 ft west/northwest of release
Date: 6/23/2006
Driller: Ken Cooper (Harrison and Cooper, Inc.)
Drill method: Air Rotary
Logged by: L. Peter Galusky, Jr.

Depth	Field Chloride Test (ppm)	Lab Chloride Test (ppm)	Field OVM test (ppm)	Lab BTEX test (ppm)	Cutting Description
0					light gray caliche
-5	113		0		"
-10	122	16	0		"
-15	58		0		"
-20	60		0		"
-25	55		0		light brown sand
-30	29		0		"
-35	57		0		"
-40	28		0		"
-45	28		0		"
-50	29		0		"
-55	29	16	0		"
-60					

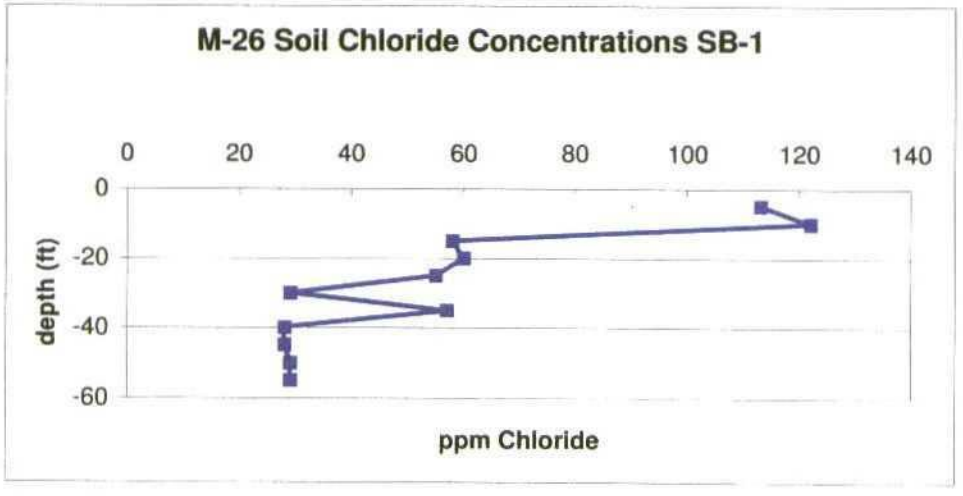


Table 1 – Soil boring log and chloride levels for SB-1.

Soil Boring Log
Rice Operating Company
Vacuum Field SWD System
M-26 vent

Identification: **SB-2**
Location: approx. 30 ft east/southeast of release
Date: 6/23/2006
Driller: Ken Cooper (Harrison and Cooper, Inc.)
Drill method: Air Rotary
Logged by: L. Peter Galusky, Jr.

Depth	Field Chloride Test (ppm)	Lab Chloride Test (ppm)	Field OVM test (ppm)	Lab BTEX test (ppm)	Cutting Description
0					light gray caliche
-5	120		0		"
-10	113		0		"
-15	57		0		"
-20	29		0		"
-25	62		0		light brown sand
-30	55		0		"
-35	59		0		"
-40	28		0		"
-45	59		0		"
-50	59		0		"
-55	28	32	0		"
-60					

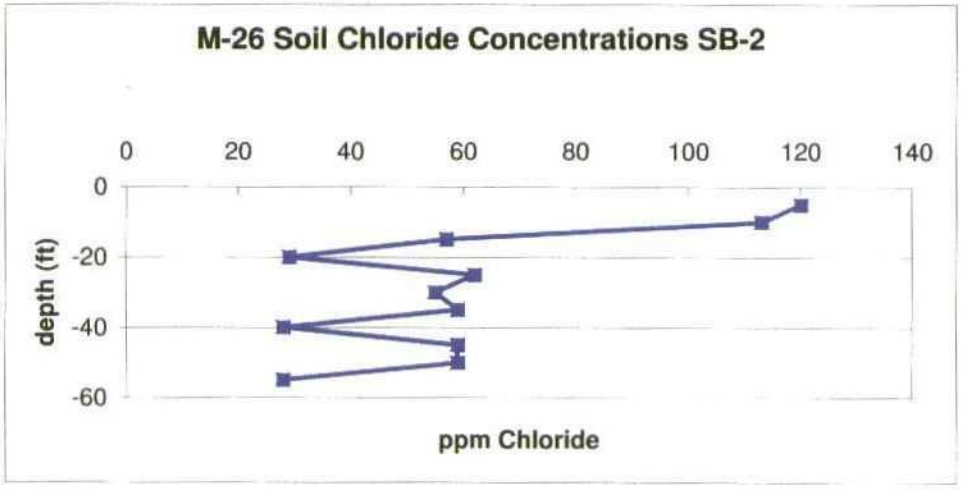


Table 2 – Soil boring log and chloride levels for SB-2.

Soil Boring Log
Rice Operating Company
Vacuum Field SWD System
M-26 vent

Identification: **SB-3**
Location: approx. 30 ft northeast of release
Date: 6/23/2006
Driller: Ken Cooper (Harrison and Cooper, Inc.)
Drill method: Air Rotary
Logged by: L. Peter Galusky, Jr.

Depth	Field Chloride Test (ppm)	Lab Chloride Test (ppm)	Field OVM test (ppm)	Lab BTEX test (ppm)	Cutting Description
0					light gray caliche
-5	61		0		"
-10	88		0		"
-15	27		0		"
-20	55		0		"
-25	58		0		light brown sand
-30	28		0		"
-35	56		0		"
-40	55		0		"
-45	55		0		"
-50	27		0		"
-55	29	16	0		"
-60					"

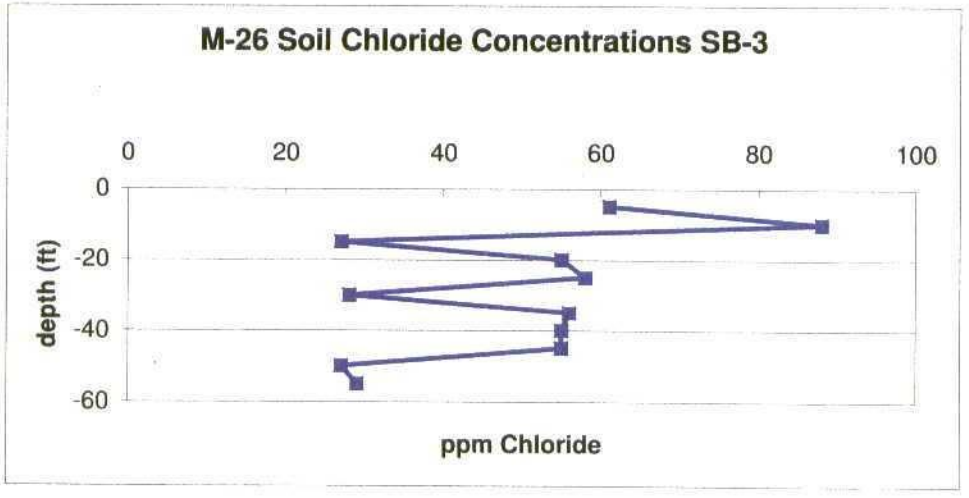


Table 3 – Soil boring log and chloride levels for SB-3.

Appendix C – Soil Chloride Model Rationale and Results

Rationale

A simple spreadsheet model (SCl-lpg) was developed to provide a means to estimate how residual soil chloride would affect groundwater chloride concentrations over time, under the conservative assumptions presented below.

The frequency of precipitation sufficient to affect significant groundwater recharge is assumed to be once every 10 years. During each recharge event (year), 50% of the residual soil chlorides are assumed to leached to the groundwater.

It is assumed that the leached chlorides are mixed only into the upper 10 feet of the underlying aquifer, (not into the entire 100 ft column of saturated thickness). Every year, it is assumed that (only) 10% of the chlorides in the saturated zone beneath area affected by the release site are removed through dilution by groundwater flow.

Other relevant parameter values used in the model:

Input	Value	Comment
Aquifer porosity	35%	Typical of Ogallala formation
Cl- concentration released water	55,000 ppm	Averaged from several measurements of produced water in field.
Estimated volume produced water released	15 bbls	Estimated by ROC during initial response activities.
Baseline (upgradient) groundwater chloride concentration	50 ppm	Taken from data reported for upgradient well from K-35-1 boot, which is near this project.
Estimated annual groundwater dilution rate	10%	A low estimate (conservative from the standpoint of environmental protection), considering the likely rate of movement of the aquifer of at least 50 ft/yr.

The logic (algorithm) and arithmetic of the model are simple, and the spreadsheet can be obtained at no cost from the author (L. Peter Galusky, Jr.) upon request.

Results

The model predicts that the residual soil chloride mass diminishes in a stepwise manner (indicative of the periodic "pulsed" nature of groundwater recharge) from 300 lbs to near zero within 50 years (Figure 6a).

Groundwater chloride concentration is predicted to rise from its baseline value of 50 ppm to a maximum value of approximately 120 ppm after the first recharge event (10 years). Dilution then causes a decline to approximately 80 ppm after nine years, followed by a lower "spike" to approximately 105 ppm. The predicted dilution of this and subsequently smaller "spikes" of chlorides continues through three more recharge-dilution cycles until baseline concentrations are reached at about 60 years (Figure 6b).

Appendix D - Investigation and Characterization Plan w/ OCD correspondence

- Investigation and Characterization Plan (ICP)
- C-141
- Preliminary soil chloride data
- Photographs taken during initial response
- OCD approval of ICP (e-mail)

L. Peter Galusky, Jr. Ph.D., P.G.
Consulting Hydrogeologist

December 12th, 2005

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

RE: **Investigation and Characterization Plan**
Vacuum M-26 Produced Water Discharge, UL C Sec 35 T17S R35E

CERTIFIED MAIL, RETURN RECEIPT 7005 0390 0002 9698 2631

Mr. Price:

RICE Operating Company (ROC) has retained L. Peter Galusky, Jr. Ph.D. to address potential environmental concerns at the above-referenced site. ROC is the service provider (operator) for the Vacuum SWD System and has no ownership of any portion of the pipeline, well, or facility. The System is owned by a consortium of oil producers, System Partners, who provide all operating capital on a percentage ownership/usage basis. Environmental projects of this magnitude require System Partner AFE approval and work begins as funds are received. In general, project funding is not forthcoming until NMOCD approves the work plan. Therefore, your timely review of this submission would be greatly appreciated.

For all such environmental projects, ROC will choose a path forward that:

- protects public health,
- provides the greatest net environmental benefit,
- complies with NMOCD Rules, and
- is supported by good science.

Each site shall generally have three submissions, as described below:

1. **This** Investigation and Characterization Plan (**ICP**) **is a proposal** for data gathering and site characterization and assessment.

2. Upon evaluating the data and results from the ICP, a recommended remedy will be submitted in a Corrective Action Plan (CAP) if this is warranted.

3. Finally, after implementing the remedy, a Closure Report with final documentation will be submitted.

Background and Previous Work

On July 1st, 2003 Rice Operating Company (ROC) discovered an accidental discharge of approximately 15 bbls of produced water at the referenced location, immediately south of CR-50 and approximately 4 ¼ miles east of Buckeye, New Mexico; (*please see Appendix A for site location map*). The produced water was released where a six-inch flow line had apparently settled and broken. This release affected approximately 225 square feet of soil material near the ground surface, based upon visual observation. The pipe was repaired at the break with a six inch clamp, and returned to service.

On August 20th, 2003 soils were excavated at the location of the break using a backhoe. Field tests were performed for chlorides (using field silver nitrate titration kits), the primary constituent of concern. The presence of hydrocarbons was also noted visually. Soils were evaluated to the practical reach of the backhoe (12 ft). Following this, the resulting pit was backfilled with the excavated soil material. In brief, chlorides exceeded 10,000 ppm to the limit of evaluation (12 ft), and there was a slight odor of hydrocarbons throughout, becoming very slight in soils taken from the bottom of the excavation. *Please see Appendix B for the correspondence record with OCD, as well as the results and photographs from the initial soils evaluation.*

The surface (ecological) impact of this release was relatively small. However, as the potential for groundwater contamination exists, this warrants further evaluation for chlorides and petroleum hydrocarbons, the constituents of concern. Therefore, ROC proposes additional investigative work, as outlined in the Investigation and Characterization Plan (ICP) below, to more definitively evaluate the extent of contamination caused by the release, and to then evaluate the potential for groundwater degradation. Yet, it should be noted that the source of this impact is historical. There is no longer a threat of continued, compounded impact at this site as the source of the release has been corrected.

The release site is located immediately south of CR-50, a few hundred feet east of a large Conoco-Phillips battery. The topography is gently sloping toward the southeast, and the release site is adjacent to a southeasterly trending surface ephemeral drainageway. Soils on the site are mapped (as KO) in the Lea County Soil Survey[5] as belonging to the Kimbrough gravelly loam soil series. These are characterized by gravelly loam to a depth of approximately 6 inches, and this is underlain by several feet of calcium indurated caliche. Groundwater is estimated to occur at a depth of approximately 51 feet, occurring in unconsolidated Tertiary alluvium of the Ogallala Formation[6].

[5] USDA SCS. Soil Survey of Lea County, New Mexico. Issued January, 1974.
[6] New Mexico Bureau of Geology & Mineral Resources. 1982. Circular 175 – Western extent of the Ogallala Formation in New Mexico.

It should be noted that the source of this impact is historical. There is no longer a threat of continued, compounded impact at this site as the source of the release has been corrected and the Vacuum SWD System is no longer in service.

Investigation and Characterization Plan

Task 1 - Collect Regional Hydrogeologic Data

Published maps and reports of surficial geology, soils, hydrogeology and ecosystem characteristics will be reviewed and summarized to provide a context and baseline from which to evaluate the results of subsequent analysis. State and county records of water wells will be reviewed and summarized to identify downgradient receptors which could potentially be affected.

Task 2 - Evaluate Concentrations of Constituents of Concern in Soil (and Ground Water)

Soils samples will be taken from a sufficient number of selected representative locations and depths in order to quantify the areal extent and depth of contamination with respect to chlorides and hydrocarbons. Soil samples will be taken and tested for chlorides, using field titration methods, and for BTEX, using EPA-standard PID methodology. A small sub-set of samples at key locations (such as the total sampled depth, apparent "hot spots", etc.) will be sent to a commercial laboratory for verification/calibration of the field tests, according to standard EPA sampling and laboratory methods.

A limited number of monitoring wells may be constructed in selected, representative locations, generally where WQCC standards are exceeded within 10+/- feet of the water table and where the location of such wells will useful for hydrogeological analysis . All such monitoring wells will be constructed (with the annular space sealed with a cement/bentonite mix) per NM Dept. Environment standards; (see Appendix C).

Task 3 - Evaluate Risk of Groundwater Impact

The data gathered from this study will be summarized and presented in simple and clear graphs and maps. This will provide a means for an intuitive evaluation of the apparent potential for groundwater impacts. Additionally, simple spreadsheet vadose zone /or groundwater dilution models may be used as a supplemental, interpretive tool. The information thus obtained from this work will be evaluated to determine if there exists any substantial risk for groundwater impacts resulting from this release of produced water.

If the evaluation demonstrates that residual constituents pose no threat to ground water quality, then only a surface restoration plan will be proposed to OCD. If, as a result of this work, it is believed that this produced water leak does pose a present or future risk of impacting groundwater quality, then a *risk-based* corrective action plan (CAP) will be developed and proposed to OCD which addresses the identified risks.

I appreciate the opportunity to work with you on this project. Please call either myself, at the number below, or Kristin Farris Pope (ROC) at 505-393-9174, if you have any questions or wish to discuss these matters.

Thank you for your consideration.

Sincerely,

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

505 N. Big Spring, Suite 404
Midland, Texas 79701
Tel: 432-967-2128
E-mail: lpg@texerra.com
Web site: www.texerra.com

cc: CDH, KFP, file

attachments: site map, correspondence and photos as noted in the Appendix

Appendix A – Site Map

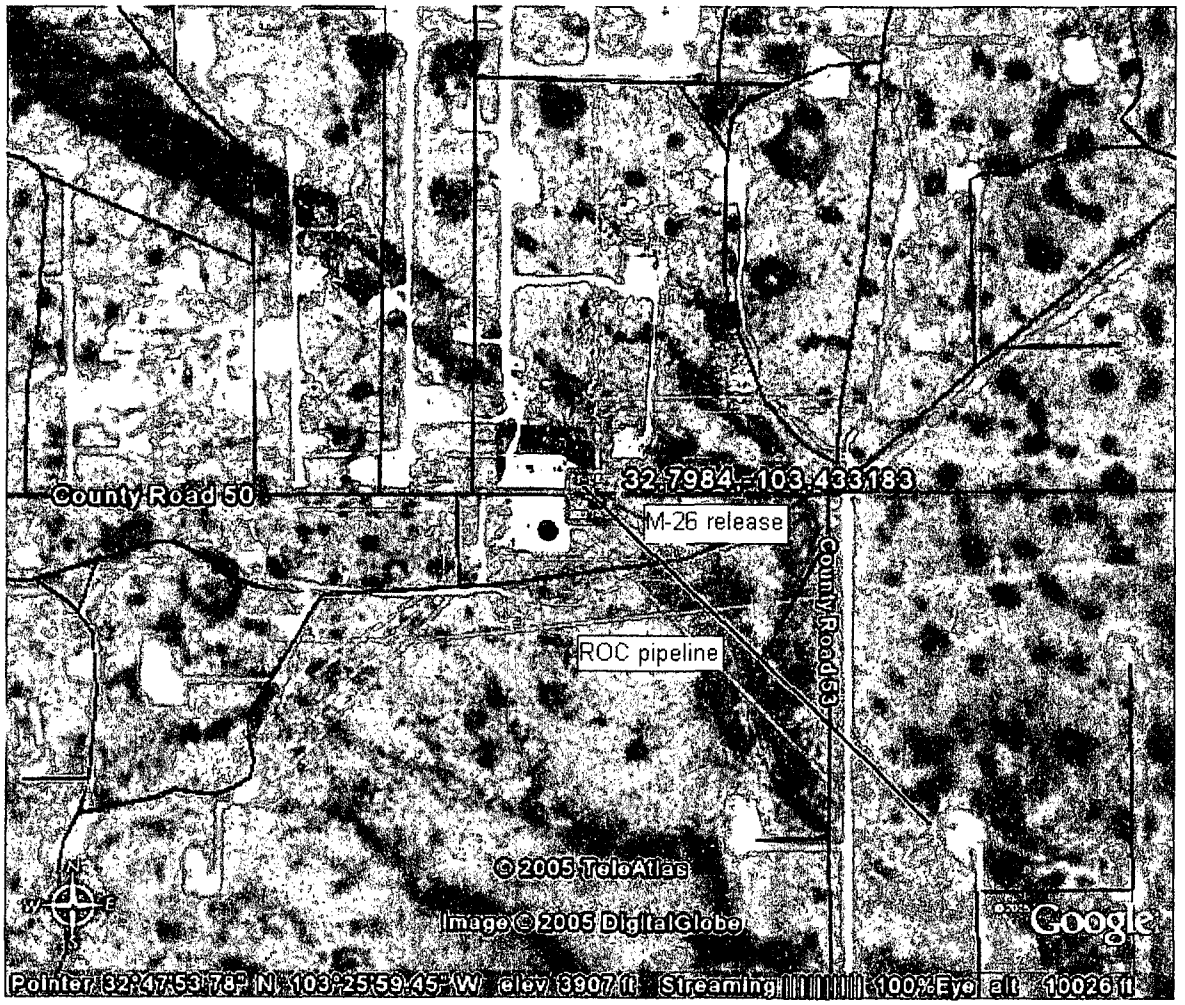


Figure 1 – Satellite photo (10,000 ft view) of M-26 ROC produced water release[7].

[7] From www.earth.google.com .

RICE *Operating Company*

122 West Taylor • Hobbs, New Mexico 88240
Phone: (505)393-9174 • Fax: (505) 397-1471

January 19, 2004

Paul Sheeley
NMOCD Hobbs Office
1625 N. French Drive
Hobbs, New Mexico

Re: Vacuum SWD System
ULM Sec. 35 T17S R35E
Lea County, New Mexico

C
K

Dear Mr. Paul Sheeley:

On July 1, 2003 Rice Operating Company (ROC) discovered an accidental discharge at the above referenced site. The release consisted of 15 bbls, which affected 225 square feet. ROC now wishes to notify the NMOCD of the future actions to be taken at this site.

On August 20, 2003 a vertical delineation was done with a backhoe. ROC trenched to 12' bgs sampling at every foot. At 12' bgs, a field test showed the chloride numbers remained at 12,000 ppm. The depth to groundwater is 51 feet. ROC has come to the conclusion that this site may have the potential for groundwater impact. ROC notified NMOCD Environmental Bureau Chief Roger Anderson on 1/16/04.

As for the surface, ROC feels that it will revegetate with natural attenuation, due to the small area affected.

Because this sites impact is beyond the scope of the ROC Generic Spill Work Plan, it will be prioritized and placed on the major project list for further characterization and if necessary, remediation. ROC will notify NMOCD and or submit a RBCA once the plan of action has been determined.

ROC requests approval of this C-141 as the Final Report. If you have any questions please call me at the above referenced number.

Sincerely,

Joe Gatts
Environmental Technician

Hand Delivery to OCD 1/19/04

District I
P.O. Box 1980, Hobbs, NM 88241-1980
District II
811 South First, Artesia, NM 88210
District III
1000 Rio Brazos, Aztec, NM 87410
District IV
2040 South Pacheco, Santa Fe, NM 87505

State of New Mexico
Energy, Minerals & Natural Resources Department
OIL CONSERVATION DIVISION
2040 South Pacheco
Santa Fe, NM 87505
OPERATOR'S MONTHLY REPORT

Form C-141
Originated 2/13/97

Submit 2 copies to Appropriate District Office in accordance with Rule 116 on back side of form

Release Notification and Corrective Action

OPERATOR

☐ Initial Report ☒ Final Report

Name	Contact
Rice Operating Company	Joe Gatts
Address	**Telephone No.**
122 West Taylor Hobbs, NM 88240	505-393-9174
Facility Name	**Facility Type**
Vacuum	SWD Disposal Line

Surface Owner	Mineral Owner	Lease No
State		

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South line	Feet from the	East/West Line	County
M	35	T17S	R35E					LEA

NATURE OF RELEASE

Type of Release	Volume of Release	Volume Recovered
Produced Water	15 bbls	10 bbls
Source of Release	**Date and Hour of Occurrence**	**Date and Hour of Discovery**
Pipeline	unknown	07/01/2003
Was Immediate Notice Given? ☐ Yes ☐ No ☒ Not Required	**If YES, To Whom?**	
By Whom?	**Date and Hour**	
Was a Watercourse Reached? ☐ Yes ☒ No	**If YES, Volume Impacting the Watercourse**	

If a Watercourse was Impacted, Describe Fully. (Attach Additional Sheets If Necessary)

Describe Cause of Problem and Remedial Action Taken. (Attach Additional Sheets If Necessary)
Ground settled on 6" A/C pipe and pipe broke all the way around. Placed 6" clamp on pipe.

Describe Area Affected and Cleanup Action Taken. (Attach Additional Sheets If Necessary)
The released consisted of 15 bbls, which affected 225 square feet. Vertical delineation was done with a backhoe up to 12' bgs. It has been determined that the impact is out of the scope of ROC's Generic Spill and leak plan and may have the potential for groundwater impact. ROC will now prioritize and place this site the major projects list for further characterization and if necessary, remediation.

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to NMOCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the NMOCD marked as "Final Report" does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to ground water, human health or the environment. In addition, NMOCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

Signature: Joe Gatts

Printed Name: Joe Gatts

Title: Environmental Technician

Date: 01/19/04 Phone: 505-393-9174

OIL CONSERVATION DIVISION

Approved by District Supervisor:

Approval Date: Expiration Date:

Conditions of Approval: Attached ☐

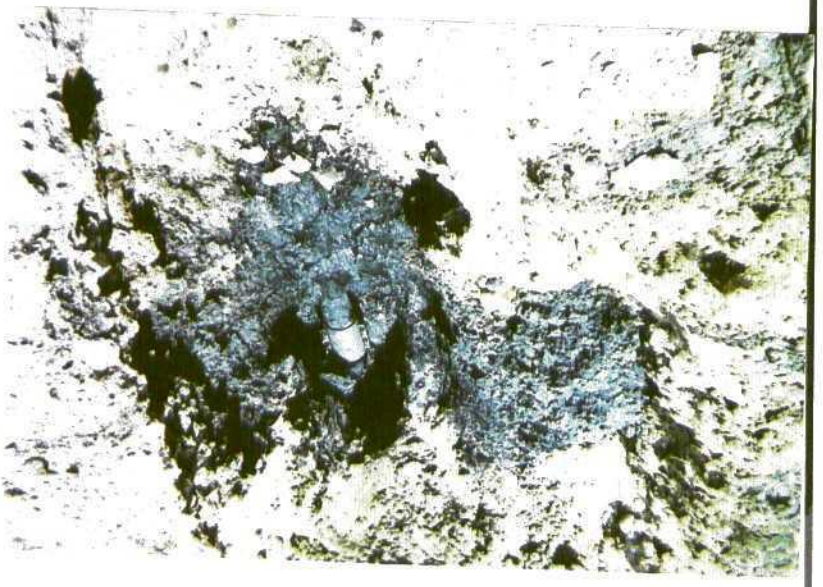
Hand Delivered to OCD 1/19/04

Vacuum M-26 leak

unit 'C', sec. 35, T17S, R37E

August 20, 2003 Backhoe Delineation with Field Tests

ft BGS	Soil Sample Lithology	Hydrocarbon Odor	[Cl-] ppm
6	dark brown caliche	slight	7243
7	light brown caliche	slight	10099
8	light brown caliche	slight	9009
9	light brown caliche	slight	12659
10	light brown caliche & sand	slight	11398
12	light brown caliche & sand	very slight	12337



Appendix C – NM Environmental Dept. Monitoring Well Standards

In order to accurately determine aquifer characteristics and obtain representative ground- water samples, it is important that monitoring wells be constructed and installed properly. In addition, the construction materials utilized should not alter the chemical composition of the groundwater in such a way as to interfere with the compounds being analyzed during assessment activities. The practices set forth in the American Society for Testing and Materials (ASTM) document D 5092-90 and in the State Engineer Office regulations should be followed, in addition to the items below (see schematic diagram below text):

- Borehole: The borehole should be drilled a minimum of 4 inches larger than the casing diameter, to allow for the emplacement of sand and sealant.

- Casing: The casing should, unless otherwise approved by the department, consist of Schedule 40 or heavier, flush mount threaded, o-ring sealed, PVC pipe of not less than two inches nominal inside diameter. Four inches nominal inside diameter may be appropriate for wells greater than or equal to 100 feet deep. No adhesive should be used to join the sections of casing.

- Screen: The screen should be of an appropriate length not to exceed 20 feet and should be machine slotted or other manufactured screen. The slot size should be appropriate for the grain size of the sand pack. No on-site or hack-saw slotting is permitted. A sediment sump should be attached to the base of the screen, with a cap at the bottom. The length of the sump may vary, depending on the nature and grain size of the formation, but should be a minimum of 2 feet in length. If the uppermost aquifer is unconfined, the top of the screen should be five feet above the water table to allow for seasonal fluctuations and to determine if NAPL is present. If the aquifer is confined, the top of the screen should be placed in such a way as to preserve the integrity of the aquifer.

- Filter pack: An annular space from 2 feet below to 2 feet above the screen should be packed with filter pack sand. The sand should be clean, silica based, and properly sized to prevent fines from entering the well. A tremmie pipe should be used for sand placement for wells greater than 50 feet deep.

- Filter pack seal: When appropriate, monitoring wells and piezometers should be constructed with a filter pack seal. The filter pack seal is to extend 1 foot above the top of the filter pack and should consist of 1 foot of clean, fine-grained silica sand.

- Bentonite seal: The annular space for at least 2 feet above the filter pack seal should be grouted or sealed with hydrated bentonite pellets, 0.25 or 0.5 inch in size as appropriate.

- Annular space above seal: The annular space above the seal should be filled with a bentonite/cement grout to reduce permeability.

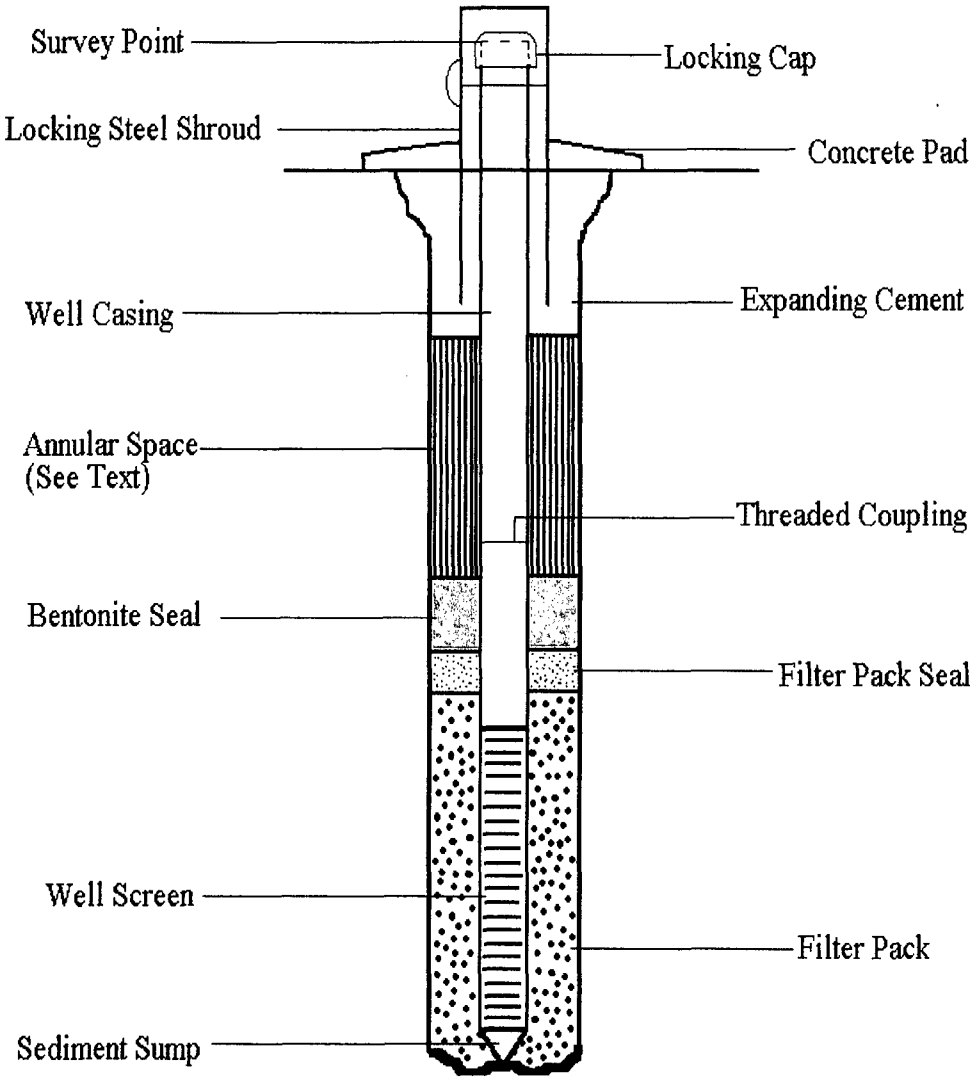
  Note: Where shallow groundwater exists (less than 10 feet below ground surface), well construction must be pre-approved by the department.

- Surface completion: Where site conditions allow, the casing should extend at least 2 feet above ground surface. The casing top should be protected by a locking cap, and a locking shroud or well vault is to protect the exposed casing. Caps or steel covers should contain a clear label for monitoring well. The shroud or vault should be large enough to allow easy access for removal of the well cap. Flush mounted well vaults should be water tight, bolted down, and appropriately sized for anticipated traffic. A concrete slab (minimum of a 2 foot radius and a 6 inch thickness and reinforced in high traffic areas) should be poured around the shroud. The pad should be sloped so that rainfall and runoff flows away from the shroud.

- Well construction: Care must be taken during installation to prevent contaminants from entering the well. After installation is complete, develop the monitoring well to remove all sediment, to reduce turbidity to the greatest extent possible, and to allow groundwater to flow freely through the well screen. See Chapter 1, Section 1.5 for procedures on monitoring well development.

- Survey: The top of casing of each monitoring well should be surveyed to determine its USGS elevation. This elevation and the depth to water should be established to an accuracy of 0.01 foot. In this way, the USGS elevation of the groundwater surface can be established. A unique, easily identifiable point should be marked on the top of the casing for this measurement. The horizontal location of the well should be determined to an accuracy of 0.1 foot.

- Lithologic log: A lithologic log and a well construction diagram should be completed for each monitoring well and submitted to the Department.



Monitoring Well Construction Diagram

Print - Close Window

Subject: RE: Vacuum Field Sites ICPs ... drilling/sampling notifications

Date: Thu, 15 Jun 2006 08:07:56 -0600

From: "Price, Wayne, EMNRD" <wayne.price@state.nm.us>

To: lpg@texerra.com

Good luck!

From: L. Peter Galusky, Jr. P.E. [mailto:lpg@texerra.com]
Sent: Wednesday, June 14, 2006 7:57 PM
To: Price, Wayne, EMNRD
Cc: Sanchez, Daniel J., EMNRD; Johnson, Larry, EMNRD; Caperton, Patricia, EMNRD; Sheeley, Paul, EMNRD; Kristin Pope
Subject: Vacuum Field Sites ICPs ... drilling/sampling notifications

Mr. Price,

I will be supervising environmental drilling and sampling at the four Rice Operating Company sites located in the Vacuum Field and listed below, per the ICPs that you have approved for these. We plan to drill and sample these sites beginning next Monday, June 19th and likely wrapping up by June 22nd or 23rd.

- E-2. UL E Sec 2 T 18S R 35 E. OCD No. 1R425-01

- K-35-1. UL K Sec 35 T 17S R 35E. OCD No. 1R425-03

- M-26. UL C Sec 35 T 17S R 35E. OCD No. (not yet assigned)

- N-6-1. UL N Sec 6 T 18S R 35 E. OCD No. (not yet assigned)

Please be advised that you and/or your staff and associates are welcomed to be present during this work. We plan to begin work on Monday at the N-6-1 site, and from there move to the others.

Please call me if you have any questions or need any additional information.

Thank you.

Sincerely,

L. Peter Galusky, Jr. Ph.D.

Consulting Environmental Scientist

Energy Square

505 N. Big Spring, Suite 404

Midland, Texas 79701

Tel/Fax: 877 534-9001

Cell: 432-634-9257

E-mail: http://b2.mail.yahoo.com/ym/texerra.com/Compose?To=lpg@texerra.com

Web: http://www.texerra.com/

Appendix E – Laboratory Data … laboratory results[8]

CARDINAL LABORATORIES

PHONE (325) 673-7001 • 2111 BEECHWOOD • ABILENE, TX 79603
PHONE (505) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
RICE OPERATING COMPANY
ATTN: KRISTIN FARRIS-POPE
122 W. TAYLOR STREET
HOBBS, NM 88240
FAX TO: (505) 397-1471

Receiving Date: 06/26/06
Reporting Date: 06/27/06
Project Number: NOT GIVEN
Project Name: M-26 LEAK
Project Location: VACUUM

Analysis Date: 06/27/06
Sampling Date: 06/23/06
Sample Type: SOIL
Sample Condition: COOL & INTACT
Sample Received By: HM
Analyzed By: HM

LAB NO.	SAMPLE ID	Cl⁻ (mg/kg)
H11274-1	SB 2 55' BGS	32
H11274-2	SB 1 55' BGS	16
H11274-3	SB 1 10' BGS	16
H11274-4	SB 3 55' BGS	16
Quality Control		990
True Value QC		1000
% Recovery		99
Relative Percent Difference		2.0
METHOD: Standard Methods		4500-Cl'B

NOTE: Analyses performed on 1:4 w:v aqueous extracts.

Chemist

06-27-06
Date

H11274

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.

[8] These laboratory results are from selected, representative field samples and are intended to provide a QA/QC check on the field chloride titration methodology.

ARDINAL LABORATORIES, INC.
2111 Beechwood, Abilene, TX 79603 101 East Marland, Hobbs, NM 88240
(325) 673-7001 Fax (325) 673-7020 (505) 393-2326 Fax (505) 393-2476

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

Page ___ of ___

Company Name: Rice Operating
Project Manager: Kristin Farris-Pope
Address: 122 W. Taylor
City: Hobbs State: NM Zip: 88240
Phone #: 393-9174 Fax #: 397-1471
Project #: Project Owner:
Project Name: M 26 leak
Project Location: Vacuum
Sampler Name: Melanie Franks

BILL TO: P.O. #: Company: Attn: Address: City: State: Zip: Phone #: Fax #:

ANALYSIS REQUEST: Cl

Lab I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	ACID/BASE	ICE / COOL	OTHER:	DATE	TIME	Cl
H11294-1	SB 2 55' bgs		1			X					X		6/23/06	10:42	X
-2	SB 1 55' bgs		1			X					X		6/23/06	10:01	X
-3	SB 1 10' bgs		1			X					X		6/23/06	9:52	X
-4	SB 3 55' bgs		1			X					X		6/23/06	11:18	X

PLEASE NOTE: Liability and Damages. [illegible]

Terms and Conditions: [illegible]

Sampler Relinquished: Date: Time: Received By:
Relinquished By: Melanie Franks Date: 06-26-06 Time: 4:50 Received By: (Lab Staff) [signature]
Delivered By: (Circle One) Sampler - UPS - Bus - Other:
Sample Condition: Temp. °C: Cool Intact? ☑ Yes ☐ No Checked By: (Initials)

Phone Result: ☐ Yes ☐ No
Fax Result: ☐ Yes ☐ No
REMARKS: EMAIL TO MELANIE & KRISTIN

† Cardinal cannot accept verbal changes. Please fax written changes to (325) 673-7020.