2R - 52

GENERAL CORRESPONDENCE

YEAR(S):

OCT 09,2004 —

OCT 05,2004

Price, Wayne

From: Fesmire, Mark
Sent: Saturday, October 09, 2004 1:10 PM
To: Price, Wayne
Subject: RE: Magnum Booster OCD Case # 2R0052

Wayne:

Make sure we keep a detailed chronological file including every communication with the operator and Randy. We will want to set this for a hearing on their formal proposal. No more "would you consider" and "but you said we could" arguments from consultants.

Mark

-----Original Message-----
From: Price, Wayne
Sent: Wednesday, October 06, 2004 4:35 PM
To: 'Randall Hicks'; Price, Wayne
Cc: 'Chuck Jones'; Gum, Tim; Bratcher, Mike; Anderson, Roger; Olson, William; Fesmire, Mark
Subject: RE: Magnum Booster OCD Case # 2R0052

Dear Randy:

Please send me the contact name for the operator with address, tele, E-mail etc. OCD will respond to the company and CC you once you submit all of the information and request a response from OCD. As you know we did not receive all of the info in the E-mail. One issue that Roger, I and Bill discussed this morning is that the operator will be required to perform delineation to determine the actual size and depth of contamination and depending upon those results and the model, may require a monitor well for long term monitoring. The surface issue must also be addressed. Who is the land owner and have they been notified and do they approve burying this waste on-site.

As discussed on the phone, OCD will evaluate the "no remediation action" model submitted using local site specific conditions and other in-house tools and site information. The burden of proof will be on the operator to demonstrate that the state's groundwater will not be impacted in the foreseeable future. As you know or should be aware of, is that these type of submittals where an operator has released an unknown amount of fluid, and a considerable amount of time has lapsed it may be impossible to actually model such a release unless the proper horizontal and vertical delineation is performed. The other issue with these models is the fact that our experience has shown that a lot of these type of releases have preferential pathways in which the model does not address. Therefore, you and your customer should be aware that this type of approval can be very time consuming and labor intensive on both the operator and OCD. Also make sure in the mixing model that you use a 10 foot interval in the groundwater for worst case conditions.

During our telephone conversation you ask the question if OCD would be willing to accept such an approach and you requested (paraphrasing) what would streamline such an approach. As noted above, OCD will evaluate your proposal but remember that OCD may or mostly likely will require additional information in order to properly evaluate this site to ensure that the State's groundwater is protected. So the finish line could be a ways down the road or OCD may reject the proposal and require an alternate clean-up method.

The last issue is one concerning the "Notice of Violation" issued by the OCD Artesia District office. St Mary Land & Exploration must contact the OCD District office Mr. Tim Gum within 10 days to address the "Notice of Violation" and notify this office.

-----Original Message-----

From: Randall Hicks [mailto:R@rthicksconsult.com]
Sent: Tuesday, October 05, 2004 4:45 PM
To: 'Price, Wayne'
Cc: 'Chuck Jones'
Subject: RE: Magnum Booster

Yes – Mike Stubblefield was the original inspector

-----Original Message-----
From: Price, Wayne [mailto:WPrice@state.nm.us]
Sent: Tuesday, October 05, 2004 3:35 PM
To: 'Randall Hicks'; Price, Wayne; Gum, Tim; Bratcher, Mike
Cc: 'Chuck Jones'; david@rthicksconsult.com
Subject: RE: Magnum Booster

Dear Randy: The letter addressed to me on October 05, 2004 is RE: St. Mary Land & Exploration Unit A sec 9-Ts20s-R29E (NOTICE OF VIOLATION-iNSPECTION No. imcs0324140421. Is this a N.O.V. that was issued by OCD District office ????

> -----Original Message-----
> **From:** Randall Hicks [mailto:R@rthicksconsult.com]
> **Sent:** Tuesday, October 05, 2004 3:19 PM
> **To:** 'Price, Wayne'
> **Cc:** 'Chuck Jones'; david@rthicksconsult.com
> **Subject:** Magnum Booster
> Wayne
>
> We will provide the following to you:
>
> the net infiltration rate (water flux) calculated by HYDRUS-1D at several nodes – 20 feet, 50 feet and 100 feet below land surface
> Maps showing the site and its general location
> Appendices that provide data suggesting that the water in the underlying Rustler is confined
> Another simulation that employs a 600 barrel release of produced water and a vegetative cover to predict the possible impact to ground water.
> Several references that show how some chemical species, such as chloride and/or nitrate, are sequestered within the vadose zone in arid environments.
>
> Please allow a few weeks for us to assemble these data and run the new simulations.
>
> Thanks for your help with moving this project along.
>
> Randy Hicks

505-266-5004 - office
505-238-9515 - cell

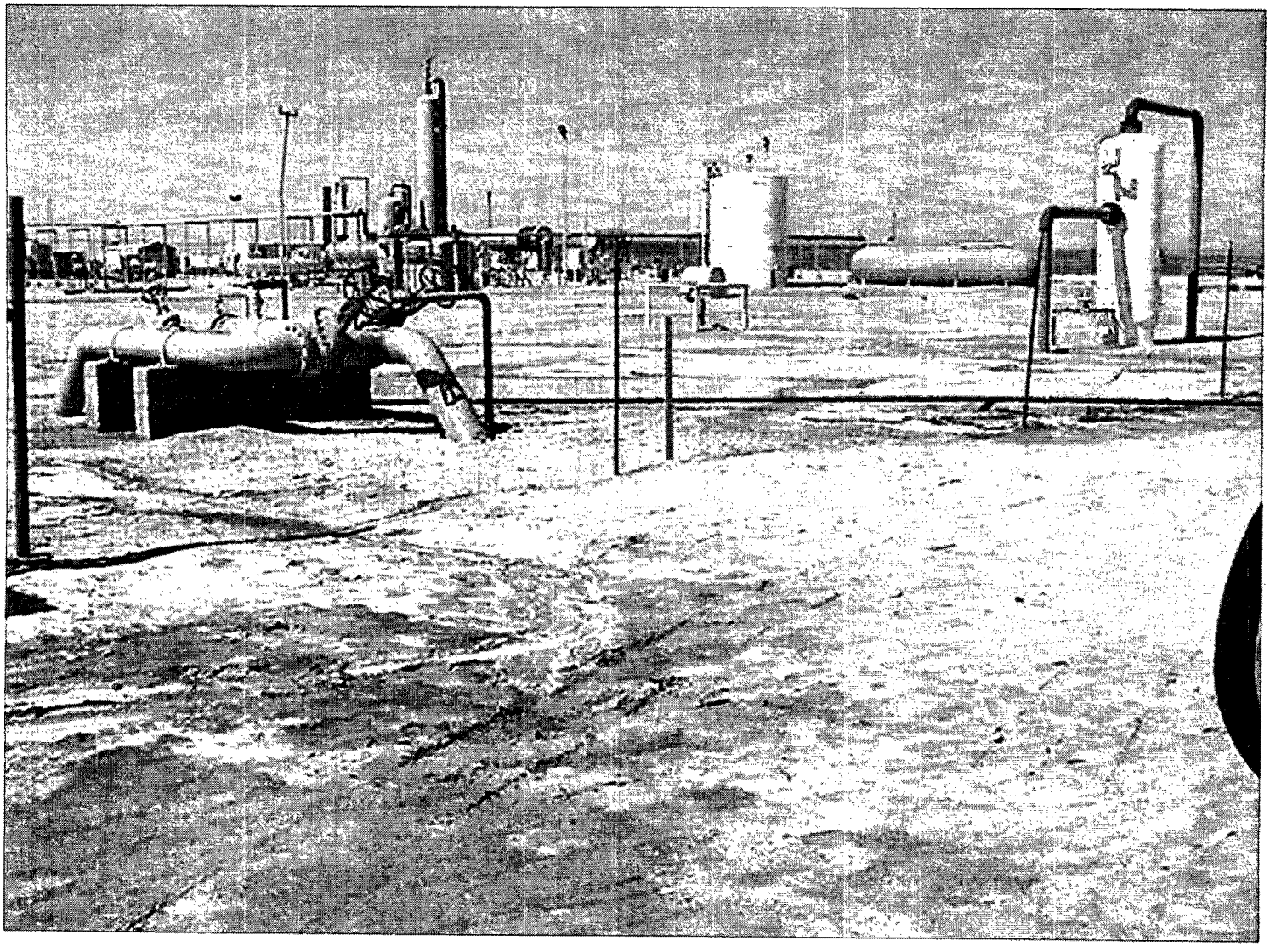
Price, Wayne

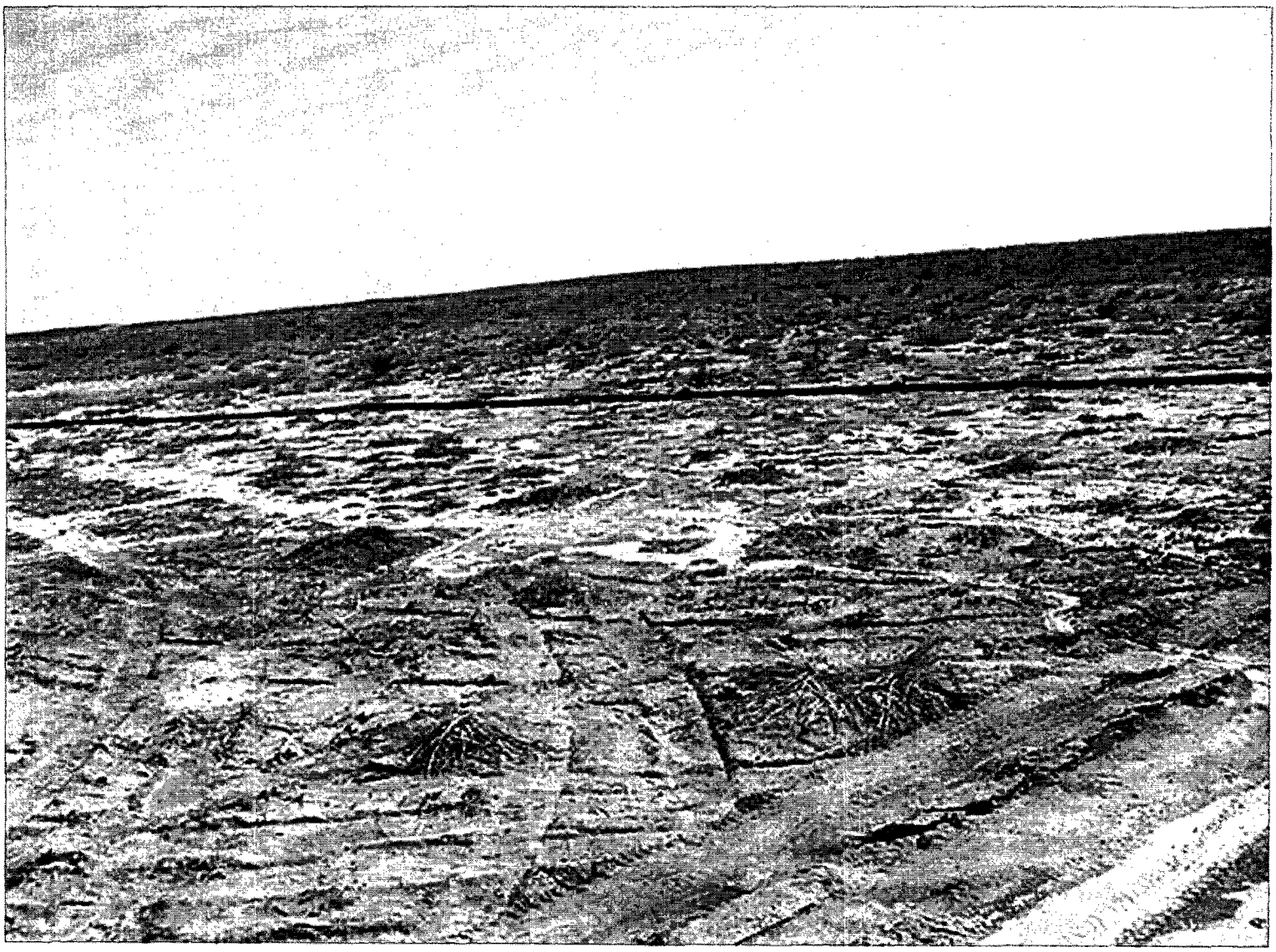
From: Bratcher, Mike
Sent: Thursday, October 07, 2004 9:14 AM
To: Price, Wayne
Cc: Gum, Tim
Subject: Magnum Booster Photos


Magnum Booster 1.jpg


Magnum Booster 2.jpg


Magnum Booster 3.jpg





FAX COVER SHEET

OIL CONSERVATION DIVISON
1301 W. GRAND AVE
ARTESIA, NM 88210

PHONE (505-748-1283
FAX (505-748-9720

Date 10/7/04

TO: Wayne Price

FROM: Mike Bratcher

NUMBER OF PAGES 6 (INCLUDING COVER SHEET)

MESSAGE Magnum Booster / St. Mary L&E

NEW MEXICO ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT

BILL RICHARDSON
Governor
Joanna Prukop
Cabinet Secretary

COPY

Lori Wrotenbery
Director
Oil Conservation Division

Field Inspection Program
"Preserving the Integrity of Our Environment"

02-Sep-03

ROSWELL, LLC
1776 LINCOLN STREET, STE
DENVER, CO 80203-0000

NOTICE OF VIOLATION - Inspection

Dear Operator:

The following inspection(s) indicate that the well, equipment, location or operational status of the well(s) failed to meet standards of the New Mexico Oil Conservation Division as described in the detail section below. To comply with standards imposed by Rules and Regulations of the Division, corrective action must be taken immediately and the situation brought into compliance. The detail section indicates preliminary findings and/or probable nature of the violation. This determination is based on an inspection of your well or facility by an inspector employed by the Oil Conservation Division on the date(s) indicated.

Please notify the proper district office of the Division, in writing, of the date corrective actions are scheduled to be made so that arrangements can be made to reinspect the well and/or facility.

INSPECTION DETAIL SECTION

TUESDAY FEDERAL 001 M-34-19S-29E **30-015-25123-00-00**

Inspection Date	Type Inspection	Inspector	Violation?	*Significant Non-Compliance?	Corrective Action Due By:	Inspection No.
08/29/2003	Routine/Periodic	Mike Stubblefield	Yes	No	9/29/2003	iMCS0324140321

Comments on Inspection: A section of the gathering line has had nermourous unreported produced water releaes that have ran onto Duke Energy Magnum Station. Location as per GPS is 32.58693 deg. N. 104.07775 deg. W. The impacted area is est. 100 yds x 100 yds and contains visbile Hydrocarbons and Chloride contaminated soils. Violation of Rule 116.A. reporting A C-141 form is required submitted to N.M.O.C.D. with corrective workplan attached. Photos of Tuesday Federal Facility taken, Photos of unauthorized release area near the Duke Energy Magnum compressor station taken.

10/9/03. * After meeting with R.T. Hills Consultants LTD. Soil samples Taken Today. Extented NOV To 11/10/2003.

In the event that a satisfactory response is not received to this letter of direction by the "Corrective Action Due By:" date shown above, further enforcement will occur. Such enforcement may include this office applying to the Division for an order summoning you to a hearing before a Divison Examiner in Santa Fe to show cause why you should not be ordered to permanently plug and abandon this well. Such a hearing may result in imposition of CIVIL PENALTIES for your violation of OCD rules.

Sincerely,

Mike Stubblefield Environ Eng. Spec. N.M.O.C.D.

Artesia OCD District Office

Note: nformation in Detail Section comes directly from field inspector data entries - not all blanks will contain data.
*Significant Non-Compliance events are reported directly to the EPA, Region VI, Dallas, Texas.

FAX COVER SHEET

OIL CONSERVATION DIVISON
1301 W. GRAND AVE
ARTESIA, NM 88210

PHONE (505-748-1283
FAX (505-748-9720

Date 9/25/2003

406 . 245 - 8627 OFF.

TO: Herb Zackery 406-245-9106 Fax.
SAINT mary oil & Ranch Billings Montana.

FROM: Mike Stubblefield

NUMBER OF PAGES 20 (INCLUDING COVER SHEET)

MESSAGE Please send O.C.D. Corrective Action Remediation Workplan by 10/25/2003. As per the Guidelines for Remediation of leaks, spills & releases, dated Aug. 13, 1993.

Faxed Copy Guidelines for Remediation of Leaks, spill

NANCE PETROLEUM CORPORATION
FAX TRANSMITTAL FORM

P.O. BOX 7168 BILLINGS, MT 59103
PHONE (406)245-6248 FAX(406)245-9106

DATE: 9/25/03

TO: Mike Stubblefield OCD

RE: C-141

FAX #: (505) 748-9720 **NO. PAGES:** 2
(including cover sheet)

FROM: Herb Thackeray
406-255-8627

Mike - here is a copy of the C-141 for the spill we were discussing which I had previously submitted.

Herb

District I
1625 N. French Dr., Hobbs, NM 88240
District II
1301 W. Grand Avenue, Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-141
Revised June 10, 2003

Submit 2 Copies to appropriate District Office in accordance with Rule 116 on back side of form

30-015-25123

Release Notification and Corrective Action

nAC503226952852

OPERATOR

☒ Initial Report ☒ Final Report

Name of Company ST MARY LAND & EXPLORATION	Contact HERB THACKERAY
Address PO BOX 7168 BILLINGS, MT 59103	Telephone No. (406) 245-6248
Facility Name NONE Tuesday Fed #1 Battery line	Facility Type NONE

Surface Owner BLM	Mineral Owner BLM	Lease No.

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County
A	9	20S	29E					EDDY

NATURE OF RELEASE

Type of Release PRODUCED WATER	Volume of Release +/- 5 BBLS	Volume Recovered 0
Source of Release POLY FLOWLINE LEAK	Date and Hour of Occurrence 8/4/03 (time unknown)	Date and Hour of Discovery 8/4/03 (time unknown)
Was Immediate Notice Given? ☒ Yes ☐ No ☐ Not Required	If YES, To Whom? MIKE STUBBLEFIELD - NMOCD JIM AMOS - BLM	
By Whom? DUKE ENERGY MAGNUM PLANT	Date and Hour 8/4/03 (time unknown)	
Was a Watercourse Reached? ☐ Yes ☒ No	If YES, Volume Impacting the Watercourse.	

If a Watercourse was Impacted, Describe Fully.*

A

Describe Cause of Problem and Remedial Action Taken.* APPROXIMATELY 10 B/D OF PRODUCED WATER FROM THE ST. MARY TOG #5 AND JC WILLIAMSON'S TOG WELLS ARE TRANSFERRED FROM JCW'S BATTERY IN SEC. 16 NORTH TO THE ST. MARY TUESDAY FEDERAL BATTERY IN SEC. 3 (ALL IN T20S-R29E) VIA A 3" POLY LINE. HEAT FROM DUKE'S FLARE AT THEIR GAS PLANT IN SEC. 9 HAS MADE THE POLY LINE EXTREMELY BRITTLE WHICH CAUSES LEAKS. WE HAVE RE-ROUTED THE LINE FROM JCW'S BATTERY EAST TO OUR WSW, EXX FEDERAL #1 IN SEC. 15, AND TIED IT INTO OUR 6" TRANFER LINE.

Describe Area Affected and Cleanup Action Taken.*
BECAUSE OF THE HEAT FROM THE DUKE FLARE AND ACTIVITY ASSOCIATED WITH THE PLANT, WE COULD IDENTIFY NO MATERIAL SURFACE VEGETATION AFFECTS AS A RESULT OF THIS RELEASE. STUDIES BY THE API HAVE SHOWN THAT SMALL RELEASES SUCH AS THIS 5-10 BARREL PRODUCED WATER SPILL, DO NOT HAVE A MATERIAL IMPACT ON GROUND WATER QUALITY. NATURAL RESTORATION WILL RETURN THE PROPERTY TO ITS ORIGINAL PRODUCTIVE CAPACITY ONLY AFTER THE DUKE PLANT IS RECLAIMED. BECAUSE WE HAVE RE-ROUTED THE PRODUCED WATER LINE, WE WILL HAVE NO FUTURE RELEASES AT THIS SITE. WE DO NOT RECOMMEND ANY CLEANUP ACTION. IN THE OPINION OF OUR ENVIRONMENTAL CONSULTANT, R.T. HICKS CONSULTANTS, GROUND WATER AT THIS LOCATION IS NOT THREATENED BY THIS SMALL RELEASE.

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, surface 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: Herbert R Thackeray	OIL CONSERVATION DIVISION
Printed Name: HERB THACKERAY	Approved by District Supervisor:
Title: OPERATIONS ENGINEER	Approval Date: / Expiration Date:
E-mail Address: hthackeray@nancepetro.com	Conditions of Approval: / Attached ☐
Date: 8/18/03 Phone: (406)245-6248	

* Attach Additional Sheets If Necessary

cc: Jim Amos, BLM Carlsbad

P.01

TRANSACTION REPORT

OCT-07-2004 THU 10:02 AM

'FOR: '

RECEIVE

DATE	START	SENDER	RX TIME	PAGES	TYPE	NOTE	M#	DP
OCT-07	10:00 AM	15057489720	1'44"	6	RECEIVE	OK		

Price, Wayne

From: Price, Wayne
Sent: Wednesday, October 06, 2004 4:35 PM
To: 'Randall Hicks'; Price, Wayne
Cc: 'Chuck Jones'; Gum, Tim; Bratcher, Mike; Anderson, Roger; Olson, William; Fesmire, Mark
Subject: RE: Magnum Booster OCD Case # 2R0052

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Sent: Tuesday, October 05, 2004 4:45 PM
To: 'Price, Wayne'
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Yes – Mike Stubblefield was the original inspector

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Cc: 'Chuck Jones'; david@rthicksconsult.com

Subject: RE: Magnum Booster

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Randy Hicks
505-266-5004 - office
505-238-9515 - cell

This email has been scanned by the MessageLabs Email Security System.
For more information please visit http://www.messagelabs.com/email

Price, Wayne

From: Price, Wayne
Sent: Wednesday, October 06, 2004 2:33 PM
To: Bratcher, Mike
Cc: Gum, Tim
Subject: RE: Magnum Booster Spill

Thanks Mike, I would like to get a copy of the C-141 and photos.

-----Original Message-----
From: Bratcher, Mike
Sent: Wednesday, October 06, 2004 8:53 AM
To: Price, Wayne
Cc: Gum, Tim
Subject: Magnum Booster Spill

Wayne,
I have located Mike Stubblefield's original C-141 and inspection on this incident. The well API number that he attached the inspection and violation to does not have anything to do with the line or the release. I remember when he was out there because Gerry and I both had opened violations on the well he attached this incident to. His violation letter is in the well file but I do not see the C-141, so I just assume that it did not get imaged. I do have the hard copy. There is also a fax message that he sent to Herb Zachery w/St.Mary L&E requesting a corrective action remediation workplan. It was sent 9/25/03 and the workplan was requested to be submitted by 10/25/03 with an extension granted to 11/10/03.
The information he listed in the incident module is taken directly from the C-141 submitted by the operator. There are also three printed color pictures of the release site. I dont know if they exist anywhere electronically but we can image and send them if you want. Linda said she could do it, but it would probably take some time to open on your end?
The API # is: 30-015-25123
The incident # is: nMCS50326957852
Just so you dont have to sift through all the well file docs, his violation letter is the 6th doc from the bottom on your right hand side and is 67kb.
Let me know if I can do anything on this end and if you want me to send the pics.

Mike Bratcher

Price, Wayne

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Subject: Magnum Booster Spill

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Price, Wayne

From: Price, Wayne
Sent: Tuesday, October 05, 2004 3:37 PM
To: Gum, Tim; Bratcher, Mike
Subject: FW: Magnum Booster Spill

2R0052

Tim! Do you know anything about this site?

Dear Randy: The letter addressed to me on October 05, 2004 is RE: St. Mary Land & Exploration Unit A sec 9-Ts20s-R29E (NOTICE OF VIOLATION-iNSPECTION No. imcs0324140421. Is this a N.O.V. that was issued by OCD District office ????
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From: Randall Hicks [mailto:R@rthicksconsult.com]
Sent: Sunday, October 03, 2004 6:16 AM
To: mbratcher@state.nm.us; 'Price, Wayne'
Cc: 'Chuck Jones'
Subject: Magnum Booster Spill

Gentlemen

I attach a report that was due to Mike Stubblefield prior to his departure. This submission should permit closure of the regulatory file. The flow line that was responsible for the multiple releases at this site has been moved away from the Duke flare and the road. We believe the flare and traffic was caused the pipeline to fail. As discussed herein, all evidence suggests that the ground water beneath this site (Rustler) is confined. Therefore a surface release, such as this, would not impact this ground water. Nevertheless, this report assumes that the water is unconfined. Using this assumption and other highly conservative input data (an 1800 barrel spill), the modeling predicts slight impairment of ground water quality (350 ppm chloride) will occur in about 300 years from present. Because production data suggest the maximum release was less than 600 barrels, the most probable chloride concentration in ground water is less than 200 ppm (if background chloride in ground water is 100 ppm).

Randy Hicks
505-266-5004 - office
505-238-9515 - cell

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Please allow a few weeks for us to assemble these data and run the new simulations.

Thanks for your help with moving this project along.

Randy Hicks
505-266-5004 - office
505-238-9515 - cell

received this transmission in error, please notify us immediately by telephone and return the original message to us at the address listed above. Thank you.

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Subject: Magnum Booster Spill

Gentlemen

I attach a report that was due to Mike Stubblefield prior to his departure. This submission should permit closure of the regulatory file. The flow line that was responsible for the multiple releases at this site has been moved away from the Duke flare and the road. We believe the flare and traffic was caused the pipeline to fail. As discussed herein, all evidence suggests that the ground water beneath this site (Rustler) is confined. Therefore a surface release, such as this, would not impact this ground water. Nevertheless, this report assumes that the water is unconfined. Using this assumption and other highly conservative input data (an 1800 barrel spill), the modeling predicts slight impairment of ground water quality (350 ppm chloride) will occur in about 300 years from present. Because production data suggest the maximum release was less than 600 barrels, the most probable chloride concentration in ground water is less than 200 ppm (if background chloride in ground water is 100 ppm).

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October 5, 2004

Mr. Wayne Price
New Mexico Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

Via E-mail

RE: St. Mary Land & Exploration, Unit A Section 9 T20S R29E
Notice of Violation- Inspection No. iMCS0324140421

Dear Mr. Price:

Since Mike Stubblefield has left the NMOCD for greener pastures, I elected to send this modeling report to you. I would believe that this report would find its way to Santa Fe and your desk simply because you have been reviewing these modeling reports. As you can see, I sent this report to Mr. Bratcher in Artesia as well.

St. Mary Land and Exploration Company (St. Mary) retained R.T. Hicks Consultants (Hicks Consultants) to examine the site of an accidental release of produced water adjacent to the Duke Energy Magnum Booster Station (Magnum Booster) in Eddy County, New Mexico and, if necessary, develop a remedy. We evaluated the release through field sampling, an analysis of the hydrogeologic setting, and predictive modeling using HYDRUS-1D. We used "conservative" input parameters in our model that could result in an exaggeration of the impact of the release to ground water quality. Our evaluation allows us to conclude that the residual chloride in the vadose zone poses no material threat to ground water quality. However, the modeling also suggests that that precipitation will not flush residual chloride below the root zone at this site for about 20 years. We recommend that St. Mary inspect the site on an annual basis and re-seed the area when invasive species become established. Recent heavy rains in the area probably accelerated chloride flushing from the surface soil.

Background

St. Mary operates a three-inch poly line which moves produced water from JC Williamson's Tank Battery in Section 16-T20S-R29E to the St. Mary Tuesday Federal Battery in Section 3-T20S-R29E. The produced water originates from St. Mary TOG #5 and JC Williamson's TOG wells.

On August 8, 2003, St Mary submitted Form C-141 notifying the New Mexico Oil Conservation Division (OCD) of an authorized release of produced water near the southeast corner of Duke Magnum Booster (Unit A, Section 9-T20S-R29E). Plate 1 shows the location of the release site relative to Carlsbad. Plate 2 shows the location of the release relative to

the Duke Energy Magnum Booster Station and nearby water wells identified on the Office of the State Engineer (OSE) database. Plate 3 shows the dimensions of the release.

On August 29, 2003 the OCD issued a Notice of Violation – Inspection numbered iMCS0324140321. The notice stated that a "section of gathering line has had numerous unreported produced water spills that have run onto the Magnum Booster site." The notice also indicated that the impacted area is estimated to be approximately 100 yards x 100 yards or 90,000 square feet.

Environmental Setting

Driller's logs from nearby water wells show that ground water exists at a depth of about 180 feet below land surface (See Appendix A). Caliche, clay and limestone are the dominant rock types of the unsaturated zone. In well CP-698, which is about 1 mile northeast of the release site, the driller's log reports over 70 feet of clay between land surface and the water-bearing horizon. In well CP-745, which is about 2 miles east of the release site, the driller's log describes over 100 feet of fine-grained clay and caliche in the unsaturated zone. CP-740 is a dry hole located about 3 miles east of the release site. This boring describes fine-grained sediments like clay, caliche and anhydrite for 174 of the 190-foot boring.

Examination of Plate 4 shows that the spill site lies near the contact between the Triassic Dockum Group and the underlying Rustler Formation. The wells described above penetrate the Rustler Formation and draw water from a limestone unit at a depth of about 180 feet below land surface. This water-bearing limestone unit, which underlies the site, is probably a confined aquifer. If this is the case, any vertical seepage from the release cannot enter ground water. Unfortunately, we can find no published data to permit us to determine if the ground water beneath the site is confined or unconfined. We measured a depth to water of 54 feet in a windmill that is about 0.25 miles southeast from the site (Plate 2). Unfortunately, the OSE database does not have a well log for this well. If this well, like other nearby wells, draws water from the honeycomb limestone unit, then we could conclude that ground water is confined in this area.

For the purpose of this report, we will assume that the ground water is unconfined and is at a depth greater than 100 feet below land surface.

Release Volume

After extensive interviews with St. Mary L&E personnel, we determined that the poly line could have released produced water several times to the same general area. Based upon production records of the well discharging to this line and the size of produced water storage tanks at the well, we believe that the line might have experienced six releases, with each spill less than 100 barrels. Therefore, using this method of estimation, the total release at the site is no more than 600 barrels. We believe these six releases occurred in relative quick succession (e.g. within a single year).

Collection and Evaluation of Data

Hicks Consultants conducted field reconnaissance of the release site on October 7, 2003, November 6, 2003 and April 15, 2004. During the October field event, Hicks Consultants:

- Measured the extent of the impact,
- Sampled soil from hand auger borings, and
- Obtained photographic evidence.

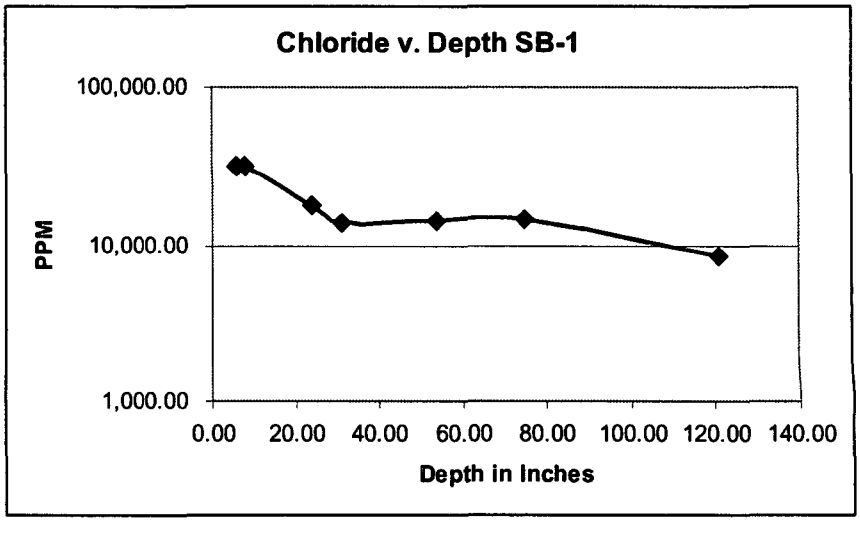
In November, we re-sampled a soil boring location to obtain samples from greater than 3 feet deep. On April 15, we sampled the soil column within the spill site to measure the effect of recent rains.

The extent of the impacted area is illustrated on Plate 3. The impacted area is approximated by two geometrical figures, a half circle and an adjacent rectangle. The average radial extent of the impacted area approximated by the half circle is 139ft. This corresponds to an area of 30,334 square feet. The impacted area of the rectangular area is 5,520 square feet. Therefore the total area impacted, over time due to multiple releases, is 35,850 square feet.

If these releases did occur in quick succession, they would behave like a single 600 barrel release that spreads over 35,850 square feet. Simple arithmetic shows that such a release would create a spill height of 1.21 inches. We cross-checked this estimate using the results of soil samples taken at the site and we discuss this estimate of the release volume in the following sections.

In order to characterize the site with respect to chloride impact, we collected depth discrete samples from three soil boring locations and one soil sample from an area not impacted by any releases. Sample location #1 was at the location of the latest release, as evidenced by a crack in the poly pipe (sampling site 1). Sampling location #2 was near the edge of the release and not adjacent to the pipe. In April, we collected a vertical profile at sample location #3. Table 1 shows the chloride concentration in these samples as well as the background sample (341 mg/kg). The locations of the soil borings are illustrated on Plate 3.

Figure 1 is a graphical representation of chloride vs. depth at the boring location nearest the most recent release point, location #1. As the data show, the chloride concentration decreases with depth. Chloride levels from 6 to 8 inches are 31,400 mg/kg, as would be expected from a



sample adjacent to the pipeline failure. We elected to obtain this sample from a small area of approximately 1 square foot where a small amount of produced water and recently exited the line. We hand augured vertically down from this point to obtain samples at 24, 31, 54, 75 and 121 inches. As Figure 1 illustrates, a chloride mass from a prior release has migrated downward to a depth of between 24 and 75 inches due to rainfall events. The decrease in chloride concentration between that measured at 24 inches and 121 inches is 58%. Due to the nature of the soil, we were unable to obtain samples by hand auger below 121 inches, however, the slope of the line between the points at 75 and 121 inches respectively, allows the extrapolation of the curve to estimate the depth where chloride concentration equals that of background – 394 mg/kg. This linear extrapolation yields a depth of 182 inches or 15.22 feet as the maximum vertical extent of the release at this location.

Figure 2 shows the chloride v. depth profile for Sampling Site #3. This sample is about 20 feet distant from the pipe and will be more representative of the soil profile throughout the release area than location #1. At this sampling site, the release has penetrated less than 90 inches

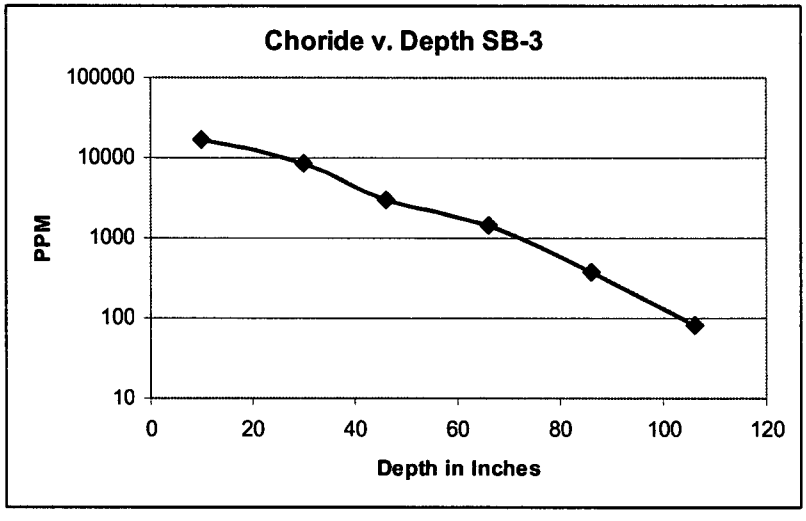
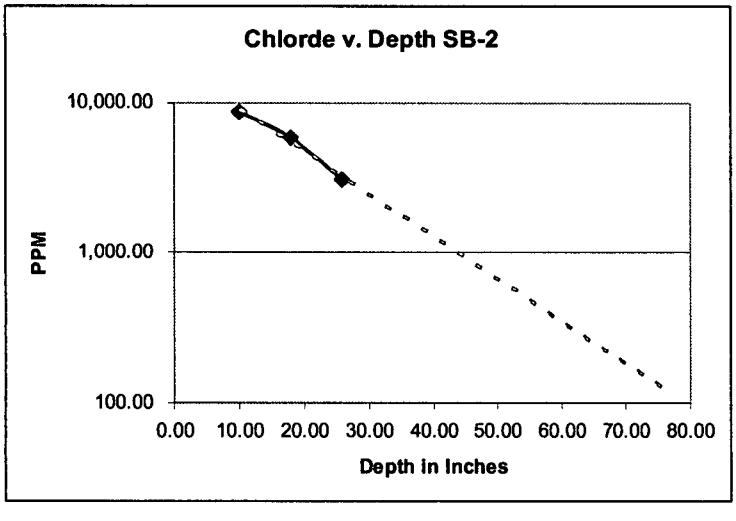


Plate 5 shows the calculation of chloride load for sampling location #2, which we employed for input to our predictive modeling program. We selected #2 because of the higher chloride values observed in the samples. Although we do not have samples deeper than 26 inches; we predicted the chloride concentrations based upon the slope of the graph (Figure 3). At this location, the spill penetrated to a depth of about 60 inches. The resultant chloride load onto the ground surface is 9.6 kg/m^2. Simple arithmetic allows us to calculate the spill height if we know the chloride load and the concentration of chloride in the released water. Applying this arithmetic, we calculated that the spill height was 3 inches at this location, not 1.1 inches as suggested earlier in this report. This calculation suggets that the total volume of released water is probably in excess of 600 barrels.



Evaluation of Chloride Flux from the Vadose Zone to Ground Water

We employed the HYDRUS-1D and a simple ground water mixing model to evaluate the potential of residual chloride mass in the vadose zone to materially impair ground water quality at the site. Appendix B presents the background documentation for this modeling approach. We applied the results from the HYDRUS-1D modeling of the migration of chloride ions from the vadose zone to ground water in our selection of an appropriate remedy for the land surface and underlying vadose zone. This simulation is the "no action" alternative, which predicts chloride flux to ground water in the absence of any action by St. Mary L&E.

Data for Simulation Modeling

The HYDRUS1D and mixing model simulation requires input of 11 parameters. As Table 2 shows, several site specific data are required for several of these parameters and other data are available from public sources. We employed the well logs in Appendix A to determine the vadose zone thickness and create the vadose zone textural profile shown in Plate 5. The dispersion length of 6 meters is 10% of the total length of the HYDRUS-1D model and is consistent with standard modeling protocol.

Our previous work with the American Petroleum Institute showed that soil moisture values did not strongly influence the ability of the model to predict chloride migration from the vadose zone to ground water. We used HYDRUS-1D to predict the initial soil moisture at the site by running the model for 46 years with "dry" initial conditions and allowing the climate data to equilibrate the soil to precipitation and evaporation.

Table 2: Input Parameters for Simulation Modeling

Input Parameter	**Source**
1. Vadose Zone Thickness – 185 feet	Appendix A well logs
2. Vadose Zone Texture –	Attached well log
3. Dispersion Length - 6 meters	Professional judgement
4. Soil Moisture	HYDRUS-1D initial condition simulation
5. Chloride in release – 120,000 ppm	Samples of produced water
6. Height of spill on land surface – 3 inches	Calculated from chloride load at sampling location #2 and chloride in released water
7. Length of release parallel to ground water flow – 215 ft	Field Measurements
8. Climate - Arid	Pearl Weather Station near Hobbs Airport
9. Background Chloride in Ground Water – 100 ppm	Professional judgement
10. Ground Water Flux – 2 in./day	Calculated from published data
11. Aquifer Thickness – 15 feet	Appendix A well logs

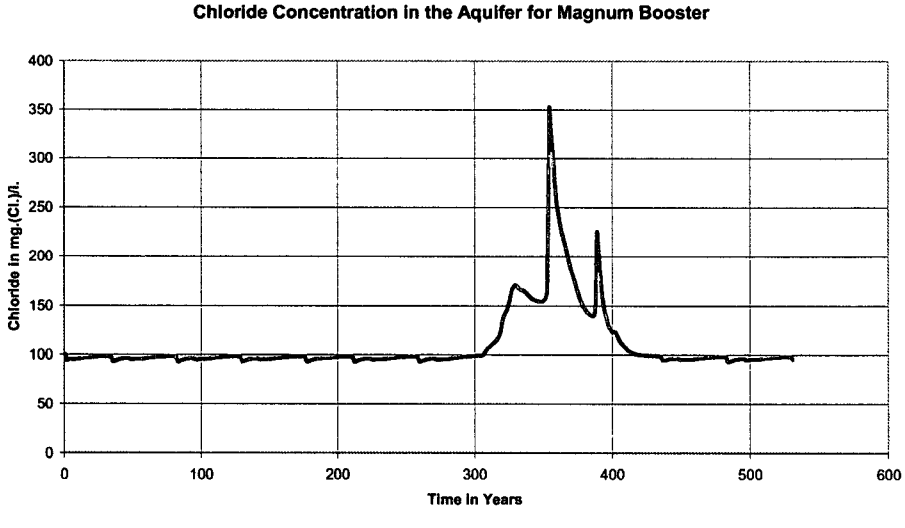
Samples provided the chloride concentration in the released water. By calculating the chloride load in the soil at location #2, we employed simple arithmetic to predict the spill height. A release that covers the area of the spill to a depth of 3 inches, as calculated from the soil samples at location #2, suggests a release of about 1800 barrels. We believe that this assumption in the modeling grossly overestimates the volume of fluid released at this site. Water production data and the observations of field staff cannot justify this release estimate. Therefore, the modeling exercise will exaggerate the impact to ground water quality as a result.

We used the maximum dimension of the spill (215 feet) as the length of the spill parallel to ground water flow. We used climate data from the Pearl Weather Station near the Hobbs, New Mexico airport in our modeling. We did not have any samples of ground water from the area; therefore we assumed a background chloride concentration of 100 ppm. To calculate the ground water flux, we assumed a hydraulic gradient of 0.005 and a hydraulic conductivity in the honeycomb limestone of 10^{-6} m/s. The well logs in Appendix A show that the honeycomb limestone is only 15 feet thick in this area.

Results of Simulation Modeling

We simulated chloride movement through the vadose zone with HYDRUS-1D for 528 years. We found that the center of chloride mass associated with the release enters ground water between 300 years from present and 435 years from present.

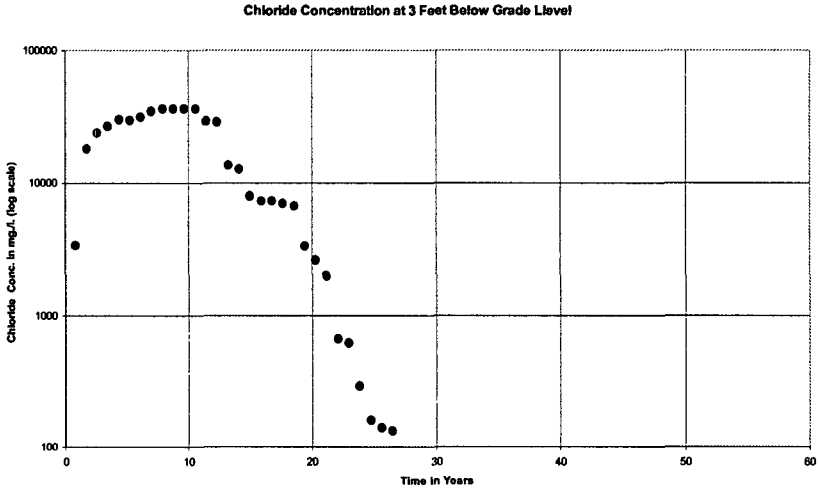
We input the chloride flux from the vadose zone into the aquifer mixing model. The results of the mixing model simulation show impairment of water quality as a result of the surface release. Figure 4 shows the prediction of the mixing model. The predicted concentration in the aquifer is above 250 ppm for a time interval of less than ten years beginning 350 years from now. Peak concentration is slightly above 350 ppm. Note that the model assumes that rainfall is essentially distilled water and the vadose zone contains 0 ppm chloride soil water at the time of the release (time 0). Then natural precipitation (0 ppm chloride) moves the chloride through the vadose zone and dilutes the chloride mass during transport. Thus from time zero to slightly more than 300 years, a small flux of 0 ppm chloride enters the aquifer from the vadose zone, diluting the 100 ppm chloride ground water to 99.8 ppm. After 310 years, the chloride mass from the release enters ground water raising chloride concentration as high as 350 ppm. The effects of the



spill are no longer noticeable 435 years from present. Thus, we can confidently conclude that the release of about 1800 barrels at this site will cause minimal impairment of ground water quality.

A release of 600 barrels, which is the more likely scenario given the water production of the nearby wells, decreases the chloride load at this site by 66% and would result in commensurate reduction in the impact to ground water quality as the relationship between chloride load and water quality predictions is almost linear. Therefore, we can expect a resultant chloride concentration of about 200 ppm at a water table aquifer beneath this 600-barrel release site (if background chloride concentration is 100 ppm).

The HYDRUS-1D model predicts that chloride load measured at one meter below grade will not drop below 1000 ppm for approximately 23 years from present (Figure 5). When the pore water below the root zone (about 1 meter deep) is less than 1000 ppm chloride, we can be confident that the soil is fully restored and can support native vegetation without concern that chloride "wick up" to the root zone from deeper in the vadose zone.



Recommendations

We recommend that St. Mary Land and Exploration take no action to re-seed the area at this time. The occurrence of a several years of normal or high precipitation will move sufficient chloride out of the root zone to allow vegetation to reenter the area. However, a return to dry conditions would result in upward chloride movement removing the vegetation. We recommend St. Mary inspect the site on an annual basis and re-seed the site after invasive species have fully colonized the area. We advise periodic removal of noxious weeds as appropriate. If you have any questions, please contact me.

Sincerely,
R.T. Hicks Consultants, Ltd.

Randall Hicks

Copy: Chuck Jones, St. Mary