AP - 50

GENERAL CORRESPONDENCE

YEAR(S):
2006-2003

RICE ***Operating Company***

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

CERTIFIED MAIL
RETURN RECIEPT NO. 7005 1820 0001 6804 7722

2006 FEB 15 PM 12 49

February 13, 2006

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: BD Zachary Hinton EOL
PUBLIC NOTICATIONS
NMOCD CASE #AP-50

Mr. Price:

In accordance with Rule 19 (Section 19.15.1.19 NMAC, Subsection G) Public Notice requirements, please accept the enclosed copies of proof that the appropriate individuals and entities were notified of the Stage 1 and 2 Abatement Plan submitted by the consulting firm of R.T. Hicks Consultants of Albuquerque for the Zachary Hinton junction box site.

Notices were sent via certified mail to landowners within the prescribed radius and return receipts were received for all landowners, indicating that the mailing was received. Mailings were also sent to the Lea County Commission and the list of Interested Parties found on the New Mexico Oil Conservation Division (OCD) website. Some mail deliveries could not be confirmed so the document was sent via electronic mail (e-mail) to the addresses provided on the list. Thirty-five total notifications were sent and two were not delivered, both from the OCD Interested Parties list. The notification to Mike Schultz of the International Technology Corp. was returned as "attempted—not known." Previous delivery attempts to this address have been refused. Gerald R. Zimmerman of the Colorado River Board of California could not be notified by US Mail nor e-mail.

As directed by OCD, the Stage 1 and 2 Abatement Plan notifications were published in the *Albuquerque Journal* and the *Hobbs News-Sun* newspapers. Affidavits for these publications are enclosed.

ROC requests that OCD consider public notice complete for this site. Should you have any further questions regarding this request, do not hesitate to contact me. Thank you for your consideration.

ROC is the service provider (operator) for the Blinebry-Drinkard (BD) 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.

RICE OPERATING COMPANY

Kristin Farris Pope

Kristin Farris Pope
Project Scientist

enclosures: summary table of notifications,
newspaper affidavits,
return receipt copies,
e-mail copies

cc: CDH, Hicks, file, Daniel Sanchez (NMOCD),

Pat Caperton
NMOCD, District I Office
1625 N. French Drive
Hobbs, NM 88240

AFFIDAVIT OF PUBLICATION

State of New Mexico,
County of Lea.

I, Kenneth Norris

Advertising Manager

of the Hobbs News-Sun, a newspaper published at Hobbs, New Mexico, do solemnly swear that the clipping attached hereto was published once a week in the regular and entire issue of said paper, and not a supplement thereof for a period

of 1

issue(s).

Beginning with the issue dated

January 18, 2006

and ending with the issue dated

January 18, 2006

Advertising Manager

Sworn and subscribed to before

this 19th day of

January, 2006

Notary Public.

My Commission expires
February 07, 2009
(Seal)

OFFICIAL SEAL
DORA MONTZ
NOTARY PUBLIC
STATE OF NEW MEXICO

My Commission Expires: ____________

LEGAL NOTICE
January 18, 2006

NOTICE OF PUBLICATION

State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division

Notice is hereby given that pursuant to New Mexico Oil Conservation Division Regulations, the following Stage 1 and 2 Abatement Plan has been submitted to the Director of the Oil Conservation Division, 1220 S. St. Francis Dr., Santa Fe, New Mexico 87504, Telephone (505) 476-3440:

Rice Operating Company, Carolyn Doran Haynes, Engineering Manager, Telephone (505) 393-9174, 122 West Taylor, Hobbs, New Mexico 88240, has submitted a Stage 1 and 2 Abatement Plan for the Zachary Hinton EOL site, Blinebry Drinkard Salt Water Disposal System, located about 2.5 miles southeast of the intersection of State Routes 18 and 8/176, near Eunice, New Mexico in Unit Letter O, Section 12, T22S, R37E, Lea County, New Mexico. Concentrations of chloride and total dissolved solids were above background conditions in the past but currently ground water quality is equal to background concentrations. The Stage 1 and 2 Abatement Plan describes the proposed measures to prevent future impairment of ground water quality due to residual chloride in the unsaturated zone and the proposed response to past ground water impairment.

Any interested person may obtain further information from the Oil Conservation Division and may submit written comments to the Director of the Oil Conservation Division at the address given above. The Stage 1 and 2 Abatement Plan may be viewed at the above address or at the Oil Conservation Division District Office, 1625 N. French Drive, Hobbs, New Mexico 88240, Telephone (505) 393-6161 between 8:00 a.m. and 4:00 p.m., Monday through Friday. Prior to ruling on any proposed Stage 1 and 2 Abatement Plan, the Director of the Oil Conservation Division shall allow at least thirty (30) days after the date of publication of this notice during which written comments may be submitted to him.
#22074

This newspaper is duly qualified to publish legal notices or advertisements within the meaning of Section 3, Chapter 167, Laws of 1937, and payment of fees for said publication has been made.

01104367000 67535643
RICE OPERATING COMPANY
122 WEST TAYLOR
HOBBS NM 88240

STATE OF NEW MEXICO
County of Bernalillo SS

Bill Tafoya, being duly sworn, declares and says that he is Classified Advertising Manager of **The Albuquerque Journal**, and that this newspaper is duly qualified to publish legal notices or advertisements within the meaning of Section 3, Chapter 167, Session Laws of 1937, and that payment therefore has been made of assessed as court cost; that the notice, copy of which is hereto attached, was published in said paper in the regular daily edition, for 1 times, the first publication being on the 18 day of Jan., 2006 ~~and the~~ subsequent consecutive publications on ______ ______, 20___.

[signature]

Sworn and subscribed to before me, a Notary Public, in and for the County of Bernalillo and State of New Mexico this 18 day of Jan., of 2006

PRICE $41.85

Statement to come at end of month.

ACCOUNT NUMBER C82274

OFFIC[IAL SEAL]
Elyn
NOTAR[Y PUBLIC]
STATE OF
My Commission Expires:

CLA-22-A (R-1/93)

NOTICE OF PUBLICATIO[N]

State of New Mexico
Energy, Minerals and Natur[al]
Resources Department
Oil Conservation Division

Notice is hereby given that pu[rsu]ant to New Mexico Oil Conse[rva]tion Division Regulations, the [fol]lowing Stage 1 and 2 Abatem[ent] Plan has been submitted to [the] Director of the Oil Conserva[tion] Division, 1220 S. St. Francis [Drive,] Santa Fe, New Mexico 875[05,] Telephone (505) 476-3440:

Rice Operating Company, C[aro]lyn Doran Haynes, Enginee[ring] Manager, Telephone (5[05]) 393-9174, 122 West Tay[lor,] Hobbs, New Mexico 88240, [has] submitted a Stage 1 an[d 2] Abatement Plan for the Zach Hinton EOL site, Bline[bry-]Drinkard Salt Water Dispo[sal] System, located about 2.5 m[iles] southeast of the intersectio[n of] State Routes 18 and ..., [near] Eunice, New Mexico in Unit [Let]ter O, Section 12, T22S, R3[7E,] Lea County, New Mexico. C[on]centrations of chloride and t[otal] dissolved solids were ab[ove] background conditions in the [past] but currently ground water qu[ality] is equal to background conc[en]trations. The Stage 1 an[d 2] Abatement Plan describes [the] proposed measures to prev[ent] future impairment of ground [wa]ter quality due to residual c[hlo]ride in the unsaturated zone [and] the proposed response to [any] ground water impairment.

Any interested person may ob[tain] further information from the [Oil] Conservation Division and [may] submit written comments to [the] Director of the Oil Conserva[tion] Division at the address gi[ven] above. The Stage 1 and 2 Ab[ate]ment Plan may be viewed at [the] above address or at the Oil C[on]servation Division District Of[fice,] 1625 N. French Drive, Hob[bs,] New Mexico 88240, Teleph[one] (505) 393-6161 between 8:00 a[.m.] and 4:00 p.m., Monday thro[ugh] Friday. Prior to ruling on any [pro]posed Stage 1 and 2 Abatem[ent] Plan, the Director of the Oil C[on]servation Division shall allow [at] least thirty (30) days after the [date] of publication of this notice du[ring] which written comments may [be] submitted to him.
Journal: January 18, 2006

BD Zachary Hinton EOL

Unit 'O', Sec. 12, T22S, R37E

Public Notice Mailings (1/11/2006)
Stage 1 & 2 Abatement Plan

	Landowner or Interested Party	Delivery Status			Comments
		Delivered US Mail	Delivered E-mail	Not Delivered	
1	G. P. Sims P.O. Box 1046 Eunice, NM 88231	X			Return Receipt Received
2	Irvin and Shirley Boyd P.O. Box 121 Eunice, NM 88231	X			Return Receipt Received
3	Leo V. Sims P.O. Box 2630 Hobbs, NM 88240	X			Return Receipt Received
4	NM State Highway Department P. O. Box 1458 Roswell, NM 88202	X			Return Receipt Received
5	Ray A. Pierce P.O. Box 1969 Eunice, NM 88231	X			Return Receipt Received
6	Winnie Lea Simms Kennann P.O. Box 186 Eunice, NM 88231	X			Return Receipt Received
7	Lea County Administration Office Attn: Lue Ethridge 100 N. Main Street, Suite 4 Lovington, NM 88260	X			Return Receipt Received
8	Attorney General's Office P.O. Box 1508 Santa Fe, NM 87504	X			Return Receipt Received
9	Bruce S. Garber Attorney at Law P.O. Box 0850 Santa Fe, NM 87504-0850 Email: bsg@garbhall.com	X			Return Receipt Received
10	State Director Bureau of Land Management P.O. Box 27115 Santa Fe, NM 87502-0115	X			Return Receipt Received
11	Chief Groundwater Bureau Runnels Building Santa Fe, NM 87504 Email: Bill.Olsen@state.nm.us	X			Return Receipt Received
12	Chief Hazardous Waste Bureau Runnels Building Santa Fe, NM 87504 E-Mail: James.Bearzi@state.nm.us	X			Return Receipt Received
13	Gerald R. Zimmerman Colorado River Board of Calif. 770 Fairmont Ave. Ste 100 Glendale, CA 91203-1035 E-mail: jcc_crb@pacbell.net			X	No Reply (US Mail and e-mail)

14	Jack A Barnett Colorado River Basin Ctrl. Forum 106 West 500 South, Suite 101 Bountiful, UT 84010 Email: James.Bearzi@state.nm.us	X			Return Receipt Received
15	Department of Game & Fish Director Villagra Building Santa Fe, NM 87503	X			Return Receipt Received
16	Dr. Harry Bishara P.O. Box 748 Cuba, NM 78013	X			Return Receipt Received
17	Colin Adams Environmental Counsel Public Service Company of new Mexico 414 Silver, SW Albuquerque, NM 87158 Email: cadams@pnm.com	X			Return Receipt Received
18	Mike Schulz International Technology Corp. 5301 Central Avenue, NE Suite 700 Albuquerque, NM 87108 E-mail: mschulz@theitgroup.com			X	Undeliverable mail, not able to forward
19	Jay Lazarus P.O. Box 5727 Santa Fe, NM 87502 E-mail: Lazarus@glorietageo.com	X			Return Receipt Received
20	Ken Marsh CRI P.O. Box 388 Hobbs, NM 88241 E-mail: ken@crihobbs.com	X			Return Receipt Received
21	Lee Wilson & Associates P.O. Box 931 Santa Fe, NM 87501 E-mail: lwa@lwasf.com	X			Return Receipt Received
22	Ned Kendrick Attorney at Law 325 Paseo de Peralta Santa Fe, NM 87501 E-mail: ekendrick@montand.com	X			Return Receipt Received
23	Secretary New Mexico Environment Department P.O. Box 26110 Santa Fe, NM 87504 E-mail: Cathy.Tyson@state.nm.us	X			Return Receipt Received
24	Lynn Brandvold NM Bureau of Mines & Mineral Resources NM Institute of Mining & Tech. Socorro, NM 87801	X			Return Receipt Received
25	NM Oil & Gas Association P.O. Box 1864 Santa Fe, NM 87504-1864	X			Return Receipt Received
26	Randy Hicks 901 Rio Grande Blvd NW, Suite F-142 Albuquerque, NM 87104 E-mail: r@rthicksconsult.com	X			Return Receipt Received
27	Soil and Water Conservation Bureau New Mexico Department of Agriculture Programs and Resources Division Box 30005/APR Las Cruces, NM 88003-8005	X			Return Receipt Received

28	Chris Shuey Southwest Research & Information Center P.O. Box 4524 Albuquerque, NM 87106 E-mail: sricdon@earthlink.net	X			Return Receipt Received
29	Ron Dutton Southwestern Public Service P.O. Box 1261 Amarillo, Texas 79170 E-mail: ron.dutton@xcelenergy.com	X			Return Receipt Received
30	Elmo Baca State Historic Preservation Officer 228 East Palace Avenue Villa Rivera Room 101 Santa Fe, NM 87503	X			Return Receipt Received
31	Director State Parks & Recreation 1220 S. St. Francis Dr. Santa Fe, NM 87505	X			Return Receipt Received
32	Field Supervisor US Fish & Wildlife Service 2105 Osuna Road, Northeast Albuquerque, NM 87113-1001	X			Return Receipt Received
33	Regional Forester USFS Regional Office 517 Gold Avenue SW Albuquerque, NM 87102 E-mail: cgarcia@fs.fed.us		X		Undeliverable mail, not able to forward; e-mailed 2/8/2006
34	State Engineer Water Resources Division Bataan Building Santa Fe, NM 87503	X			Return Receipt Received
35	William Turner New Mexico Trustee for Natural Resources C/O American Ground Water consultants 610 Gold St. SW, Suite 111 Albuquerque, NM 87102	X			Return Receipt Received
TOTALS		32	1	2	

Kristin Farris Pope

From: "Kristin Farris Pope" <kpriceswd@valornet.com>
To: <jcc_crb@pacbell.net>
Sent: Wednesday, February 08, 2006 10:31 AM
Attach: Zachary Hinton.doc
Subject: Rule 19 Public Notice (Zachary Hinton)

Mr. Zimmerman:

In accordance with the NMOCD Rule 19 Public Notice requirements, please find the attached public notification document. This document was originally mailed to you on January 11, 2006. Thank you.

Kristin Farris Pope
Project Scientist
RICE Operating Company
Hobbs, New Mexico
(505) 393-9174

Kristin Farris Pope

From: <MAILER-DAEMON@mail2.valornet.net>
To: <kpriceswd@valornet.com>
Sent: Wednesday, February 08, 2006 10:31 AM
Subject: failure notice

Hi. This is the qmail-send program at mail2.valornet.net.
I'm afraid I wasn't able to deliver your message to the following addresses.
This is a permanent error; I've given up. Sorry it didn't work out.

<jcc_crb@pacbell.net>:
207.115.57.16 does not like recipient.
Remote host said: 553 5.3.0 <jcc_crb@pacbell.net>... Addressee unknown, relay=[69.30.128.27]
Giving up on 207.115.57.16.

--- Below this line is a copy of the message.

Return-Path: <kpriceswd@valornet.com>
Received: (qmail 1229 invoked by uid 120); 8 Feb 2006 17:31:43 -0000
Received: from 72.16.119.254 by mail2.valornet.net (envelope-from <kpriceswd@valornet.com>, uid 89) with qmail-scanner-1.24st
(clamdscan: 0.80/791. spamassassin: 3.0.1. perlscan: 1.24st.
Clear:RC:1(72.16.119.254):SA:0(0.0/5.0):.
Processed in 2.275885 secs); 08 Feb 2006 17:31:43 -0000
X-Spam-Status: No, hits=0.0 required=5.0
Received: from unknown (HELO rice5d6y3hrqfi) (kpriceswd@72.16.119.254)
by 0 with SMTP; 8 Feb 2006 17:31:40 -0000
Message-ID: <004001c62cd5$8bce3100$2601a8c0@rice5d6y3hrqfi>
Reply-To: "Kristin Farris Pope" <kpriceswd@valornet.com>
From: "Kristin Farris Pope" <kpriceswd@valornet.com>
To: <jcc_crb@pacbell.net>
Subject: Rule 19 Public Notice (Zachary Hinton)
Date: Wed, 8 Feb 2006 10:31:49 -0700
Organization: Rice Operating Company
MIME-Version: 1.0
Content-Type: multipart/mixed;
boundary="----=_NextPart_000_003C_01C62C9A.DE840EA0"
X-Priority: 3
X-MSMail-Priority: Normal
X-Mailer: Microsoft Outlook Express 6.00.2900.2180
X-MIMEOLE: Produced By Microsoft MimeOLE V6.00.2900.2180

This is a multi-part message in MIME format.

------=_NextPart_000_003C_01C62C9A.DE840EA0
Content-Type: multipart/alternative;
boundary="----=_NextPart_001_003D_01C62C9A.DE840EA0"

------=_NextPart_001_003D_01C62C9A.DE840EA0
Content-Type: text/plain;
charset="iso-8859-1"

Kristin Farris Pope

From: "Kristin Farris Pope" <kpriceswd@valornet.com>
To: <cgarcia@fs.fed.us>
Sent: Wednesday, February 08, 2006 10:33 AM
Attach: Zachary Hinton.doc
Subject: Rule 19 Public Notice (Zachary Hinton)

Regional Forester:

In accordance with the NMOCD Rule 19 Public Notice requirements, please find the attached public notification document. This document was originally mailed to you on January 11, 2006. Thank you.

Kristin Farris Pope
Project Scientist
RICE Operating Company
Hobbs, New Mexico
(505) 393-9174

NDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

Article Addressed to:

Bruce S. Garber
Attorney at Law
PO BOX 0850
Santa Fe, NM 87504-0850

2-H-BD

Article Number (Transfer from service label) 7005 1820 0001 6804 1683

Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

COMPLETE THIS SECTION ON DELIVERY

A. Signature X M. Turner ☐ Agent ☐ Addressee

B. Received by (Printed Name) M. Turner

C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

SANTA FE JAN 17 2006 USPS

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☒ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

William Turner NM Trustee for Natural Resources
C/O American Ground Water Consultants
610 Gold St. SW, Suite 111
Albuquerque, NM 87102

2-H-BD

2. Article Number (Transfer from service label) 7005 1820 0001 6804 1454

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-154

COMPLETE THIS SECTION ON DELIVERY

A. Signature X Elysia Manz ☒ Agent ☐ Addressee

B. Received by (Printed Name) Elysia Manz

C. Date of Delivery 1-13-06

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☒ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☒ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

NDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

Article Addressed to:

Department of Game & Fish
Director
Villagra Building
Santa Fe, NM 87503

2-H-BD

Article Number (Transfer from service label) 7005 1820 0001 6804 1652

S Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

COMPLETE THIS SECTION ON DELIVERY

A. Signature X ☐ Agent ☐ Addressee

B. Received by (Printed Name)

C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

JAN 13 2006

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☒ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Environmental Counsel ATTN: Colin Adams
Public Service Company of NM
414 Silver, Southwest
Albuquerque, NM 87158

2-H-BD

2. Article Number (Transfer from service label) 7005 1820 0001 6804 1645

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-154

COMPLETE THIS SECTION ON DELIVERY

A. Signature X Colin Adams ☐ Agent ☐ Addressee

B. Received by (Printed Name)

C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☒ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

NDER: *COMPLETE THIS SECTION*

Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
Print your name and address on the reverse so that we can return the card to you.
Attach this card to the back of the mailpiece, or on the front if space permits.

Article Addressed to:

State Parks & Recreation
Director
1220 S St Francis
Santa Fe, NM 87505

2-H-BD

Article Number
(Transfer from service label) 7005 1820 0001 6804 1478

Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Alan Jewell ☐ Agent ☐ Addressee

B. Received by (Printed Name) C. Date of Delivery 1-18

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

SENDER: *COMPLETE THIS SECTION*

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Jay Lazarus
PO BOX 5727
Santa Fe, NM 87502

2-H-BD

2. Article Number
(Transfer from service label) 7005 1820 0001 6804 1638

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-15

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X ☐ Agent ☐ Addresse

B. Received by (Printed Name) C. Date of Deliver

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

CORONADO JAN 19 2006

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandis
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

NDER: *COMPLETE THIS SECTION*

Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
Print your name and address on the reverse so that we can return the card to you.
Attach this card to the back of the mailpiece, or on the front if space permits.

Article Addressed to:

Water Resources Division
State Engineer
Bataan Building
Santa Fe, NM 87503

2-H-BD

Article Number
(Transfer from service label) 7005 1820 0001 6804 1447

Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X ☐ Agent ☐ Addressee

B. Received by (Printed Name) C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

JAN 13 2006 SANTA FE

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

SENDER: *COMPLETE THIS SECTION*

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

State Historic Preservation Officer Attn:Elmo Baca
228 East Palace Avenue
Villa Rivera Room 101
Santa Fe, NM 87503

2-H-BD

2. Article Number
(Transfer from service label) 7005 1820 0001 6804 1423

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-15

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X ☐ Agent ☐ Addresse

B. Received by (Printed Name) C. Date of Deliver
Victoria L. Oliver

D. Is delivery address different from item 1? ☑ Yes
If YES, enter delivery address below: ☐ No

SANTA FE NM 87501 JAN 24 2006 USPS

Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandis
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

NDER: COMPLETE THIS SECTION

Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
Print your name and address on the reverse so that we can return the card to you.
Attach this card to the back of the mailpiece, or on the front if space permits.

Article Addressed to:

Colorado River Basin Ctrl. Forum
Jack A. Barnett
106 West 500 South, Suite 101
Bountiful, UT 84010

2-H-BD

Article Number (Transfer from service label) 7005 1820 0001 6804 1669

Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

COMPLETE THIS SECTION ON DELIVERY

A. Signature X Nola Patterson ☐ Agent ☐ Addressee

B. Received by (Printed Name) C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☑ Certified Mail ☐ ~~Express Mail~~
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

New Mexico Environmental Department
Secretary
PO BOX 26110
Santa Fe, NM 87504

2-H-BD

2. Article Number (Transfer from service label) 7005 1820 0001 6804 1614

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-154

COMPLETE THIS SECTION ON DELIVERY

A. Signature X Sig Rivera ☐ Agent ☐ Addressee

B. Received by (Printed Name) Sig Rivera C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☑ No

SANTA FE NM 87505 JAN 13 2006

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

NDER: COMPLETE THIS SECTION

Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
Print your name and address on the reverse so that we can return the card to you.
Attach this card to the back of the mailpiece, or on the front if space permits.

Article Addressed to:

G.P. Sims
P.O. Box 1046
Eunice, NM 88231

2-H-BD

Article Number (Transfer from service label) 7005 0390 0000 9980 2978

Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

COMPLETE THIS SECTION ON DELIVERY

A. Signature X [signature] ☐ Agent ☐ Addressee

B. Received by (Printed Name) C. Date of Delivery 01-13-06

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

EUNICE JAN 13 2006

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Southwestern Public Service
Ron Dutton
PO BOX 1261
Amarillo, TX 79170

2-H-BD

2. Article Number (Transfer from service label) 7005 1820 0001 6804 1485

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-154

COMPLETE THIS SECTION ON DELIVERY

A. Signature X [signature] ☐ Agent ☑ Addressee

B. Received by (Printed Name) William Glenn C. Date of Delivery 1-13-06

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

NDER: COMPLETE THIS SECTION

Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
Print your name and address on the reverse so that we can return the card to you.
Attach this card to the back of the mailpiece, or on the front if space permits.

Article Addressed to:

Bureau of Land Management
State Director
PO BOX 27115
Santa Fe, NM 87502-0115

2-H-BD

Article Number
(Transfer from service label) 7005 1820 0001 6804 1577

Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X ☐ Agent ☐ Addressee

B. Received by (Printed Name) C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

SANTA FE NM JAN 1 3 2006 87505

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

SENDER: COMPLETE THIS SECTION

■ Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
■ Print your name and address on the reverse so that we can return the card to you.
■ Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Attorney General's Office
PO BOX 1508
Santa Fe, NM 87504

2-H-BD

2. Article Number
(Transfer from service label) 7005 1820 0001 6804 1584

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-154

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X JA ☐ Agent ☐ Addressee

B. Received by (Printed Name) C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

JAN 1 3 2006

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

NDER: COMPLETE THIS SECTION

Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
Print your name and address on the reverse so that we can return the card to you.
Attach this card to the back of the mailpiece, or on the front if space permits.

Article Addressed to:

Chief
Hazardous Waste Bureau
Runnels Building
Santa Fe, NM 87504

2-H-BD

Article Number
(Transfer from service label) 7005 1820 0001 6804 1560

Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Sig Rivera ☐ Agent ☐ Addressee

B. Received by (Printed Name) Sig Rivera C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

SANTA FE NM JAN 1 3 2006 87505

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

SENDER: COMPLETE THIS SECTION

■ Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
■ Print your name and address on the reverse so that we can return the card to you.
■ Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Soil & Water Conservation Bureau
NM Dept of Agriculture/Ag Programs & Resources
BOX 30005/APR
Las Cruces, NM 88003-8005

2-H-BD

2. Article Number
(Transfer from service label) 7005 1820 0001 6804 1591

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-154

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X ☑ Agent ☐ Addressee

B. Received by (Printed Name) C. Date of Delivery 1-13-06

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

NDER: COMPLETE THIS SECTION

Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
Print your name and address on the reverse so that we can return the card to you.
Attach this card to the back of the mailpiece, or on the front if space permits.

Article Addressed to:

NM Oil & Gas Association
PO BOX 1864
Santa Fe, NM 87504-1864

2-H-BD

Article Number (Transfer from service label): 7005 1820 0001 6804 1607

Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

COMPLETE THIS SECTION ON DELIVERY

A. Signature X [signature] ☐ Agent ☐ Addressee

B. Received by (Printed Name) C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes If YES, enter delivery address below: ☐ No

JAN 17 2006 USPS

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☒ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Leo V. Sims
P.O. Box 2630
Hobbs, NM 88240

2-H-BD

2. Article Number (Transfer from service label) 7005 0390 0000 9980 2961

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-154

COMPLETE THIS SECTION ON DELIVERY

A. Signature X [signature] ☐ Agent ☐ Addressee

B. Received by (Printed Name) Leo S C. Date of Delivery 1/18/6

D. Is delivery address different from item 1? ☐ Yes If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☒ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

NDER: COMPLETE THIS SECTION

Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
Print your name and address on the reverse so that we can return the card to you.
Attach this card to the back of the mailpiece, or on the front if space permits.

Article Addressed to:

Lee Wilson & Associates
PO BOX 931
Santa Fe, NM 87501

2-H-BD

Article Number (Transfer from service label) 7005 1820 0001 6804 1621

Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

COMPLETE THIS SECTION ON DELIVERY

A. Signature X [signature] ☐ Agent ☐ Addressee

B. Received by (Printed Name) C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☒ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Winnie Lea Simms Kennann
PO BOX 186
Eunice, NM 88231

2-H-BD

2. Article Number (Transfer from service label) 7005 1820 0001 6804 5469

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-15

COMPLETE THIS SECTION ON DELIVERY

A. Signature X [signature] ☐ Agent ☐ Addressee

B. Received by (Printed Name) C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☒ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

NDER: COMPLETE THIS SECTION

- :omplete items 1, 2, and 3. Also complete :em 4 if Restricted Delivery is desired.
- 'rint your name and address on the reverse o that we can return the card to you.
- ttach this card to the back of the mailpiece, r on the front if space permits.

rticle Addressed to:

r. Harry Bishara
O BOX 748
uba, NM 87013

2-H-BD

rticle Number
ransfer from service label) 7005 1820 0001 6804 1546

orm 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X ☐ Agent ☐ Addressee

B. Received by (Printed Name) C. Date of Delivery 1/13/06

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

US Fish & Wildlife Service
Field Supervisor
2105 Osuna Road, Northeast
Albuquerque, NM 87113-1001

2-H-BD

2. Article Number
(Transfer from service label) 7005 1820 0001 6804 1430

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-154

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X ☐ Agent ☐ Addressee

B. Received by (Printed Name) C. Date of Delivery 1/13/06

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

NDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

Article Addressed to:

NM State Highway Department
PO BOX 1458
Roswell, NM 88202
ATTN: Darrel Johnson

2-H-BD

Article Number
(Transfer from service label) 7005 1820 0004 7485 4441

Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X M. Cronie ☐ Agent ☐ Addressee

B. Received by (Printed Name) M. Cronie C. Date of Delivery 1-13-06

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Ned Kendrick
Attorney at Law
325 Paseo de Peralta
Santa Fe, NM 87501

2-H-BD

2. Article Number
(Transfer from service label) 7005 1820 0001 6804 1515

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-154

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X V. Casias ☐ Agent ☐ Addressee

B. Received by (Printed Name) C. Date of Delivery 1/17/06

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

SANTA FE
JAN 17 2006
USPS 87501

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

NDER: COMPLETE THIS SECTION

Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
Print your name and address on the reverse so that we can return the card to you.
Attach this card to the back of the mailpiece, or on the front if space permits.

Article Addressed to:

Southwest Research & Information Center
Chris Shuey
PO BOX 4524
Albuquerque, NM 87106

Z-H-BD

Article Number (Transfer from service lab 7005 1820 0001 6804 1416

Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

COMPLETE THIS SECTION ON DELIVERY

A. Signature X Dan H ☐ Agent ☐ Addressee

B. Received by (Printed Name) Dan Hancock C. Date of Delivery 1-13-06

D. Is delivery address different from item 1? ☐ Yes If YES, enter delivery address below: ☐ No

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Irvin and Shirley Boyd
P.O. Box 121
Eunice, NM 88231

Z-H-BD

2. Article Number (Transfer from service label) 7005 0390 0000 9980 2985

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-154

COMPLETE THIS SECTION ON DELIVERY

A. Signature X Shirley Boyd ☑ Agent ☐ Addressee

B. Received by (Printed Name) C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes If YES, enter delivery address below: ☐ No

3. Service Type
☐ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

NDER: COMPLETE THIS SECTION

Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
Print your name and address on the reverse so that we can return the card to you.
Attach this card to the back of the mailpiece, or on the front if space permits.

Article Addressed to:

Randy Hicks
901 Rio Grande Blvd NW Suite F-142
Albuquerque, NM 87104

Z-H-BD

Article Number (Transfer from service label) 7005 1820 0001 6804 1492

Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

COMPLETE THIS SECTION ON DELIVERY

A. Signature X ☐ Agent ☐ Addressee

B. Received by (Printed Name) C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes If YES, enter delivery address below: ☐ No

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Chief
Groundwater Bureau
Runnels Building
Santa Fe, NM 87504

Z-H-BD

2. Article Number (Transfer from service label) 7005 1820 0001 6804 1676

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-15

COMPLETE THIS SECTION ON DELIVERY

A. Signature X Sig Rivera ☐ Agent ☐ Addressee

B. Received by (Printed Name) Sig Rivera C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes If YES, enter delivery address below: ☐ No

SANTA FE NM JAN 13 2006 87505

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

NDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

Article Addressed to:

Ray A. Pierce
P.O. Box 1969
Eunice, NM 88231

2-H-BD

Article Number (Transfer from service label) 7005 0390 0000 9980 2954

COMPLETE THIS SECTION ON DELIVERY

A. Signature X ☐ Agent ☐ Addressee

B. Received by (Printed Name) C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

JAN 12 2006 USPS

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Lea County Administration Office
Attn: Lue Ethridge
100 N. Main Street, Suite 4
Lovington, NM 88260

2-H-BD

2. Article Number (Transfer from service label) 7005 1820 0001 6804 5452

COMPLETE THIS SECTION ON DELIVERY

A. Signature X Hope Bonilla ☐ Agent ☑ Addressee

B. Received by (Printed Name) Hope Bonilla C. Date of Delivery 1-12-06

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-15

NDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

Article Addressed to:

NM Bureau of Mines & Mineral Resources
Lynn Brandvold
NM Institute of Mining & Tech
Socorro, NM 87801

2H

Article Number (Transfer from service label) 7005 1820 0001 6804 1508

COMPLETE THIS SECTION ON DELIVERY

A. Signature X Bennie Naranjo ☑ Agent ☐ Addressee

B. Received by (Printed Name) Bennie Naranjo C. Date of Delivery 1/17/06

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

CAMPUS STATION SOCORRO JAN 17 2006 87801

N.M.I.M.T. campus Post office

3. Service Type
☐ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Ken Marsh
CRI
PO BOX 388
Hobbs, NM 88241

2-H-BD

2. Article Number (Transfer from service label) 7005 1820 0001 6804 1522

COMPLETE THIS SECTION ON DELIVERY

A. Signature X B Strickland ☐ Agent ☐ Addressee

B. Received by (Printed Name) B Strickland C. Date of Delivery 1-12-06

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-154

RICE *Operating Company*
122 West Taylor
Hobbs, NM 88240

7005 1820 0001 6804 1539

U.S. POSTAGE
PB5512802
$04.64 JAN 11 2006
MAILED FROM ZIP CODE 88240

Attempted

RECEIVED
JAN 17 2006
RICE OPERATING
HOBBS, NM

International Technology Corp.
Mike Schulz
5301 Central Avenue, NE Suite 700
Albuquerque, NM 87108

RETURNED TO SENDER

- ☐ Undeliverable as Addressed
- ☐ Moved, Left No Address
- ☐ Unclaimed
- ☐ Refused
- ☑ Attempted - Not Known
- ☐ No Such Street
- ☐ No Such Number
- ☐ No Receptacle
- ☐ Deceased
- ☐ Vacant

[redacted]

PLACE STICKER AT TOP OF ENVELOPE TO THE RIGHT OF THE RETURN ADDRESS, FOLD AT DOTTED LINE

CERTIFIED MAIL™ RECEIPT
(Domestic Mail Only; No Insurance Coverage Provided)

For delivery information visit our website at www.usps.com®

OFFICIAL USE

Postage	$ .39
Certified Fee	2.40
Return Receipt Fee (Endorsement Required)	1.85
Restricted Delivery Fee (Endorsement Required)	
Total Postage & Fees	$ 4.64

Postmark Here: CONTRACT STATION # III HOBBS NM 88240 USPS JAN 11 2006

2-H-BD

Sent To: International Technology Corp.
Street, Apt. No.; or PO Box No.: Mike Schulz 5301 Central Avenue, NE Suite 700
City, State, ZIP+4: Albuquerque, NM 87108

PS Form 3800, June 2002 See Reverse for Instructions

7005 1820 0001 6804 1539

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

International Technology Corp.
Mike Schulz
5301 Central Avenue, NE Suite 700
Albuquerque, NM 87108

2-H-BD

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X ☐ Agent ☐ Addressee

B. Received by (Printed Name) C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☑ Certified Mail ☐ Express Mail
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service label) 7005 1820 0001 6804 1539

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

RICE *Operating Company*
122 West Taylor
Hobbs, NM 88240

RETURN TO SENDER
NOT DELIVERABLE AS ADDRESSED
UNABLE TO FORWARD

7005 1820 0001 6804 1461

PITNEY BOWES
U.S. POSTAGE
PB5512802
$04.64 JAN 11 2006
5685 MAILED FROM ZIP CODE 88240

RECEIVED
JAN 3 0 2006
RICE OPERATING
HOBBS, NM

USFS Regional Office
Reginal Forester
517 Gold Avenue SW
Albuquerque, NM 87102

PLACE STICKER AT TOP OF ENVELOPE TO THE RIGHT OF THE RETURN ADDRESS, FOLD AT DOTTED LINE

U.S. Postal Service™
CERTIFIED MAIL™ RECEIPT
(Domestic Mail Only; No Insurance Coverage Provided)

For delivery information visit our website at www.usps.com®

OFFICIAL USE

7005 1820 0001 6804 1461

Postage	$ .39
Certified Fee	2.40
Return Receipt Fee (Endorsement Required)	1.85
Restricted Delivery Fee (Endorsement Required)	
Total Postage & Fees	$ 4.64

Postmark Here: CONTRACT STATION # III HOBBS NM 88240 USPS JAN 11 2006

Sent To: USFS Regional Office 2-H-BD
Street, Apt. No.; or PO Box No.: Reginal Forester, 517 Gold Avenue SW
City, State, ZIP+4: Albuquerque, NM 87102

PS Form 3800, June 2002 — See Reverse for Instructions

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

USFS Regional Office
Reginal Forester
517 Gold Avenue SW
Albuquerque, NM 87102

2-H-BD

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X ☐ Agent ☐ Addressee

B. Received by (*Printed Name*) C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☒ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? *(Extra Fee)* ☐ Yes

2. Article Number
(*Transfer from service label*) 7005 1820 0001 6804 1461

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

PROJECTS WITH OCD APPROVAL PENDING

System	Site	Legal Description				NMOCD case #	Type of Submission	Date Submitted	Consultant	Current Status	Comments
		Unit	Sec.	Township	Range						
BD	Jct. Zachary Hinton	O	12	22S	37E	AP-50	Stage 1 & 2 AP	10/13/05	R. T. Hicks	public notice proof submitted 2/10/2006; OCD approval pending	
EME	M-9 SWD	M	9	20S	37E	1R0331	Stage 1 Abatement Plan	1/3/06	Trident	public notice proof submitted 3/16/2006; OCD approval pending	
EME	jct. N-5	N	5	20S	37E	1R0427-90	Stage 1 Abatement Plan	12/6/05	Trident	public notice proof submitted 1/13/06; OCD approval of AP pending	
EME	jct. K-6	K	6	20S	37E	AP-46	Stage 1 Abatement Plan	10/17/05	Trident	public notice proof submitted 1/13/06; OCD approval of AP pending	
EME	jct. D-1 leak	D	1	20S	36E		Stage 1 Abatement Plan	12/5/05	Trident	public notice proof submitted 2/6/06; OCD approval of AP pending	
EME	P-6 Leak	P	6	20S	37E	AP-45	Stage 1 & 2 AP	7/14/05	Trident	public notice proof submitted 1/30/06; OCD approval of AP pending	
Vacuum	F-35 SWD	G	35	17S	35E	1R0330	Stage 1 & 2 Abatement Plan	1/2/06	R. T. Hicks	public notice proof submitted 3/22/06; OCD approval of AP pending	
Vacuum	G-35 SWD	G	35	17S	35E	1R0332	Stage 1 & 2 Abatement Plan	1/2/06	R.T. Hicks		
Hobbs	I-29 boot EOL	I	29	18S	38E		Corrective Action Plan	10/25/05	R. T. Hicks		will model other Hobbs CAPs after this one
BD	jct. N-29	N	29	21S	37E	1R0426-37	Closure	2/10/06	R. T. Hicks	monitoring	
EME	jct. N-4-1	N	4	20S	37E	1R224	Closure	1/11/06	ROC	monitoring	
EME	jct. E-5 (Marathon Barber)	E	5	20S	37E	1R0427-91	Corrective Action Plan	1/16/06	R.T. Hicks	monitoring	
Generic Junction Box Upgrade Work Plan							Request Letter	orig. letter 2/2/2005	Rice Operating	last email to WP on 9/19/05	requesting the option to use clay OR poly liners
BD	K-4 leak	K	4	22S	37E		Investigation & Characterization Plan	9/15/05	Highlander		

PROJECTS WITH OCD APPROVAL PENDING

System	Site	Legal Description				NMOCD case #	Type of Submission	Date Submitted	Consultant	Current Status	Comments
		Unit	Sec.	Township	Range						
Vacuum	M-26 leak	C	35	17S	35E		Investigation & Characterization Plan	12/12/05	P. Galusky		
Vacuum	N-6-1 leak	N	6	18S	35E		Investigation & Characterization Plan	12/12/05	P. Galusky		
EME	M-5 SWD	M	5	20S	37E		Corrective Action Plan	9/6/04	R.T. Hicks	monitoring	
EME	Sarah Phillips EOL	K	33	19S	37E		Investigation & Characterization Plan	3/23/05	Whole Earth		
Abo	G-1 Leak Site	G	1	17S	36E	1R0415	Closure Report	3/3/06	R. T. Hicks		
BD	Jct. J-26	J	26	21S	37E	1R0426-40	Stage 1 & 2 AP	12/5/05	Trident	Public Notice	
EME	jct. K-33-1	K	33	19S	37E	1R0427-92	Stage 1 Abatement Plan	12/12/05	Whole Earth	Public Notice	

NEW MEXICO ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT

BILL RICHARDSON
Governor
Joanna Prukop
Cabinet Secretary

Mark E. Fesmire, P.E.
Director
Oil Conservation Division

November 22, 2005

Ms. Carolyn Doran Haynes
Rice Operating Company
122 West Taylor
Hobbs, New Mexico 88240

**RE: ABATEMENT PLAN PROPOSAL(S)
LEA COUNTY, NEW MEXICO**

Dear Ms. Haynes:

The New Mexico Oil Conservation Division (OCD) has reviewed Rice Operating Company's (Rice) ABATEMENT PLAN(S). These documents contains Rice's proposed Stage 1 and Stage 2 abatement plans for investigation and remediation of contamination for the site(s) listed below. Please note OCD has issued each site with a new abatement plan number. Please use this number in the future on all correspondence. The OCD has determined that the below Abatement Plan Proposal(s) are administratively complete.

BD Jct. Zachary-Hinton	O-12-22s-37e	1R0426-36	Stage 1&2	10/13/05	New AP-50

Before the OCD can complete a review of the proposals, the OCD requires that:

1. Rice issue approved notice of publication in the Albuquerque Journal and Hobbs News Sun pursuant to OCD Rule 19.G.(2).

2. Prior to issuing public notice, Rice shall issue approved written notice of the proposals pursuant to OCD Rule 19.G.(1). Please note 19.G(1)(d) can be found on OCD's web page.

3. Rice provide the OCD with proof of publication and proof of written notice. Proof of notice shall include a map of the surface owners of record within one (1) mile of the perimeter of the site and shall identify compliance with each of the provisions of Rule 19.G.

Please note in the future it might be prudent to include you public notice provisions in the abatement plan submittal. If you have any questions please do not hesitate to call (505)-476-3487 or E-mail wayne.price@state.nm.us.

Sincerely,

Wayne Price

Wayne Price-Senor Envr. Engr.

Enclosures

cc: Chris Williams, OCD Hobbs District Office

R. T. HICKS CONSULTANTS, LTD.

901 Rio Grande Blvd NW ▲ Suite F-142 ▲ Albuquerque, NM 87104 ▲ 505.266.5004 ▲ Fax: 505.266-0745

October 13, 2005

Mr. Daniel Sanchez
Enforcement & Compliance Manager
New Mexico Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

RE: Zachary Hinton EOL Junction Box (O-12) Sec 12, T22S, R37E
NMOCD Case #1R0426-36

Dear Mr. Sanchez:

R.T. Hicks Consultants, Ltd. is pleased to submit the attached Stage I & II Abatement Plan for the above referenced site. If you have any questions or concerns, please don't hesitate to contact us.

Sincerely,
R.T. Hicks Consultants, Ltd.

Katie Lee

Katie Lee
Staff Scientist

Copy:

Wayne Price, NMOCD; OCD Hobbs Office;
& Kristin Pope, Rice Operating Company

NEW MEXICO ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT

BILL RICHARDSON
Governor
Joanna Prukop
Cabinet Secretary

Mark E. Fesmire, P.E.
Director
Oil Conservation Division

July 13, 2005

Carolyn Doran Haynes
Rice Operating Company (ROC)
122 West Taylor
Hobbs, New Mexico 88240

Re: Zachary Hinton EOL
UL O Sec 12-Ts22S-R37E
OCD case # 1R0426-36

Dear Ms. Haynes:

The New Mexico Oil Conservation Division (NMOCD) is in receipt of Rice Operating Company's (ROC) letter dated June 29, 2005 requesting that OCD reconsider requiring an abatement plan for the above referenced site. The OCD technical staff has reviewed the documents submitted and determined that ROC did not properly investigate or remediate the vadose zone or groundwater which was impacted from the site's operations. The facts in this case are as follows:

1. ROC discovered in 2002 that its operations had caused groundwater contamination.
2. The groundwater beneath the site still exceeds the groundwater standards for Chlorides and TDS.
3. The groundwater contamination was never delineated.
4. Contamination still remains in the vadose zone.

<u>Therefore, you are hereby ordered to submit an abatement plan pursuant to OCD Rule 19 as required in my letter dated May 05, 2005.</u> Failure to perform the above requested actions will result in OCD setting this case for a compliance hearing in front of an OCD hearing examiner. The OCD will ask for corrective actions and civil penalties.

Sincerely;

Daniel Sanchez-Enforcement and Compliance Manager

Xc: Roger Anderson-Environmental Bureau Chief
OCD Hobbs Office

R. T. HICKS CONSULTANTS, LTD.
901 Rio Grande Blvd NW ▲ Suite F-142 ▲ Albuquerque, NM 87104 ▲ 505.266.5004 ▲ Fax: 505.266-0745

June 29, 2005

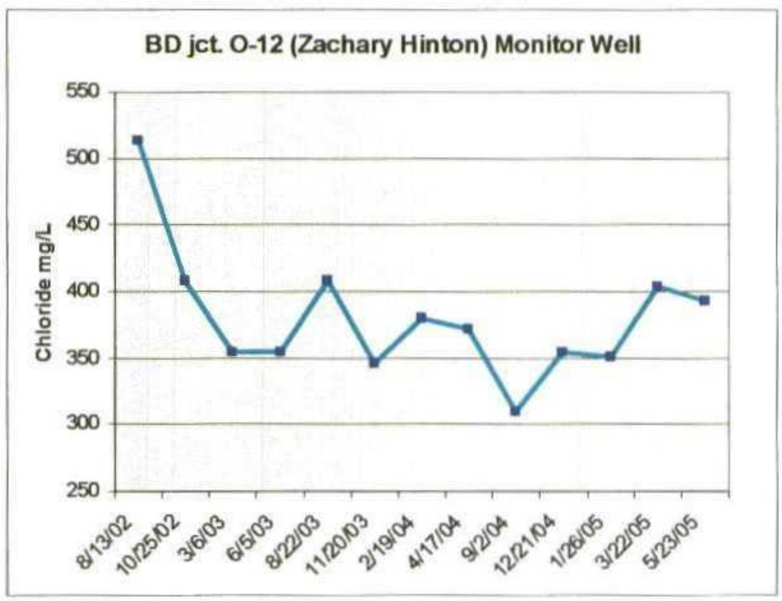
2005 JUL 6 AM 10 52

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

RE: Zachary Hinton EOL UL O Sec 12, T22S, R37E 1R0426-36

Dear Mr. Sanchez:

In your letter of May 5, 2005, NMOCD required Rice Operating Company (ROC) to submit an abatement plan for the above-referenced site on or before July 15, 2005. We respectfully request that NMOCD re-consider this request based upon the information presented in our January 2004 Corrective Action Plan (2004 CAP), our response to NMOCD comments (December 2004), and the ground water data presented below. All of these submissions are included in the attached disc.



As the recent data (figure) show, ground water chloride concentrations decreased from over 500 ppm in 2002 to the regional background concentration of 300-400 ppm by 2003. Data presented on page 12 of the 2004 CAP discuss the regional water quality.

Eleven quarters of ground water monitoring allow us to conclude that natural attenuation has effectively restored ground water quality at the site. Alternatively, one could also conclude from these data that the first sample taken in 2002 was unusually high, perhaps due to disequilibrium in the ground water caused by the drilling process.

We believe that the HYDRUS-1D modeling within the CAP demonstrates that:

1. Water contaminants in the vadose zone will not with reasonable probability contaminate ground water or surface water, in excess of the standards in Paragraphs (2) and (3) below, through leaching, percolation, or other transport mechanisms, or as the water table elevation fluctuates.

We believe the 11 quarters of ground water monitoring and the research on regional ground water quality presented within the CAP show:

2. Ground-water pollution at any place of withdrawal for present or reasonably foreseeable future use (e.g. the Zachary Hinton monitoring well or future down gradient wells), where the TDS concentration is 10,000 mg/L or less, conforms to the following standards:
   a. Toxic pollutant(s) as defined in 20.6.2.7 NMAC are not present; and
   b. The standards of 20.6.2.3103 NMAC are met.

Due to the location of the site, we believe it is obvious that:

3. Surface-water is not affected by the site and surface water conforms to the Water Quality Standards for Interstate and Intrastate Surface Waters in New Mexico 20.6.4 NMAC.

Therefore, we respectfully request NMOCD:

- withdraw their request for an Abatement Plan for this site,
- carefully review our previous submissions, and
- evaluate the site for closure of the regulatory file.

Thank you for consideration of this request.

Sincerely,
R.T. Hicks Consultants, Ltd.

Randall T. Hicks

Randall Hicks
Principal

Copy:

Kristin Pope, Rice Operating Company

NEW MEXICO ENERGY, MINERALS and
NATURAL RESOURCES DEPARTMENT

BILL RICHARDSON
Governor

Joanna Prukop
Cabinet Secretary
Mark Fesmire
Director
Oil Conservation Division

May 05, 2005

Carolyn Doran Haynes
Rice Operating Company
122 West Taylor
Hobbs, New Mexico 88240

Re: Sites with confirmed Groundwater Contamination

Dear Ms. Haynes:

Pursuant to the New Mexico Oil Conservation Division rule 19.15.1.19 (Rule 19) Prevention and Abatement of Water Pollution requires all responsible persons who are abating water pollution in excess of the standards shall do so pursuant to an abatement plan approved by the director.

Therefore, Rice Operating Company is hereby required to submit individual abatement plans for OCD approval by July 15, 2005 for each of the following sites:

<u>EME Sites;</u>

H-13	UL	H	Sec 13, T20s, R36E	1R0429
M-9	UL	M	Sec 9, T20s, R37E	1R0331
P-6	UL	P	Sec 6, T20s, R37E	1R0422
Jct. N-5	UL	N	Sec 5, T20S, R37E	1R0427-90
Jct. M-16-1	UL	M	Sec 16, T20S, R37E	1R0427-93
Jct. K-33-1	UL	K	Sec 33, T19S, R37E	1R0427-92
Jct. A-20	UL	A	Sec 20, T20S, R37E	1R0427-89
Jct. K-6	UL	K	Sec 6, T20S, R37E	1R0427-88
Marathon Barber EOL	UL	E	Sec 5, T20S, R37E	1R0427-91
jct. D-1 leak	UL	D	Sec. 1, T20S, R36E	not assigned

BD Sites:

Zachary Hinton EOL	UL	O	Sec 12, T22S, R37E	1R0426-36
Jct. J-26	UL	J	Sec 26, T21S, R37E	1R0426-40
Jct. F-17	UL	F	Sec 17, T21S, R37E	1R0426-33
Jct. I-27	UL	I	Sec 27, T21S, R37E	1R0426-35
Jct. N-29	UL	N	Sec 29, T21S, R37E	1R0426-37
jct. E-3	UL	E	Sec 3, T22S, R37E	1R0426-53

Justis Sites:

jct. L-1	UL	L	Sec 1, T25S, R37E	1R0423-0
SWD H-2	UL	H	Sec 2, T26s, R37E	1R0423-01

Hobbs Sites:

Jct. F-29-1A	UL	F	Sec 29, T18S, R38E	not assigned
I-29 Vent	UL	I	Sec 29, T18S, R38E	not assigned

After OCD receives the plans each site will be assigned a new Abatement Plan number (AP#) for tracking purposes. If you have any questions please do not hesitate to contact me at 505-476-3493 or E-mail DJSanchez@state.nm.us; or contact Wayne Price of my staff at 505-476-3487 or e-mail WPRICE@state.nm.us.

Sincerely;

Daniel Sanchez

Daniel Sanchez
Enforcement and Compliance Manager
DS/wp

Cc: OCD Hobbs office

R. T. HICKS CONSULTANTS, LTD.

901 Rio Grande Blvd NW ▲ Suite F-142 ▲ Albuquerque, NM 87104 ▲ 505.266.5004 ▲ Fax: 505.266-0745

December 8, 2004

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

RECEIVED
DEC 27 2004
Oil Conservation Division
1220 S. Saint Francis Drive
Santa Fe, NM 87505

RE: Zachary Hinton EOL
Unit O, Section 12, 22S, 37E
NMOCD Case # 1R0426-36

Dear Wayne:

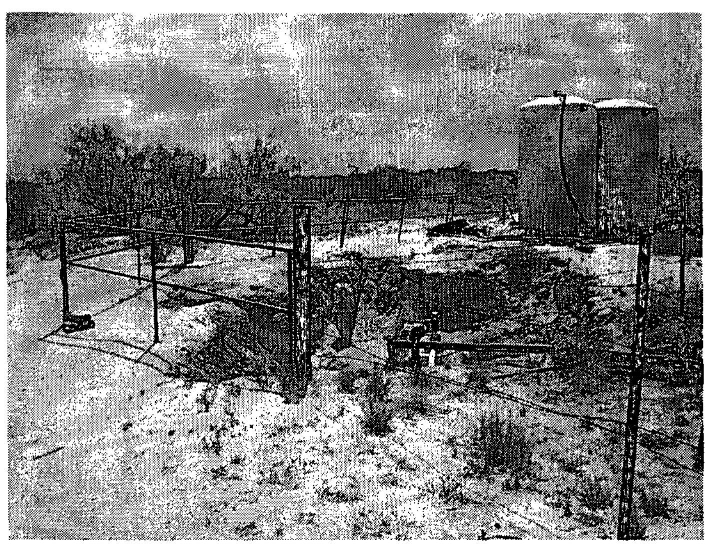
In your December 3, 2004 email to Rice Operating Company (attached) you asked for the following submissions:

1. Photos of the site before, during and after excavation.
2. Photos of the liner and backfill.
3. A plat showing location of all monitor wells and a chloride/TDS chronologic summary table for these wells.
4. A copy of the NMOCD approved work plan (July 02, 2003) that R.T. Hicks is working under.
5. A copy of the Hicks January 30, 2004 final corrective action plan.

I attach a CD that contains all of the requested information.

In the CD folder named "site photos" you will find digital images of the site after excavation of the box associated with the Zachary Hinton End of Line (EOL) site. This site was excavated in 2001, when the Junction Box Plan was being written by ROC and under review by NMOCD. At this time, ROC was not creating a photographic record of their efforts. Therefore, no images exist that show the site before excavation.

Because the site remains open pending NMOCD approval of the Corrective Action Plan, there is no liner and backfill at this time. The Corrective Action Plan does not call for a liner at this site.



Because the site is so small, we elected to show the location of the monitoring well relative to the former EOL box with Figure 7 of the Corrective Action Plan. Figure 7 of the CAP is reproduced herein.

Note the red monitor well protection box with the concrete pad in the left center of the image – that is the monitoring well discussed in the CAP. The former EOL box excavation is in the center of the photograph. No other monitoring wells exist at this site. The monitoring well lies to the south-southeast of the former EOL, directly down gradient of ground water flow. The image on the CD titled "Northwest ZH 12.8.04" shows that the site remains relatively unchanged since Figure 7 of our CAP. The Corrective Action Plan, as submitted to NMOCD via email on 1/30/2004 (from Katie Lee of R.T. Hicks Consultants to Wayne Price), is on the CD in the zip-file folder titled "ZH_CAP".

In the CAP, Figure 1 provides the graphical display of the chemical data for the monitoring well to the end of 2003. Table 1 of the CAP presents these same data in tabular format.

We included the July 2, 2003 workplan in the CAP as Appendix A. NMOCD approval of the workplan is attached to this letter.

We are using the Zachary Hinton CAP as a template for other sites where slow leakage of produced water over time has created potential impacts to ground water. Examples of such sites are Vacuum G-35 and the various sites associated with the Hobbs Salt Water Disposal System abandonment. We are happy to provide submission of R.T. Hicks Consultants deliverables (on CD) via US Mail to NMOCD as well as via E-mail per your request and we look forward to your review the Zachary Hinton CAP and any guidance you could give to allow us to improve future submissions. Thanks for your input in advance.

Sincerely,
R.T. Hicks Consultants, Ltd.

Randy

Randall Hicks
Principal

December 3 Request for Information from NMOCD

From: "Price, Wayne" <WPrice@state.nm.us>
To: "Price, Wayne" <WPrice@state.nm.us>; "'Carolyn Doran Haynes (E-mail)'" <riceswd@leaco.net>; "'Kristin Farris Pope (E-mail)'" <enviro@leaco.net>
Sent: Friday, December 03, 2004 4:35 PM
Subject: RE: Zachary Hinton EOL BD SWD System

\> Added Case OCD Case Number 1R0426-36
\>
\>> -----Original Message-----
\>> From: Price, Wayne
\>> Sent: Friday, December 03, 2004 4:33 PM
\>> To: Carolyn Doran Haynes (E-mail); Kristin Farris Pope (E-mail)
\>> Subject: Zachary Hinton EOL BD SWD System
\>>
\>> Dear Ms. Haynes:
\>>
\>> The New Mexico Oil Conservation Division (OCD) is in receipt of the
\>> Rice Operating Company (ROC) March 04, 2004 letter requesting closure
\>> of the above subject site. OCD has a copy of the Disclosure report
\>> which was submitted as part of the
\>> ROC BD Junction Box Generic closure project approved by OCD on July 22,
\>> 2003.
\>>
\>> In order for OCD to properly evaluate this closure please provide
\>> the
\>> following:
\>>
\>> 1. Photos of the site before, during and after excavation. 2. Photos
\>> of the liner and backfill. 3. A plat showing location of all monitor
\>> wells and a chloride/TDS chronologic summary table for these wells.
\>> 3. A copy of the NMOCD approved work plan (July 02, 2003) that R.T.
\>> Hicks is working under.
\>> 4. A copy of the Hicks January 30, 2004 final corrective action plan.
\>>
\>> Please provide ASAP so OCD can respond to your request. The Case
\>> Number for this site will be 1R0426-36. Please include this case
\>> number on all documnets pertaing to this site.
\>>
\>> Sincerely:
\>>
\>> Wayne Price
\>> New Mexico Oil Conservation Division
\>> 1220 S. Saint Francis Drive
\>> Santa Fe, NM 87505
\>> 505-476-3487
\>> fax: 505-476-3462
\>> E-mail: WPRICE@state.nm.us

NMOCD Approval E-mail string

-----Original Message-----
From: Price, Wayne [mailto:WPrice@state.nm.us]
Sent: Thursday, August 21, 2003 3:53 PM
To: 'Randall Hicks'; Price, Wayne
Cc: Carolyn Doran Haynes (E-mail)
Subject: RE: Zachary Hinton

APPROVED!

Please be advised that NMOCD approval of this plan does not relieve Rice Operating Company of liability should their operations fail to adequately investigate and remediate contamination that pose a threat to ground water, surface water, human health or the environment. In addition, NMOCD approval does not relieve Rice Operating Company of responsibility for compliance with any OCD, federal, state, or local laws and/or regulations.

[Price, Wayne]
-----Original Message-----
From: Randall Hicks [mailto:R@rthicksconsult.com]
Sent: Thursday, August 21, 2003 3:45 PM
To: 'Price, Wayne'
Subject: FW: Zachary Hinton

-----Original Message-----
From: Randall Hicks [mailto:R@rthicksconsult.com]
Sent: Thursday, July 31, 2003 9:37 AM
To: 'WPRICE@state.nm.us'
Cc: 'enviro@leaco.net'; 'riceswd'
Subject: FW: Zachary Hinton

Wayne

Glad I ran into you today. Here is the workplan that we originally sent to you on July 3.

I am pleased to hear that you are ready to approve the Champion remedy for chloride – please finish your review of Champion then tear into this workplan next week. We plan on submitting two more in short order and you might want to review all three simultaneously. All of the workplans follow the same format – so a simultaneous review may be time efficient.

Thanks for pointing us to the data for the Chevron site west of Eunice – we will need these data to spot a monitor well location for one of the workplans coming your way.

Randy

December 3 Request for Information from NMOCD

From: "Price, Wayne" <WPrice@state.nm.us>
To: "Price, Wayne" <WPrice@state.nm.us>; "'Carolyn Doran Haynes (E-mail)'" <riceswd@leaco.net>; "'Kristin Farris Pope (E-mail)'" <enviro@leaco.net>
Sent: Friday, December 03, 2004 4:35 PM
Subject: RE: Zachary Hinton EOL BD SWD System

> Added Case OCD Case Number 1R0426-36
>
>> -----Original Message-----
>> From: Price, Wayne
>> Sent: Friday, December 03, 2004 4:33 PM
>> To: Carolyn Doran Haynes (E-mail); Kristin Farris Pope (E-mail)
>> Subject: Zachary Hinton EOL BD SWD System
>>
>> Dear Ms. Haynes:
>>
>> The New Mexico Oil Conservation Division (OCD) is in receipt of the
>> Rice Operating Company (ROC) March 04, 2004 letter requesting closure
>> of the above subject site. OCD has a copy of the Disclosure report
>> which was submitted as part of the
>> ROC BD Junction Box Generic closure project approved by OCD on July 22,
>> 2003.
>>
>> In order for OCD to properly evaluate this closure please provide
>> the
>> following:
>>
>> 1. Photos of the site before, during and after excavation. 2. Photos
>> of the liner and backfill. 3. A plat showing location of all monitor
>> wells and a chloride/TDS chronologic summary table for these wells.
>> 3. A copy of the NMOCD approved work plan (July 02, 2003) that R.T.
>> Hicks is working under.
>> 4. A copy of the Hicks January 30, 2004 final corrective action plan.
>>
>> Please provide ASAP so OCD can respond to your request. The Case
>> Number for this site will be 1R0426-36. Please include this case
>> number on all documnets pertaing to this site.
>>
>> Sincerely:
>>
>> Wayne Price
>> New Mexico Oil Conservation Division
>> 1220 S. Saint Francis Drive
>> Santa Fe, NM 87505
>> 505-476-3487
>> fax: 505-476-3462
>> E-mail: WPRICE@state.nm.us

Price, Wayne

From: Kristin Farris [enviro@leaco.net]
Sent: Tuesday, December 07, 2004 3:56 PM
To: Price, Wayne
Subject: Re: BD Site 0-12

R.T. Hicks is the consultant for this site. It is located in unit E, O Sec. 12 but we commonly refer to it as the Zachary Hinton. It was a junction box site. A disclosure report was submitted in 2002.
R.T. Hicks submitted a CAP on 7/3/2003, he will be mailing you a hard copy of the full report today.

Kristin

----- Original Message -----
From: "Price, Wayne" <WPrice@state.nm.us>
To: "Carolyn Doran Haynes (E-mail)" <riceswd@leaco.net>; "Kristin Farris Pope (E-mail)" <enviro@leaco.net>
Sent: Tuesday, December 07, 2004 3:42 PM
Subject: BD Site 0-12

\>I have one analytical report for this site showing a MW-1. I cannot match
\> it up with any of the other projects. Please provide the following:
\>
\> 1. Is it a JCT or redwood tank project.
\> 2 Was there a disclosure report submitted? .
\> 3 What is the status?.
\> Sincerely:
\>
\> Wayne Price
\> New Mexico Oil Conservation Division
\> 1220 S. Saint Francis Drive
\> Santa Fe, NM 87505
\> 505-476-3487
\> fax: 505-476-3462
\> E-mail: WPRICE@state.nm.us
\>
\>

AP-30

Price, Wayne

From: Price, Wayne
Sent: Tuesday, December 07, 2004 3:43 PM
To: Carolyn Doran Haynes (E-mail); Kristin Farris Pope (E-mail)
Subject: BD Site 0-12

I have one analytical report for this site showing a MW-1. I cannot match it up with any of the other projects. Please provide the following:

1. Is it a JCT or redwood tank project.
2 Was there a disclosure report submitted? .
3 What is the status?.

Sincerely:

Wayne Price
New Mexico Oil Conservation Division
1220 S. Saint Francis Drive
Santa Fe, NM 87505
505-476-3487
fax: 505-476-3462
E-mail: WPRICE@state.nm.us

From: Price, Wayne
Sent: Friday, December 03, 2004 4:36 PM
To: Price, Wayne; 'Carolyn Doran Haynes (E-mail)'; 'Kristin Farris Pope (E-mail)'
Subject: RE: Zachary Hinton EOL BD SWD System

Added Case OCD Case Number 1R0426-36

-----Original Message-----
From: Price, Wayne
Sent: Friday, December 03, 2004 4:33 PM
To: Carolyn Doran Haynes (E-mail); Kristin Farris Pope (E-mail)
Subject: Zachary Hinton EOL BD SWD System

Dear Ms. Haynes:

The New Mexico Oil Conservation Division (OCD) is in receipt of the Rice Operating Company (ROC) March 04, 2004 letter requesting closure of the above subject site.
OCD has a copy of the Disclosure report which was submitted as part of the ROC BD Junction Box Generic closure project approved by OCD on July 22, 2003.

In order for OCD to properly evaluate this closure please provide the following:

1. Photos of the site before, during and after excavation.
2. Photos of the liner and backfill.
3. A plat showing location of all monitor wells and a chloride/TDS chronologic summary table for these wells.
3. A copy of the NMOCD approved work plan (July 02, 2003) that R.T. Hicks is working under.
4. A copy of the Hicks January 30, 2004 final corrective action plan.

Please provide ASAP so OCD can respond to your request. The Case Number for this site will be 1R0426-36. Please include this case number on all documnets pertaing to this site.

Sincerely:

Wayne Price
New Mexico Oil Conservation Division
1220 S. Saint Francis Drive
Santa Fe, NM 87505
505-476-3487
fax: 505-476-3462
E-mail: WPRICE@state.nm.us

R.T. HICKS CONSULTANTS, LTD.

219 Central Avenue NW | Suite 266 | Albuquerque, NM 87112 | 505.266.5004 | Fax: 505.246-1818

July 2, 2003

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

RE: Zachary Hinton EOL Junction Box, Section 12, 22S, 37E Unit O

Dear Mr. Price

Rice Operating Company retained R.T. Hicks Consultants, Ltd. to address potential environmental concerns at the above referenced site. This submission proposes a scope of work that we believe will best mitigate any threat to human health and the environment and lead to closure of the regulatory file for this site.

Background

The Zachary Hinton EOL Junction Box is located about 2.5 miles southeast of the intersection of State Routes 18 and 8/176, near Eunice, New Mexico. Plate 1 shows the location of the site.

Rice Operating Company (ROC) prepared a disclosure report dated January 21, 2003 that summarizes activities to date. This report is part of the annual submission to NMOCD, due in April of each year. For your convenience, we have attached a copy of this ROC report and a copy of recent ground water data from the adjacent monitoring well. The soil boring and backhoe excavation data show relatively consistent concentrations of chloride from 11 feet below ground surface (5200 ppm chloride) to 50 feet below ground surface (6410 ppm chloride). The consistency of these concentrations suggests that a release from the junction box may have created saturated conditions in the vadose zone.

ROC installed a monitoring well adjacent to the junction box. Four quarters of ground water data show chloride concentrations in ground water are currently between 400 and 500 mg/L. The most recent analysis of total dissolved solids (11/6/02) from this well shows a result of 1290 mg/L. Because these values exceed the New Mexico Water Quality Commission Standards, we propose the work outlined below.

APPENDIX A

1. Evaluate Migration of Chloride Flux from the Vadose Zone to Ground Water

We propose to employ HYDRUS1D 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. We will employ predictions of the migration of chloride ion 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 ROC.

We might provide simulations of two "no action" scenarios. For both simulations, we will employ the input parameters to HYDRUS and the mixing model outlined in Table 1. In the first simulation, we will assume that vegetation is not present over the release site (no evapotranspiration) and a minimum aquifer thickness of 10 feet. This will simulate restriction of any released chloride to a portion of the underlying aquifer. If this first simulation does not return results that are consistent with the existing ground water monitoring data, we will increase the aquifer thickness in the mixing model to the maximum value allowed by data (a bout 35 feet). At other sites, we have found that chloride can be distributed throughout the thickness of the aquifer. Employing the entire thickness of the aquifer in the mixing model calculations may be appropriate for the Zachary Hinton site.

Table 1: Input Parameters for Simulation Modeling

Input Parameter	Source
Vadose Zone Thickness	Attached well log
Vadose Zone Texture	Attached well log
Dispersion Length	Professional judgment
Soil Moisture	Nearby Field Measurements
Vadose Zone Chloride Load	ROC Data from Disclosure Report
Length of release perpendicular to ground water flow	Field Measurements
Climate	Pearl, NM station (Hobbs)
Background Chloride in Ground Water	Samples from nearby wells
Ground Water Flux	Calculated from regional hydraulic data
Aquifer Thickness	Nicholson and Clebsch (1960) and SEO data

2. Collection and Evaluation of Data for Simulation Modeling

The HYDRUS1D and mixing model simulation requires input of 10 parameters. As Table 1 shows, we must collect site specific data for several of these parameters, some data are available from previous ROC work at the site, and other data are available from public sources. 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 plan to use soil moisture data from nearby sites for model input.

We propose a field program to collect important site-specific data for model input. First we will measure the depth to ground water at five nearby windmills and the adjacent monitoring well to determine the hydraulic gradient (Plate 1). We have examined these abandoned and active windmills; we can measure these water levels. To establish background chloride concentrations in ground water, we propose to sample the active windmill located in Section 13 (Plate 1) and, if possible, two additional up gradient wells in Sections 2 and 11 (identified as "Field Check Required" on Plate 1).

3. Design Remedy and Submit Report

ROC has completed the repair of the pipeline junction at the Zachary Hinton EOL. We do not anticipate additional releases of produced water at this site. Our modeling of the "no action alternative" (Task 1) may show that the residual chloride mass in the vadose zone poses a threat to ground water quality. If such a threat does exist, we will use the HYDRUS-1D model predictions to develop a remedy for the vadose zone. If necessary, we will simulate:

1. excavation, disposal and replacement of clean soil to remove the chloride mass,

2. installation of a low permeability barrier to minimize natural infiltration,

3. surface grading and seeding to eliminate any ponding of precipitation and promote evapotranspiration, thereby minimizing natural infiltration, and

4. a combination of the above potential remedies.

We will select the vadose zone remedy that offers the greatest environmental benefit while causing the least environmental damage.

We will use the ground water mixing model or a suitable alternative to assist in the design of a ground water remedy. It is possible, however, that the background chloride concentrations in ground water measured in the nearby windmills are equal to or higher than the chloride concentration in the adjacent monitoring well. Such data would strongly suggest that the Zachary Hinton EOL Junction Box has not caused any material impairment of ground water quality. If we find no evidence of impairment of water quality due to past activities at Zachary Hinton EOL Junction Box, we will not prepare a ground water remedy. If data suggest that the Zachary Hinton EOL Junction Box has contributed chloride to ground water and caused ground water impairment, we will examine the following alternatives:

1. Natural restoration due to dilution and dispersion,

2. Pump and dispose to remove the chloride mass in the saturated zone,

3. Pump and treat to remove the chloride mass in the saturated zone,

4. Because of the location of the site, institutional controls negotiated with the landowner may provide an effective remedy. Such controls may be restriction of water use to livestock until natural restoration returns the water quality to state standards, a provision for alternative supply well design, or a provision for well head treatment to mitigate any damage to the water resource.

We plan to commence data collection for the HYDRUS1D simulations described above in mid July. Your approval to move forward with this workplan will facilitate our access to nearby windmills and speed the implementation of a surface remedy.

Sincerely,
R.T. Hicks Consultants, Ltd.

Randall T. Hicks

Randall T. Hicks
Principal

Location: 032° 24' 36.8" N 103° 06' 56.8" W
Caption: Plate 1: Location Map

Name: EUNICE NE
Date: 3/14/2003
Scale: 1 inch equals 2666 feet

APPENDIX B

RICE OPERATING COMPANY
JUNCTION BOX DISCLOSURE FORM

BOX LOCATION

SWD SYSTEM	JUNCTION	UNIT	SECTION	TOWNSHIP	RANGE	COUNTY	BOX DIMENSIONS - FEET		
							Length	Width	Depth
BD	Zachary Hinton EOL	O	12	22S	37E	Lea	Box Has Not Been Built Yet		

LAND TYPE: BLM ______ STATE ______ FEE LANDOWNER Tom Kennan OTHER ______

Depth to Groundwater 56 feet NMOCD SITE ASSESSMENT RANKING SCORE: 10

Date Started 2/6/2001 Date Completed not complete OCD Witness No

Soil Excavated 0 cubic yards Excavation Length 0 Width 0 Depth 0 feet

Soil Disposed 0 cubic yards Offsite Facility n/a Location n/a

FINAL ANALYTICAL RESULTS: **Sample Date** n/a **Sample Depth** n/a

Procure 5-point composite sample of bottom and 4-point composite sample of sidewalls. TPH, BTEX and Chloride laboratory test results completed by using an approved lab and testing procedures pursuant to NMOCD guidelines.

Sample Location	Benzene mg/kg	Toluene mg/kg	Ethyl Benzene mg/kg	Total Xylenes mg/kg	GRO mg/kg	DRO mg/kg	Chlorides mg/kg
Vadose Zone Samples Will Be Included With Final Closure Report							

General Description of Remedial Action: Site was delineated vertically and laterally with a backhoe. Chloride impact was consistent vertically, while TPH was minimal at the location. The site was bored on 2/28/02 and chloride was found to impact groundwater. A cased monitor well was installed and the groundwater has been sampled and analyzed quarterly (see annual groundwater report for results). ROC has contracted a hydrologic consultant to assist ROC in developing a remediation plan for the vadose zone at groundwater-impacted sites with the ultimate objective being final closure.

CHLORIDE FIELD TESTS

LOCATION	DEPTH (ft)	ppm
Vertical	5	2500
	7	1400
	9	1800
	11	5200
	13	5000
	15	5400
Soil Bore	35	8160
	45	5000
	50	6410
	55	500

I HEREBY CERTIFY THAT THE INFORMATION ABOVE IS TRUE AND COMPLETE TO THE BEST OF MY KNOWLEDGE AND BELIEF.

DATE 1/21/2003 PRINTED NAME Kristin Farris

SIGNATURE ______ TITLE Project Scientist

APPENDIX C

1.0 FACTORS INFLUENCING THE MIGRATION OF CHLORIDE FROM A RELEASE

Chloride ion migration is controlled by a combination of factors related to the vadose zone, the aquifer and the characteristics of a release. Eleven factors control chloride ion migration. Here we discuss how these factors affect the movement of the chloride ion through the vadose zone and in the aquifer.

1. Vadose Zone Texture

The proportion of sand, silt, and clay in a soil or sediment defines vadose zone texture. Texture affects the flow of water and the transport of dissolved chloride. In the vadose zone, fine-grained layers containing silt and clay, which generally have relatively high moisture content, can often transmit water more quickly than drier coarse-grained units containing sand and gravel. A vadose zone composed of layers of fine-grained and coarse-grained units will often transmit water more slowly than a homogeneous, fine-grained profile. In the unsaturated zone, open fractures do not transmit water.

2. Water Content in the Vadose Zone

The soil moisture content is the volumetric fraction of water in a soil or sediment. Climate and soil texture influence soil moisture contents. Wetter, more humid environments result in higher moisture contents. Fine grained and heterogeneous soils retain water better than coarse-grained, more homogeneous soils. Therefore, the more heterogeneous and finer grained the material, the greater the water content.

The water content of a soil or sediment affects its ability to transmit fluids because the hydraulic conductivity increases with increasing water content. The hydraulic conductivity of a sandy soil with water content of 20% can be 1,000 times greater than the same soil in an arid climate where water content is only 5%. Although chloride ion from a release may migrate much faster in a wet soil profile, the natural water in the soil also dilutes the chloride concentration and provides some mitigation of its effects on ground water quality.

3. Dispersion Length of Chloride in the Vadose Zone

The dispersion length describes the amount of mixing a solute such as chloride will undergo in the vadose zone. Dispersion causes dilution of solute concentrations through mixing with ambient vadose water or ground water in a longitudinal direction parallel to water flow as well as in a transverse direction perpendicular to water flow. Systems with larger dispersion lengths produce greater mixing. Soil and aquifer heterogeneity tend to increase dispersion.

The dispersion length is very difficult to measure in the field. Researchers and field personnel rely upon professional judgement and published values (from laboratory or field experiments) to arrive at the dispersion length for a particular site. In general, researchers employ a dispersion length that is 7-10% of the total model length. When modeling a ten meter thick vadose zone, one may set the dispersion length at 10% of ten meters (100 cm).

4. Depth to Ground Water or Vadose Zone Thickness

The vadose zone is the region between the land surface and ground water table, and its thickness is defined by the depth to the ground water table. The vadose zone (also referred to as the unsaturated zone) includes the capillary fringe (pore space completely filled with water, under negative soil water pressure) and the overlying soil and sediment where the pore space is partially filled with water. Because ground water table depth rises and falls due to seasonal fluctuations in precipitation, ground water pumping withdrawals, and other factors, the thickness of the vadose zone is not constant. Like soil texture, the thickness of the vadose zone affects the time required for a release at the ground surface to reach the water table. The thicker the vadose zone, generally, the longer the travel time from ground surface to the water table. A relatively thick vadose zone also has more open pore space to temporarily store released fluid. A thick vadose zone can attenuate the effects of a chloride ion release more effectively than a thin vadose zone.

5. Climate

Precipitation and evaporation affect the water content of the vadose zone (before a release) and exert control over the migration of chloride after a release. In a humid climate regular and generous precipitation over the annual cycle can create relatively uniform infiltration patterns and a predictable soil water profile. In arid climates, where rainfall occurs in short-duration thunderstorms punctuated by long periods of drought, the infiltration is not uniform and occurs only immediately after large precipitation events. Arid climates exhibit vadose zones with relatively low water contents.

In humid climates with relatively uniform infiltration patterns, one could employ monthly climate data for simulation modeling. In arid climates, daily precipitation and evaporation data are necessary.

6. Chloride Concentration of Release

Chloride concentration in oil field brine water can be 100,000 ppm, or much lower if the producing formation contains fresh water due to infiltration of precipitation over geologic time. One of the easiest input parameters to measure in the oil and gas fields is the chloride concentration of the produced water. The chloride concentration in other types of released fluids can also be measured. The effect of chloride concentration in a released substance is straightforward: the higher the chloride concentration, the greater the environmental threat.

7. Release Volume and Chloride Mass

The volume of the release multiplied by the chloride concentration of the release yields the total mass of chloride released to the environment. The total mass released is a very important input parameter because it determines for a specific site the risk for ground water impairment. In the absence of reliable data on the volume of a release, the total mass of chloride can generally be estimated by a field investigation.

8. Height of Spill

Chloride ion releases occur in bermed areas when produced water storage tanks fail or within the natural terrain due to transmission line leaks and other transportation accidents. Releases may pond in a berm, pit, or natural depression, or can be dispersed over a large area. If the release is contained within a berm, the spill height is equal to or less than the height of the berm. In an open field, the spill height may vary. For a given site the amount of chloride ion infiltration into the soil is a function of the hydraulic head or ponding depth. As the ponding depth increases, so does the hydraulic head, (pressure, at the soil/chloride ion spill interface). Understanding the depth of ponding and the total amount of infiltration per unit area guides the characterization efforts. A large amount of infiltration may require deep drilling for site characterization while a small release may require sampling with a hand shovel.

9. Ground Water Flux

Ground water moves through an aquifer in response to its capacity for transmitting water, or, hydraulic conductivity (m/day), and the driving force caused by a sloping water table (hydraulic gradient). The hydraulic conductivity of aquifers can be measured in the field, and can be found in publications that often provide estimates of this parameter. The hydraulic gradient can be measured in the field by determining the depth to water at three wells of known surface elevation. Multiplication of the hydraulic conductivity by the hydraulic gradient yields the ground water flux, which is the volume of water flowing through a unit area of aquifer over a specified time period (expressed in $m^3/(m^2 * day)$ = m/day). The lower the ground water flux, the higher the probability that a release will cause unacceptable ground water quality impairment.

10. Aquifer Thickness

A thick aquifer contains more water than a thin aquifer. A given amount of chloride that enters from the vadose zone in a thick aquifer will result in a lower chloride concentration than the same amount entering a thin aquifer since aquifers that contain more water can be more effective at diluting contaminates. A thick aquifer that exhibits a large ground water flux may be able to absorb chloride from a large surface release without any severe impact to water quality.

11. Aquifer Ambient Chloride Concentration

Ambient chloride concentrations of ground water will influence whether or not a release causes unacceptable ground water quality impairment. If ground water has a low chloride concentration, even a considerable release may not cause chloride concentrations to exceed the US EPA Secondary Standard of 250 ppm or preclude the use of the water for agricultural needs. A high chloride concentration in ground water increases the risk that a chloride ion release will render the groundwater unfit for use. Simple field measurements from nearby well water or published data can supply an accurate estimate of the ambient chloride concentration in an aquifer.

1.1 HETEROGENEITY

Heterogeneity, most often caused by the layering of different sediment or soil types within a vadose zone, is more common in nature than not. Heterogeneity affects the distribution of chloride and other solutes through its strong influence on dispersion and hydraulic permeability.

One of the most common simplifying assumptions employed by regulators and guidance manuals is the assumption of homogeneity. However, a clay lens one meter thick found 3 meters below a release in a sandy soil will have a profound effect on the migration of chloride through the vadose zone. Heterogeneity can increase the attenuation of a release and help mitigate the effects on ground water quality.

1.2 RELEASE VOLUME, SPILL HEIGHT, AND CHLORIDE CONCENTRATION OF THE RELEASE

We have found that knowledge of the volume of a release is less important than understanding (1) the chloride load per unit area and (2) the geometry of the release with respect to ground water flow. Because release volume is seldom known with accuracy, we have combined chloride concentration in the release and spill height into a single parameter: chloride load/ unit area. We then used the release volume and spill height to calculate the size of a circular release. As described below, we used the diameter of the release as the length of a release parallel to ground water flow. If an oblong release geometry is oriented parallel to ground water flow, more chloride will enter the aquifer along a specific flow line, yeilding a higher chloride concentration in the down gradient well. If the long axis of the oval release is perpendicular to ground water flow, the impact to a well will be less. By re-arranging and combining these factors, we reduced the total number of factors from 11 to 10.

2.0 MODELING APPROACH

The modeling of chloride ion migration from the soil surface through the vadose zone into a shallow aquifer towards a monitoring well would require a sophisticated three-dimensional model, which takes into account the full coupling between unsaturated flow in the vadose zone and saturated flow in the aquifer. Such an approach is outside the scope of this study since generally acceptable three-dimensional models capable of such simulations are still being developed. Moreover, the computer time necessary to conduct such simulations would have been prohibitive for regulators and oil field personnel.

We used an approach based upon the assumption that flow through the vadose zone is mainly downward. This assumption is reasonable for humid climates where precipitation exceeds evapotranspiration most of the year. It is also reasonable in arid climates when the ground water table is so deep that no upward flow due to capillary rise can be maintained. Under these conditions, it is possible to de-couple the modeling of water flow and chloride transport in the vadose zone from the modeling of water flow and chloride transport in the aquifer. We assume that flow in the vadose zone is one-dimensional downward and flow in the aquifer is one-dimensional horizontal. This assumption allows us to first simulate water flow and chloride transport through the vadose zone using the model HYDRUS-1D. The output from HYDRUS-1D is the downward water flow seeping out of the vadose zone and the downward chloride flux over time. These outputs are used as inputs into the model for the aquifer. In this study, we used two models for the aquifer: MODFLOW and a simple groundwater mixing model. MODFLOW is a standard code for modeling water flow and solute transport through aquifers (Domenico & Schwartz, 1998). Since it takes quite some time to setup a simulation in MODFLOW, we used a validated excel spreadsheet mixing model to generate results more cost effectively.

2.1 VADOSE ZONE MODEL: HYDRUS-1D

2.1.1 Model Overview

HYDRUS-1D (Simunek et. al, 1998) is used to simulate one-dimensional transport of water, heat, and solute movement in variably saturated porous media. The HYDRUS- 1D model was developed by the George E. Brown Jr., Salinity Laboratory, USDA, ARS, Riverside, California and is distributed by the International

Ground Water Modeling Center (IGWMC), Golden, Colorado. A Microsoft Windows™ based Graphics User Interface (GUI) supports HYDRUS-1D.

The HYDRUS-1D model numerically solves the Richards' equation for water flow and Fickian-based advection-dispersion equations for heat and solute transport. The HYDRUS-1D flow equation includes a sink term (a term used to specify water leaving the system) to account for transpiration by plants. The solute transport equation considers advective, dispersive transport in the liquid phase, diffusion in the gaseous phase, nonlinear and non-equilibrium sorption, linear equilibrium reactions between the liquid and gaseous phases, zero-order production, and first-order degradation. The heat transport equation describes conduction as well as convection.

HYDRUS-1D can handle large numbers of soil layers, and uses the van Genuchten-Mualem, Brooks-Corey, Kosugi lognormal, and Durner dual porosity models to describe soil hydraulic properties. When values of soil hydraulic properties are unavailable, HYDRUS-1D can estimate them from a small catalog of values based on major textural classes (e.g., sand, sandy loam, etc.) or neural network based predictions.

The HYDRUS-1D code can simulate a wide range of boundary conditions. These are constant and time-variable pressure heads and fluxes, free drainage, seepage face, and an atmospheric boundary condition. An atmospheric boundary condition can be used to either generate run-off when the precipitation rate exceeds the infiltration capacity of the soil, or store excess water on the land surface allowing the water to infiltrate when precipitation stops. Time-variable conditions can be entered hourly, daily, or any general time interval.

We used HYDRUS-1D for the vadose zone simulations of this research project because we are interested in the vertical transport of water and chloride through the vadose zone. The outputs from HYDRUS-1D are the daily water flow and chloride flux from the vadose zone over the time period of the simulation expressed as cm day^{-1} and mg cm^{-2} day^{-1} respectively. These outputs are used as inputs into the simple mixing model.

2.1.2 Applicability of HYDRUS-1D for Chloride ion Releases

Surface or near surface releases of chloride ion migrate through the vadose zone under variably saturated conditions as a function of release volume, topography, and climatic conditions (i.e., precipitation and evapotranspiration). Although other vadose zone models exist that satisfy this criterion, we selected HYDRUS-1D over other models for the following three reasons:

1. It can simulate water and solute transport through heterogeneous porous media: horizons and sediments of varying geology;
2. It can incorporate daily climatic data; and
3. We are familiar with the model.

Dr. Jirka Šimůnek of our team developed the HYDRUS-1D model with his colleagues Dr. van Genuchten and Dr. Sejna; Dr. Jan Hendrickx, another team member, has used the HYDRUS-1D model for many years for evaluation of groundwater recharge and salt movement through the vadose zone.

2.2 Saturated Zone Model: Mixing Model and MODFLOW

As stated, the objective of this part of this study is to evaluate the impact of choride releases on ground water quality as measured in a well adjacent to and down gradient of the release. The chloride flux leaving the vadose zone, the horizontal flux in the unconfined aquifer, the original chloride concentration in the ground water, and the thickness of the unconfined aquifer also affect the chloride concentration of the aquifer. Since the water flux seeping from the vadose zone and its chloride concentration vary with time, no simple analytical solutions are available for determination of the time-varying chloride concentration in the well.

Therefore, we implemented a simple spreadsheet ground water mixing model for the determination of the chloride concentration in the well. This mixing model uses the output of the HYDRUS-1D model as input. We have to define the aquifer volume, (the mixing compartment underneath the spill) as a first step in the ground water mixing modeling process. Assuming a circular spill area and a unidirectional horizontal flux in the aquifer, the highest impact will occur where the ground water has the longest exposure to the incoming chloride from the vadose zone. This takes place along the diameter of the circular spill. Therefore, the length of the mixing compartment is made equal to the diameter of the spill area, D. The depth of the mixing compartment is the thickness of the aquifer, H. The width, W, of the mixing compartment is taken equal to unity (one) to simplify the calculations.

Now we will develop the relation between the water flux seeping out of the vadose q_v, the chloride concentration in the vadose zone flux , C_v, the horizontal flux in the aquifer underneath the release entering the compartment, $q_{in,}$ the original chloride concentration in the aquifer, C_{in}, the horizontal flux in the aquifer underneath the release leaving the compartment, q_{out}, and the chloride concentration of the aquifer flux leaving the area underneath the chloride ion release, C_{out}. The latter concentration is the one that will be monitored in the down gradient well. We make the following reasonable assumptions to determine C_{out}:

1. Ground water flow is in steady state. The discharge entering into the mixing compartment from the vadose zone, q_vHDHW, plus the horizontal discharge in the aquifer entering the mixing compartment at its up-gradient side, q_{in}HHHW, are equal to the discharge leaving the mixing compartment, q_{out}HHHW.

2. Changes in thickness of the saturated aquifer are small compared to the total thickness of the aquifer H.

3. The thickness of the aquifer, H, and its porosity, n, are constant.

4. Mixing of the chloride entering the mixing compartment is complete and immediate. This assumption appears invalid from data published in the recent literature (LeBlanc et al., 1991; Zhang et al., 1998). We can use the results of the mixing model as an excellent indicator of the mean chloride concentration in a supply well penetrating the aquifer underlying the release, but not as an indicator of the chloride distribution in the aquifer.

The volume of the mixing compartment, V, will be constant under these assumptions, and is equal to:

$$V = D \times H \times W \times n \qquad \textbf{(2-1)}$$

The water balance of the mixing compartment is equal to:

$$q_{in} \times H \times W + q_v \times D \times W = q_{out} \times H \times W \qquad \textbf{(2-2)}$$

We can eliminate variable W from Eqs. [2-1] and [2-2] by putting W= 1 m.

The chloride balance of this mixing compartment during any time period dt is:

$$\left[\left(q_{in} \times C_{in} \times H + q_v \times C_v \times D\right) - \left(q_{in} \times H + q_v \times D\right) \times C_{out}\right] dt = \left[D \times H \times n\right] dC$$

(2-3)

where dC is the change of chloride concentration occurring during time period dt.

Rearranging Eq. [2-3] we obtain the ordinary differential equation:

$$\frac{dC}{dt} = \frac{q_{in} \times C_{in} \times H + q_v \times C_v \times D - \left(q_{in} \times H \times q_v \times D\right) \times C_{out}}{H \times D \times n}$$

(2-4)

As soon as chloride from the release enters the ground water, the volume average concentration in the mixing compartment is C_{out} after complete mixing has occurred. Thus the chloride concentration of the water leaving the department, C_{out}, becomes:

$$C = C_{out} \qquad \text{and} \qquad dC = dC_{out}$$

(2-5)

Therefore, we can convert Eq. [2-4] in a forward finite difference expression:

$$\frac{C_{out}^{i+1} - C_{out}^{i}}{t^{i+1} - t^{i}} = \frac{q_{in}^{i} \times C_{in}^{i} \times H + q_v^{i} \times C_v^{i} \times D - \left(q_{in}^{i} \times H + q_v^{i} \times D\right) \times C_{out}^{i}}{H \times D \times n}$$

(2-6)

which yields an explicit expression for C_{out}^{i+1},

$$C_{out}^{i+1} = C_{out}^{i} + \frac{\left[q_{in}^{i} \times C_{in}^{i} \times H + q_v^{i} \times C_v^{i} \times D - \left(q_{in}^{i} \times H + q_v^{i} \times D\right) \times C_{out}^{i}\right] \times \left[t^{i+1} - t^{i}\right]}{H \times D \times n}$$

(2-7)

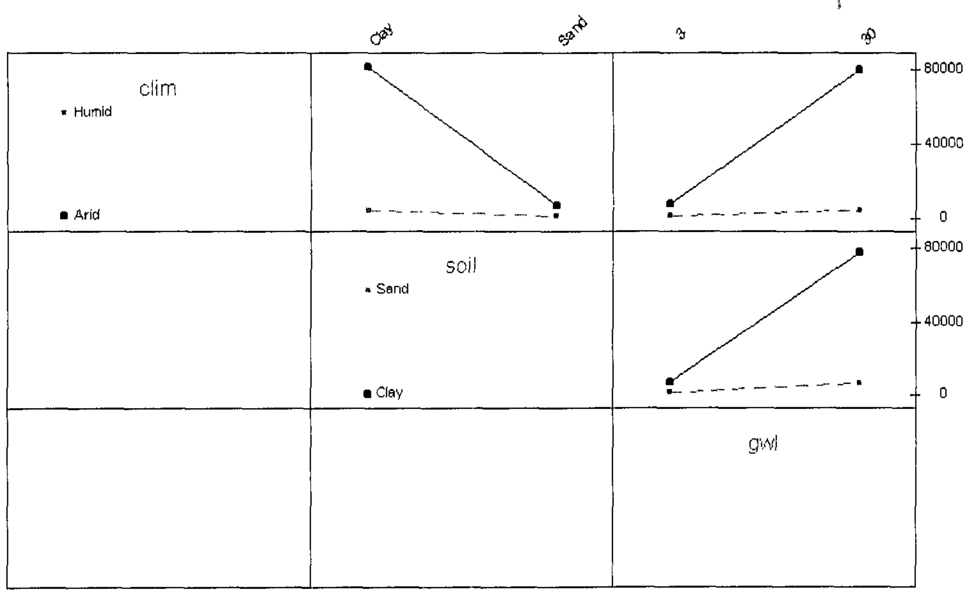
Using the output from HYDRUS-1D: the chloride concentration, C_v^{i}, of the water, q_v^{i}, entering the ground water table on day, t^{i}, we have put into a spreadsheet the mixing model of Eq.

for C_{max} to reach a well:

- Vadose Zone Texture and Climate,
- Climate and Depth to Ground Water, and
- Vadose Zone Texture and Depth to Ground Water.

The lower right section of Figure 3-5 shows that the depth to ground water has little effect on the arrival time of C_{max} if the texture of the vadose zone is sand. In a clay profile, however, the time of arrival is very different: nearly 80,000 days (219 years). This same relationship is expressed with the interaction between Climate and Depth to Ground Water (plotted in the upper right portion of Figure 3-5). In a humid climate, the texture of the vadose zone has little impact on the arrival time of C_{max}. However, in the arid Lea County, a release to a clay profile will require over 200 years longer for C_{max} to reach a well than the same release to a sandy vadose zone would.

Figure 3-5. *Interaction effects between the factors climate, soil, and ground water depth on the time when the maximum chloride concentration arrives in a down gradient monitoring well.*



[2-7]. By changing the values for spill diameter, D, ground water flux, q_{in}, original chloride concentration in the aquifer, C_{in}, and the aquifer thickness, H, we have evaluated the effect of these four factors of an unconfined aquifer.

Figure 2-1 *Comparison between MODFLOW and the Mixing Model*

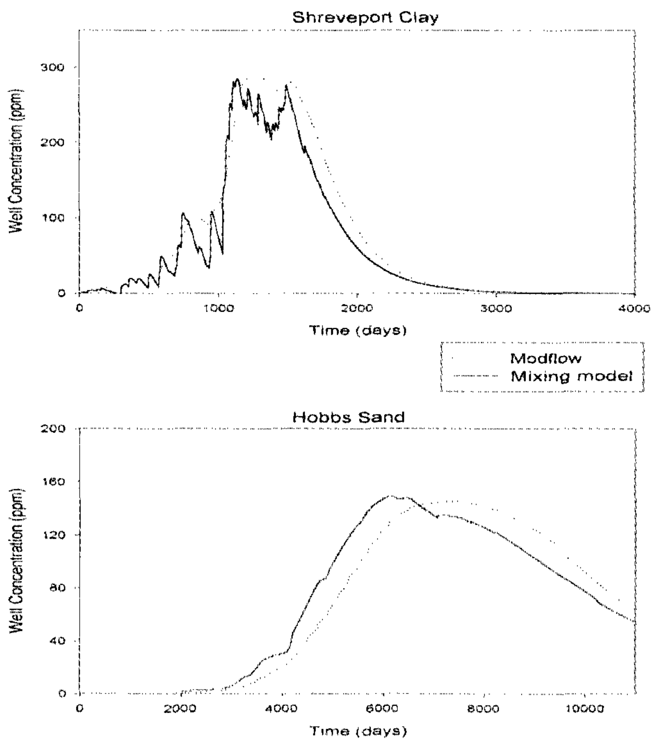


Figure 2-1 presents two comparisons between the chloride concentrations in the well located down gradient of the entry point of the release obtained with the mixing model Eq. [2-7] and those obtained with the model MODFLOW. The two comparisons deal with two complete different sets of environmental and release factors. In Shreveport the vadose zone texture is clay, the dispersion length 0.1 m, release chloride concentration 10,000 ppm, spill height 0.6 m, and aquifer flux 0.05 m/day. In Hobbs, vadose zone texture is sand, dispersion length 2.0 m, release chloride concentration 100,000 ppm, spill height 0.025 m, and aquifer flux 0.004 m/day. The maximum chloride concentrations predicted by the two models is quite similar, although the time of arrival to the maximum concentration is different between the two models. We have conducted this part of the study using the less expensive mixing model Eq. [2-7]. (Our approach using HYDRUS-1D in combination with MODFLOW and Eq. [2-7] is valid for situations where the vadose zone seepage flux, q_v, is downward. A downward flux in the vadose zone is always found in the profiles with a deep ground water table depth. However, in the profiles with a ground water table depth between **0 – (+/-) 10** m an upward flux from ground water table towards the soil surface does occur as a result of capillary rise. The magnitude of the upward capillary flux depends on soil type and climate.

A large amount of precipitation enables the downward vadose zone flux to dominate the chloride transport in both the sandy and clayey soil in the humid climate of Shreveport. Occasionally in the clayey soil an upward flux is encountered during short periods without rain.

An upward flux is sometimes found in the sanyd soil but is prevalent in the clay soil in the arid climate of Hobbs. For example, when the ground water table depth is 3 m, the average upward flux in a clay profile would be 0.04 cm/day or 13.5 cm/year; this upward capillary flux causes the chloride and soil water from the release to stay in the vadose zone and protects the ground water from impairment. In hydrogeological situations where capillary rise is common, vadose zone water movement towards ground water is sporadic. However, a big storm can push chloride ion into a shallow aquifer very quickly.

There is a strong dynamic interaction between all eleven factors, outlined in section 1.1., when water leaving the vadose zone, q_v, changes direction frequently in response to precipitation events (downward movement) and evapotranspiration (upward movement). In dry climates with shallow ground water (less than 3 m), upward movement of ground water into the vadose zone thnce to the atmosphere is common. The only manner to correctly simulate the interaction between these factors is by employing a two- or three-dimensional model, such as HYDRUS-2D. However, since the main objective of this study is ground water impairment and the effect of capillary rise in diminishing the leaching of chloride to the ground water, and is not the chloride ion concentration in the root zone, we used the mixing model Eq. [2-7] for ground water table depths of 3 m. We used the equation only for downward fluxes and made it inactive when the vadose zone flux q_v, goes upward. It was initiated again with the next occurrence of a downward flux, q_v, taking the C_{out} value of the previous occurrence of a downward q_v. In this manner a conservative estimate is obtained of the chloride concentration in the monitoring well assuming perfect mixing for shallow groundwater tables.

3.0 SENSITIVITY ANALYSIS OF FACTORS DETERMINING CHLORIDE ION FATE

3.1 PURPOSE

After a brine release, the concentration of chloride in the vadose zone decreases with time and distance traveled through the vadose zone towards ground water because of dilution with ambient soil water. Further dilution occurs in the aquifer after the chloride reaches the ground water. The maximum chloride concentration occurring at a well down gradient from the release will depend on all the factors that affect chloride transport through the vadose zone and shallow aquifer. Understanding these factors is critical for the design and implementation of a site characterization program after a chloride ion release. The degree of ground water quality impairment determines to a large extent the need for a ground water remedy. The purpose of this sensitivity study is to evaluate which of the eleven factors have the greatest effect on prediction of maximum chloride concentration in the well down gradient of the release.

3.2 MODELING SPECIFICS

We needed to optimize our simulation efforts in order to obtain the maximum amount of information from the modeling. Statistics of experimental designs (e.g. Law & Kelton, 2000; Snedecor & Cochran, 1967; Steel & Torrie, 1980) allow us to decide which combination of factors to simulate so that the desired information can be obtained with the lowest possible number of simulations.

The factors used in experimental design statistics are the input variables to our simulation models. The outputs of our simulations are the responses. The responses that we consider in this study are the maximum chloride concentration, C_{max}, occurring in the well and the time at which the maximum chloride concentration reaches the well, T_{max}.

We have opted for a 2^k *factorial design* that requires us to choose two levels of each factor in this study. This design results in a total of 2^k simulation runs, where k is the number of factors. We chose the two values for each factor so that they represent two opposite conditions such as an arid and a humid climate. The factors can be qualitative like climate or quantitative like depth to ground water. The two input values should not be too extreme or unrealistic. Additionally, the two values should not be too similar or the simulations may not adequately evaluate important aspects of the transport process under consideration. The 11 factors of this sensitivity analysis (see Table 3-1) resulted in 2^{11} or 2,048 different chloride ion release scenarios.

3.2.1 VADOSE ZONE FACTORS

Climate

We selected the two contrasting climates of Lea County, New Mexico, and Shreveport, Louisiana for the sensitivity analysis. Lea County is located in the arid southwest, and Shreveport is in the humid south. Lea County's annual precipitation and potential evapotranspiration is 14 inches and 59 inches, respectively, while annual precipitation and potential evapotranspiration for Shreveport is 46 inches and 67 inches, respectively. Lea County and Shreveport also differ in how precipitation occurs. In Lea County, the majority of precipitation occurs during the "monsoon" of July-August and much of the remainder of the year resembles drought conditions. Shreveport's precipitation falls throughout the year.

Table 3-1: *Vadose zone, aquifer, and brine release factors determining maximum chloride concentration arriving at a monitoring well down gradient.*

Factor	Factor	Factor	Maximum Chloride Concentration	
#	Description	Abbreviation	Decrease	Increase
1	Climate	clim	Arid	Humid
2	Soil Texture	soil	Clay	Sand
3	Initial Water Content	wcin	Wet	Dry
4	Chloride Dispersion Length	disp	2.0 m	0.1 m
5	Ground Water Depth	gwl	30 m	3 m
6	Ground Water Flux	qaq	0.05 m/day	0.001 m/day
7	Ambient Aquifer Cl Concentration	cin	0 ppm	100 ppm
8	Aquifer Thickness	thick	30 m	3 m
9	Release Volume	vol	100 barrels	10,000 barrels
10	Release Height	depth	0.025 m	.6m
11	Release Chloride Concentration	clcon	10,000 ppm	100,000 ppm
10*11	Release Chloride Mass	clmass	250 g/m^2	60,000 g/m^2

Vadose Zone Texture

We selected sand and clay as contrasting soil textures for the sensitivity analysis. Sand and clay differ not only in grain size but also in their ability to retain and transmit water. Sand has a relatively high-saturated hydraulic conductivity and low water retention; whereas clay has a relatively low saturated hydraulic conductivity and high water retention.

Water Content in Vadose Zone

We hypothesized that higher initial water content in the vadose zone would result in slower chloride ion movement because the initial moisture must be displaced before the chloride ion can move downward through the vadose zone. We used HYDRUS-1D to predict initial water contents for both vadose zone textures in both Lea County and Shreveport. We used these predictions as initial conditions in the sensitivity analysis.

We ran simulations for one hundred years or until we achieved dynamic equilibrium between soil water content and climatic conditions for both the wet and dry initial conditions. To create *wet* conditions, we ran simulations without any vegetation (low evapotranspiration); and ran simulations with vegetation (high evapotranspiration) in *dry* conditions. We used evergreen plants capable of transpiring soil water all year round with a 3 meter (~10 ft) deep root zone. Transpiration of soil water created a drier soil profile than simulations without vegetation.

Dispersion Length of Chloride in Vadose Zone

For the sensitivity analysis, we selected minimum and maximum chloride dispersion lengths of 0.10 m (0.33 ft) and 2.0 m (6.6 ft), respectively. The larger dispersion length will produce greater mixing of chloride ion with ambient soil water in the vadose zone, and it is expected to result in a lower maximum chloride concentration in the well. Conversely, the smaller dispersion length will result in minimal mixing, e.g. minimal attenuation of the release, and larger maximum chloride concentrations. We based our selection of dispersion lengths on values reported in the literature (Gelhar, 1993).

Depth to Ground Water

Deep ground water allows for more storage of chloride ion and more attenuation of the maximum chloride concentration during its downward migration. We selected ground water depths of 3.0 m (9.8 ft) and 30 m (98 ft) for the sensitivity analysis. These depths represent reasonable values for a shallow and deep aquifer, respectively.

3.2.2 AQUIFER FACTORS

Ground Water Flux

Ground water flux represents the rate of ground water movement and effects the ability of an aquifer to dilute chloride and other constituents of a chloride ion release. A large ground water flux produces greater dilution.

We based our selection of minimum and maximum groundwater fluxes on literature values for the Ogalalla aquifer, Southern Lea County, New Mexico (Native and Smith, 1987). We used 0.10 cm/day (0.0033 ft/day) and 5.0 cm/day (0.16 ft/day) as minimum and maximum values, respectively. The maximum flux is lower than some of the ground water fluxes reported in the literature (e.g. 40 cm/day by Zhang et al., 1998) and, thus, is a conservative estimate.

Aquifer Ambient Chloride Concentration

We selected ambient chloride concentrations for ground water of 0 ppm and 100 ppm. One hundred parts per million or less is typical for ground water of the Ogallala aquifer (Nicholson and Clebsch, 1961) and the Carrizo-Wilcox aquifer in Caddo Parish, Louisiana (Rapp, 1992). Although 10-ppm chloride is a more characteristic minimum value for the Ogallala and Carrizo-Wilcox aquifers, we selected 0.0 ppm to create a greater difference between minimum and maximum chloride concentrations of ground water.

Aquifer Thickness

The thicker the aquifer, the more opportunity for mixing (dilution), and the lower the predicted chloride concentration will be in the aquifer. We selected two aquifer thicknesses, 3.0 m (9.8 ft) and 30 m (98 ft). Three meters are approximately equal to the length of most well screens used to monitor the chloride changes. Therefore, an aquifer thickness of 3 meters provides a good estimate of expected chloride concentrations at a monitor well in a thicker aquifer under conditions of limited vertical mixing. Many unconfined, alluvial aquifers are greater than 30 m thick, but we have selected 30 m as the maximum value. A 30 m thick saturated sandy formation with a hydraulic conductivity of at least 0.0005 m/s (140 ft/day) is classified as a good aquifer (Freeze and Cherry, 1979).

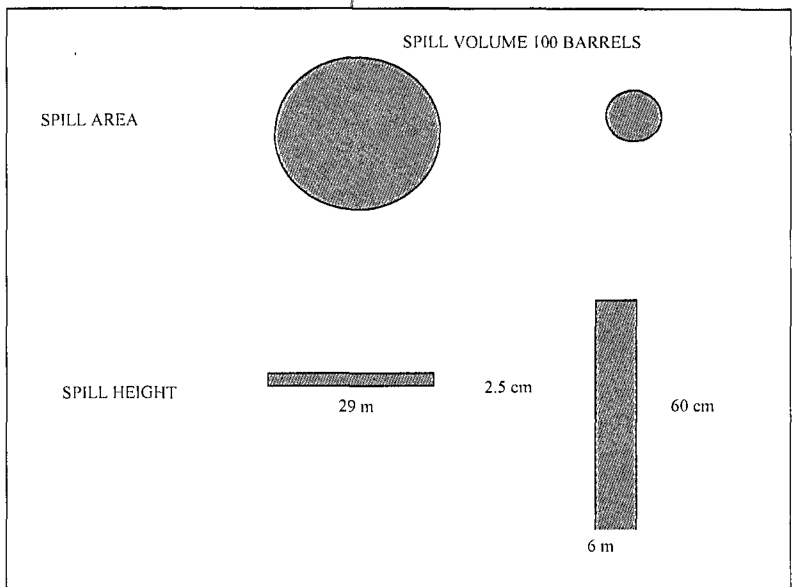
3.2.3 CHLORIDE ION RELEASE FACTORS

Release Volume

We used minimum and maximum release volumes of 100 bbl (16 m^3) and 10,000 bbl (1,600 m^3), respectively. These release volumes are representative of large and very large releases based on the experience of oil and gas industry personnel.

In the one-dimensional HYDRUS-1D model we used only spill height as an input variable. The spill volume was introduced into the mixing model using the diameter of the spill. For example, a 100 barrel release resulting in a chloride ion release of 0.025 m height with circular shape will have a diameter of 29 m while a release of 0.6m height will have a diameter of only 6m (Figure 3-1). Table 3-2 summarizes the four chloride ion release areas evaluated with the mixing model. These four release areas are combinations of the two spill heights (0.025 and 0.6 m) and two release volumes (large: 100 barrels and very large: 10,000 barrels).

Figure 3-1. *Schematic of Two Possible Brine Release Characteristics After a Release of 100 Barrels.*



We represented all spill areas as circles, and then, used the mixing model to evaluate mixing along the diameter of each circular spill (see Table 3-2). The diameter of each circle represents the longest path groundwater must flow beneath each release area, and thus provides a conservative estimate of groundwater quality impairment at a well immediately down gradient of a release.

Chloride Concentration of Release

We selected chloride concentrations of 10,000 and 100,000 ppm, as the minimum and maximum concentrations for the chloride ion release input parameter in consultation with experienced professionals. These concentrations are representative of most chloride ion releases.

Table 3-2. *Characteristics of brine releases in this study.*

Volume	Depth		Area		Diameter
Barrels	m^3	m	m^2	acres	m
100	16	0.025	640	0.16	29
		0.6	26.67	0.007	6
10000	1600	0.025	64000	16	285
		0.6	2666.67	0.7	58

The mixing model does not consider density differences between the density of the chloride ion arriving at the aquifer and the density of the water in the aquifer. These differences (even if small) may cause chloride ion to sink in an aquifer (LeBlanc et al., 1991; Zhang et al., 1998) and would influence the distribution of chloride ion in the aquifer. Since our approach assumes complete mixing in the aquifer, the chloride distribution is not taken into account. Water extracted from a well by bailing or pumping typically would represent a well mixed sample. The results of the mixing model help to identify environmental and release characteristics that cause groundwater quality impairment and provide a measure of the overall impact of a chloride ion release on an aquifer.

Height of Spill

We selected 0.025 m (1 inch) and 0.6 m (2 ft) as the minimum and maximum spill heights, respectively, of brine water on the land surface, based on observations of oil and gas industry personnel. A 0.6 m (two-foot) height represents a discharge of 1600 m^3 (10,000-bbls) of chloride ion to a 2670 m^2 (0.7 acre) bermed area or large depression. Releases to flat or gently sloped areas are likely to result in initial heights of 0.025m (an inch) or less.

Chloride Mass

Table 3-1 presents a final factor, "Release Chloride Mass". This factor, which is the product of "Release Height" and "Release Chloride Concentration", is the mass of chloride released to the ground surface per unit area. As Table 3-1 shows, a chloride ion release (see Release Chloride Concentration) of 100,000 ppm chloride that ponds to a depth of 0.6 meters (see Release Height) causes a subsurface chloride input of 60,000 grams per square meter (the Release Chloride Mass).

3.3 SIMULATION RESPONSES

The simulations with the HYDRUS-1D code and the mixing model yield large amounts of information about the flow of water and the transport of chloride through the vadose zone and the underlying aquifer. As mentioned above, we have selected two critical response variables for the sensitivity analysis: (i) the maximum chloride concentration in a down gradient monitoring well, C_{max}, and (ii) the time of arrival of the maximum chloride concentration at the monitoring well, T_{max}.

Maximum Chloride Concentration

The maximum chloride concentration defines the center of mass of a release as it migrates through the vadose zone into the aquifer and reaches a well. For this reason, we used the maximum chloride concentration, C_{max}, to identify those factors listed in Table 3-1 that have a significant influence on chloride migration through the vadose zone and the aquifer as the release moves toward the well. Evaluation of C_{max} can also identify the environmental conditions that result in significant attenuation of chloride ion. For example, for those simulations where C_{max} is much less than the original chloride concentration of released chloride ion, environmental factors cause significant chloride ion attenuation. Additionally, an evaluation of C_{max} can be used to identify release scenarios that pose little or no threat to groundwater quality. For instance, simulations that predict a C_{max} less than the EPA Secondary Water Quality Standard of 250-ppm chloride will not cause water quality impairment. On the other hand, when predictions of C_{max} are greater than 250-ppm, ground water quality may be threatened by the release. Thus, the maximum chloride concentration in the well informs us about the risk for ground water impairment and its severity.

Time of Arrival of Maximum Concentration at the Well

Time of arrival of maximum concentration, T_{max}, is the time required for the chloride center of mass to reach the well. It dictates the urgency to implement a field investigation and possible remedy. A relatively rapid response is required if simulations suggest a chloride concentration of 250 ppm or more at a well within a few years. However, when input factors combine to predict that decades or centuries are required for a well to show ground water impairment, an immediate ground water investigation may be of little value.

3.4 STATISTICAL ANALYSIS OF THE RESPONSES AT MONITORING WELL

Following the statistical approach by Law & Kelton (2000) for simulation modeling and analysis, we determined the impact of each factor presented in Table 3-1 on the migration of chloride ion through the vadose zone and aquifer. We did this by inspecting the effect of each factor on the maximum chloride concentration in a down gradient well, C_{max}, and the arrival time of this concentration, T_{max}, at the well.

Table 3-3. *Main effects of the vadose zone, aquifer, and brine release factors on the maximum chloride concentration*

Factor	Effect on Cmax	
	ppm	Relative Effect
Height of Brine Release	4,340	1
Release Chloride Concentration	4,017	0.93
Thickness of Aquifer	3,237	0.75
Soil	2,070	0.48
Aquifer Flux	1,994	0.46
Dispersion Length	1,545	0.36
Climate	1,184	0.27
Ground Water Depth	1,081	0.25
Volume of Brine Release	932	0.21
Ambient Cl Concentration	76	0.02
Initial Water Content of Soil	25	0.01

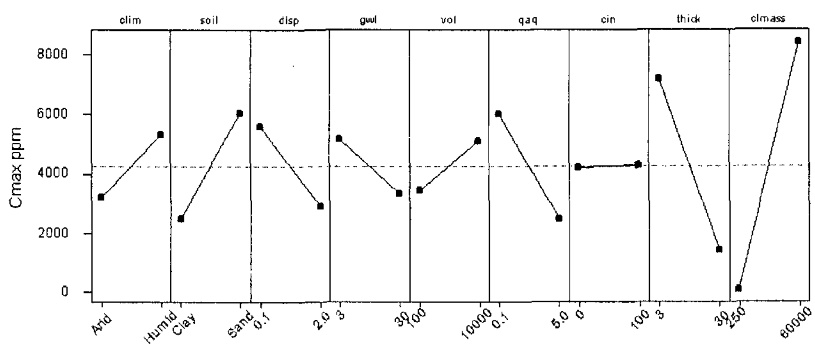
3.4.1 MAXIMUM CHLORIDE CONCENTRATION

Table 3-3 presents the sensitivity of C_{max} to each of the 11 factors considered in this study (Table 3-1). The factors are sorted according to their impact on C_{max} in Table 3-3. The most important factors are the Height of Chloride ion Release and the Release Chloride Concentration. Changing the Height of Chloride ion Release from 0.025 to 0.6 m while holding all other factors fixed results in an average increase of maximum chloride concentration of 4,340 ppm. Changing the Release Chloride Concentration from 10,000 to 100,000 ppm results in an average increase of 4,017 ppm in maximum chloride concentration in the well. The absolute concentration values depend on the set up of the simulation experiment. We have added the relative effects of each factor in Table 3-3. The factors Height of Chloride ion Release and Release Chloride Concentration have relative effects of 1.00 and 0.93 respectively, much higher than of any other factor. The predicted difference in C_{max} due to the difference in Release Chloride Concentration is 93% of predicted difference for the Height of Chloride ion Release. The predicted difference in C_{max} for the two climate's indices, however, was only 27% of predicted difference for the Height of Chloride ion Release. As Table 3-3 shows, Initial Water Content of Soil exerts the smallest influence on the prediction of C_{max}.

The two most important factors, Height of Chloride ion Release and the Release Chloride Concentration, determine the Mass of Chloride entering the soil surface during a release. If the Height of Chloride ion Release or the Release Chloride Concentration increases, the Mass of Chloride increases and consequently, the maximum chloride concentration increases. Because the Mass of Chloride appears to be the key factor in determining the maximum chloride concentration arriving at a down gradient monitoring well, we repeated the sensitivity analysis using Mass of Chloride instead of Height of Chloride ion Release and Release Chloride Concentration. We eliminated the Initial Water Content of Soil in the second sensitivity analysis since this factor has very little impact on C_{max}.

The results of the second analysis are presented in Table 3-4 and in Figure 3-2. The mean chloride concentration of all 256 scenarios with

Figure 3-2 *The effect of nine brine release, vadose zone, and aquifer factors*



Mass of Chloride 250 g/m^2 is 89 ppm and that of all 256 scenarios with Mass of Chloride 60,000 g/m^2 is 8,446 ppm (See Figure 3-2). The difference between these two values is 8,357 ppm, which is the predicted sensitivity of the maximum chloride concentration for an increase of factors fixed.

Table 3-4. *Main effects and important interactions of the vadose zone, aquifer, and brine release factors on the maximum chloride concentration arriving at the monitoring well C_{max} and the time of arrival of the maximum concentration T_{max}.*

Factor	Effect on C_{max}		Effect on T_{max}	
	ppm	Relative Effect	Years	Relative Effect
Main Effects				
Chloride Mass	8357	1	52	0.46
Aquifer Thickness	5632	0.67	5	0.04
Soil	3560	0.43	106	0.93
Aquifer Flux	3525	0.42	7	0.06
Dispersion Length	2699	0.32	11	0.06
Climate	2099	0.25	114	1
Ground Water Depth	1826	0.22	104	0.91
Volume of Brine Release	1631	0.2	0	0
Ambient Cl Concentration	82	0.01	44	0.39
Interaction Effects				
Chloride Mass x Aquifer Thickness	5573	0.67		
Chloride Mass x Soil	3519	0.42		
Chloride Mass x Aquifer Flux	3509	0.42		
Aquifer Thickness x Aquifer Flux	2529	0.3		
Aquifer Thickness x Soil	2509	0.3		
Soil x Aquifer Flux	1223	0.15		
Soil x Climate			98	0.86
Climate x Depth Ground Water			95	0.83
Soil x Depth Ground Water			90	0.79

The Thickness of Aquifer also has a large impact with a sensitivity of 5,632 ppm for a change from 3 to 30 m. All other factors are less important. For comparison, we have determined the relative impacts of each factor by dividing each affect by the influence of the Mass of Chloride (Table 3-4). The most important factors Mass of Chloride and Thickness of Aquifer with relative affects of 1.00 and 0.67, respectively. The factors Soil, Aquifer Flux, and Dispersion Length have relative affects of 0.43, 0.42, and 0.32, respectively. The factors Climate, Ground Water Depth, and Volume of Chloride ion Release have much less impact with relative affects of 0.25, 0.22, and 0.20. Ambient Chloride Concentration (Relative effect 0.01) has virtually no effect.

We know that the predicted maximum and minimum values of C_{max} for a factor of interest can depend on the values of other factors. Where this is the case, the two factors are said to interact. An Analysis of Variance revealed that six interactions affect the maximum chloride concentration. These are the interactions be-

- Chloride Mass and Thickness of Aquifer,
- Chloride Mass and Vadose zone texture,
- Chloride Mass and Aquifer Flux,

- Thickness of Aquifer and Aquifer Flux,
- Thickness of Aquifer and Vadose zone texture, and
- Vadose Zone Texture and Aquifer Flux.

Table 3-4 shows the relative importance of each interaction and the interactions are presented in Figure 3-3. As shown in Figure 3-3, if Mass of Chloride increases from 250 to 60,000 g/m^2 above an aquifer with a thickness of 3 m, the maximum chloride concentration at the well increases from 118 to 14,501 ppm. The same increase of Mass of Chloride occurring above an aquifer with a thickness of 30 m causes only a modest chloride increase from 60 to 2,757 ppm. In a sandy vadose zone, C_{max} increases from 110 to 11,985 ppm in response to the different chloride loads to the ground surface. However, different chloride ion releases to a clay result in smaller differences, 68 to 4,906 ppm, but fall within the range of responses in a sandy zone.

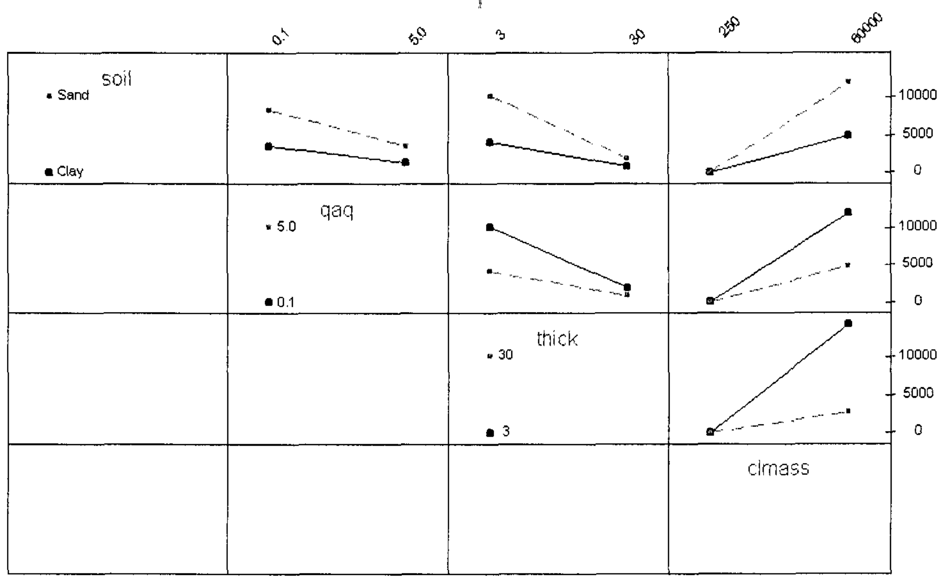


Figure 3-3. Interaction effects between the factors soil, flux in aquifer, thickness of aquifer, and chloride load on the maximum chloride concentration in a downgradient monitoring well.

The implication of the results of our sensitivity analysis is that determination of Mass of Chloride per unit surface area and Thickness of Aquifer is critical for the evaluation of ground water impairment. Knowledge of Vadose Zone Texture Conditions, Aquifer Flux, Dispersion length, Climate, Ground Water Depth, and Volume of Chloride ion Release can provide useful additional information, while ambient Chloride Concentration and Initial Water Content of Soil provide little relevant information.

The results of the sensitivity analysis cannot be used to directly evaluate field sites because they are based on the average change of maximum chloride concentration. For each factor, the maximum chloride concentration exhibits a wide range of values as is shown in Table 3-5.

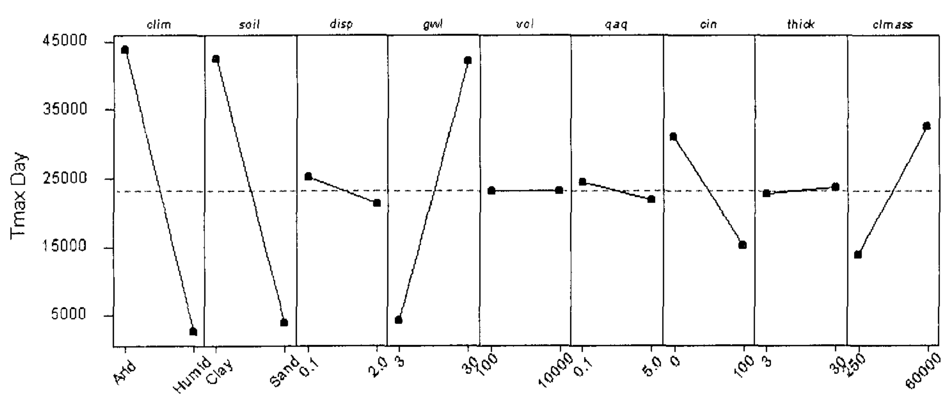
Table 3-5. *Statistics of maximum chloride concentrations (ppm) determined in the sensitivity analysis.*

Main Effect	Level	Mean	Minimum	Maximum
Mass of Chloride	250 g/m2	89	0	303
	60,000 g/m2	8,446	0	46,633
Thickness of Aquifer	30 m	1,429	0	15,354
	3 m	7,195	0	46,633
Soil	Clay	2,487	0	37,233
	Sand	6,047	2	46,633
Aquifer Flux	0.05 m/day	2,505	0	29,779
	0.001 m/day	6,030	0	46,633
Climate	Arid	3,218	0	44,372
	Humid	5,317	0	46,633
Ground Water Depth	30 m	3,354	0	40,758
	3 m	5,181	0	46,633
Volume of Brine Release	100 barrels	3,452	0	41,603
	10,000 barrels	5,083	0	46,633
Dispersion Length	2.0 m	2,918	0	25,653
	0.1 m	5,617	0	46,633
Ambient Cl Concentration	0 ppm	4,226	0	46,593
	100 ppm	4,308	0	46,633

3.4.2 ARRIVAL TIME OF MAXIMUM CHLORIDE CONCENTRATION

We present the effects of the factors on the arrival time of the maximum chloride concentration at the well in Table 3-4. The arrival time strongly depends on climate (relative effect of 1.0 in Table 3-4), vadose zone texture, and depth of ground water. In the arid climate of Lea County, New Mexico, a chloride ion release will require an additional 114 years (40,515 days) for the maximum concentration to arrive at a well than a similar release in the humid climate of Shreveport, Louisiana. The vadose zone texture and ground water table effects are of the same order of magnitude (106 and 104 years respectively). Other factors are less important. Figure 3-4 graphically displays this same information. Our Analysis of Variance identified three important interactions that effect the length of time required

Figure 3-4 *The effect of nine brine release, vadose zone, and aquifer factors on the time when the maximum chloride concentration arrives in a downgradient monitoring well.*



APPENDIX D

Chloride Content in the Vadose Zone

The purpose of this appendix is to explain different ways to quantify the amount of chloride present in the vadose zone. First, we present a number of concepts dealing with quantifying water and chloride contents. Next, we present our approach to calculate the chloride load.

Definitions

Gravimetric water content 2_g

$$\theta_g = \frac{W_{water}}{W_{dry\ soil}} \qquad [1]$$

where W_{water} is the weight of water (kg) and W_{soil} is the weight of the dry soil (kg).

Volumetric water content 2_v

$$\theta_v = \frac{V_{water}}{V_{soil}} \qquad [2]$$

where V_{water} is the volume of water (m^3) and V_{soil} is the volume of the soil (m^3).

The relationship between 2_g and 2_v is

$$\theta_v = \frac{\rho_{soil}^{dry}}{\rho_{water}} \theta_g \qquad [3]$$

where Δ_{soil}^{dry} is the bulk density of the dry soil (kg/m^3) and Δ_{water} is the density of water (in this appendix taken as 1000 kg/m^3). We also recognize the bulk density of moist soil Δ_{soil}^{moist}. The bulk densities can be found using the following expressions.

$$\rho_{soil}^{moist} = \frac{W_{moist\ soil}}{V_{soil}} = \frac{W_{dry\ soil} + W_{water}}{v_{soil}} \qquad [4]$$

$$\rho_{soil}^{dry} = \frac{W_{dry\ soil}}{V_{soil}} \qquad [5]$$

Gravimetric chloride content in moist soil $Cl_g^{moist\ soil}$

$$Cl_g^{moist\ soil} = \frac{W_{Chloride}}{W_{moist\ soil}} \qquad [6]$$

where $W_{chloride}$ is the weight of chloride (kg) and $W_{moist\ soil}$ is the weight of the moist soil (kg). Since the chloride content is often so small compared with the amount of soil, it is a custom to express chloride content in mg and soil in kg. The dimensions of $Cl_g^{moist\ soil}$ are then mg/kg or ppm.

Since the water content of a soil will vary, we prefer to express the chloride content as a weight fraction of the dry soil.

Gravimetric chloride content in dry soil $Cl_g^{dry\ soil}$

$$Cl_g^{dry\ soil} = \frac{W_{Chloride}}{W_{dry\ soil}} \qquad [7]$$

where $W_{chloride}$ is the weight of chloride (kg) and $W_{dry\ soil}$ is the weight of the dry soil (kg).

Volumetric chloride content in the soil Cl_v, (mg/m^3)

$$Cl_v = \frac{W_{Chloride}}{V_{soil}} \qquad [8]$$

The relationship between $Cl_v^{dry\ soil}$ and $Cl_g^{moist\ soil}$ is

$$Cl_v^{dry\ soil} = \frac{Cl_g^{moist\ soil}\ W_{dry\ soil}\ (1+\theta_g)}{V_{soil}} = Cl_g^{moist\ soil}\ \rho_b^{dry\ soil}\ (1+\theta_g) \qquad [9]$$

Calculation of chloride load and chloride concentration

Step 1. Gather data.

The minimum set of data we need for the calculation of the chloride load are the gravimetric chloride content in moist soil $Cl_g^{moist\ soil}$, the gravimetric soil water content

2_g, and the bulk density of the dry soil Δ_{soil}^{dry}. The gravimetric chloride content and the gravimetric water content can be measured from core samples; the bulk density of dry soil will often be estimated.

Example: $Cl_g^{moist\ soil} = 6{,}000$ ppm; $2_g = 0.08$; $\Delta_{soil}^{dry} = 1500$ kg/m^3.

Step 2. Express water content on a volumetric basis.

Since computer models for water flow and chloride transport are constructed on a volumetric basis, we need to express the measured gravimetric chloride and water contents on a volumetric basis. We can do this using Eq. [3] for the water content.

Example: $2_v = 0.08 \times 1500/1000 = 0.12$

Step 3. Calculate chloride load for one-meter depth.

Chloride load in one m^3 which equals a volume of soil with thickness 1 m and area 1 m^2 is 9,720,000 mg/m^3 or 9.720 kg/m^3.

Example: $Cl_v = 6{,}000\ (\text{mg/kg}) * 1{,}500\ (\text{kg/m}^3) * (1 + 0.08) = 9{,}720{,}000\ (\text{mg/m}^3)$

Step 4. Calculate chloride load for entire vadose zone.

For a homogeneous vadose zone with thickness D, the total chloride load is the sum of the chloride loads of all depths.

Example: Depth of vadose zone 10 m. Total chloride load is 9.720 x 10 = 97.2 kg/m^2.

For a heterogeneous vadose zone first calculate for each layer the chloride load following Steps [1-4] and sum over entire vadose zone.

RICE Operating Company

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

CERTIFIED MAIL
RETURN RECEIPT NO. 7000 1530 0005 9895 4992

RECEIVED

APR 07 2003

ENVIRONMENTAL BUREAU
CONSERVATION DIVISION

April 1, 2003

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

RE: 2002 MONITOR WELL REPORT/SAMPLING SUMMARY
BD SWD SYSTEM
LEA COUNTY, NEW MEXICO

O-12

Mr. Olson:

Rice Operating Company (ROC) takes this opportunity to submit the 2002 Monitor Well Report for the Blinebry-Drinkard (BD) Salt Water Disposal System. There are 4 sites in this system that have monitor wells that are sampled quarterly pursuant to NMOCD guidelines. Groundwater impact became apparent at these sites during the remediation process of the Junction Box Upgrade Plan.

Site Name	Unit Letter	Section	Township/Range
J-26 jct.	J	26	T21S, R37E
Zachary Hinton jct.	O	12	T22S, R37E
F-17 jct.	F	17	T21S, R37E
I-27 jct.	I	27	T22S, R37E

In 2002, the Zachary Hinton monitor well was sampled by Environmental Plus, Inc. of Eunice, and also by ROC. The 2002 sampling events for J-26, F-17, and I-27 were conducted by ROC. In 2003, ROC will continue to conduct the sampling of the monitor wells at these sites. As in 2002, either Environmental Lab of Texas of Odessa, Texas, or Cardinal Laboratories of Hobbs will conduct analytical tests of the water samples of 2003.

Trident Environmental of Midland, Texas and R. T. Hicks Consultants, Ltd. of Albuquerque have been contracted by ROC to prioritize the junction box disclosure sites and to generate work plans for remediation of the vadose zone. NMOCD can anticipate the submittal of work plans for several such sites in 2003. After NMOCD approval, AFE's will be submitted to System Partners for approval. Sites with confirmed groundwater impact will also be evaluated for the extent of groundwater impact.

ROC is the service provider (operator) for the BD Salt Water Disposal System and has not ownership of any portion of pipeline, well, or facility. The BD SWD System is owned by a consortium of oil producers, System Partners, who provide all operating capital on a percentage ownership/usage basis.

Thank you for your consideration concerning this annual summary of groundwater monitoring information. If you have any questions, do not hesitate to contact me.

RICE OPERATING COMAPANY

Kristin Farris

Kristin Farris
Project Scientist

Enclosures: Summary table & graph for each site
Analytical results

Cc: LBG, CDH, file, Chris Williams
NMOCD, District I Office
1625 N. French Drive
Hobbs, NM 88240

ANALYTICAL REPORT

Prepared for:

Kristin Farris
Rice Operating
122 W. Taylor
Hobbs, NM 88240

Project:	O-12
Order#:	G0203377
Report Date:	05/21/2002

Certificates
US EPA Laboratory Code TX00158

ENVIRONMENTAL LAB OF TEXAS

SAMPLE WORK LIST

Rice Operating
122 W. Taylor
Hobbs, NM 88240
505-397-1471

Order#: G0203377
Project:
Project Name: O-12
Location: BD SWD

The samples listed below were submitted to Environmental Lab of Texas and were received under chain of custody. Environmental Lab of Texas makes no representation or certification as to the method of sample collection, sample identification, or transportation/handling procedures used prior to the receipt of samples by Environmental Lab of Texas.

Lab ID:	Sample :	Matrix:	Date / Time Collected	Date / Time Received	Container	Preservative
0203377-01	MW 1	WATER	5/15/02 10:00	5/16/02 19:45	See COC	See COC

Lab Testing: **Rejected:** No **Temp:** See COC

8021B/5030 BTEX
Anions
Cations
Total Dissolved Solids (TDS)

ENVIRONMENTAL LAB OF TEXAS

ANALYTICAL REPORT

Kristin Farris
Rice Operating
122 W. Taylor
Hobbs, NM 88240

Order#: G0203377
Project:
Project Name: O-12
Location: BD SWD

Lab ID: 0203377-01
Sample ID: MW 1

8021B/5030 BTEX

Method Blank	Date Prepared	Date Analyzed	Sample Amount	Dilution Factor	Analyst	Method
0001761-02		5/20/02 15:38	1	1	CK	8021B

Parameter	Result mg/L	RL
Benzene	**<0.001**	0.001
Ethylbenzene	**<0.001**	0.001
Toluene	**<0.001**	0.001
p/m-Xylene	**<0.001**	0.001
o-Xylene	**<0.001**	0.001

Approval: Raland K Tuttle 5-21-02
Raland K. Tuttle, Lab Director, QA Officer Date
Celey D. Keene, Org. Tech. Director
Jeanne McMurrey, Inorg. Tech. Director
Sandra Biezugbe, Lab Tech.
Sara Molina, Lab Tech.

DL = Diluted out N/A = Not Applicable RL = Reporting Limit

ENVIRONMENTAL LAB OF TEXAS

ANALYTICAL REPORT

Kristin Farris		Order#:	G0203377
Rice Operating		Project:	
122 W. Taylor		Project Name:	O-12
Hobbs, NM 88240		Location:	BD SWD

Lab ID: 0203377-01

Sample ID: MW 1

Anions

Parameter	Result	Units	Dilution Factor	RL	Method	Date Analyzed	Analyst
Bicarbonate Alkalinity	186	mg/L	1	2.00	310.1	5/17/02	SB
Carbonate Alkalinity	<0.10	mg/L	1	0.10	310.1	5/17/02	SB
Chloride	478	mg/L	1	5.00	9253	5/17/02	SB
Hydroxide Alkalinity	<0.10	mg/L	1	0.10	310.1	5/17/02	SB
SULFATE, 375.4	261	mg/L	1	0.50	375.4	5/17/02	SB

Cations

Parameter	Result	Units	Dilution Factor	RL	Method	Date Analyzed	Analyst
Calcium	108	mg/L	50	0.500	6010B	5/17/02	SM
Magnesium	53	mg/L	10	0.010	6010B	5/17/02	SM
Potassium	12.1	mg/L	10	0.500	6010B	5/17/02	SM
Sodium	275	mg/L	250	2.50	6010B	5/17/02	SM

Test Parameters

Parameter	Result	Units	Dilution Factor	RL	Method	Date Analyzed	Analyst
Total Dissolved Solids (TDS)	1470	mg/L	1	5.0	160.1	5/17/02	CK

Approval: Raland K Tuttle 5-22-02

Raland K. Tuttle, Lab Director, QA Officer Date
Celey D. Keene, Org. Tech. Director
Jeanne McMurrey, Inorg. Tech. Director
Sandra Biezugbe, Lab Tech.
Sara Molina, Lab Tech.

RL = Reporting Limit N/A = Not Applicable

ENVIRONMENTAL LAB OF TEXAS

QUALITY CONTROL REPORT

8021B/5030 BTEX

Order#: G0203377

BLANK WATER	LAB-ID #	Sample Concentr.	Spike Concentr.	QC Test Result	Pct (%) Recovery	RPD
Benzene-mg/L	0001761-02			<0.001		
Ethylbenzene-mg/L	0001761-02			<0.001		
Toluene-mg/L	0001761-02			<0.001		
p/m-Xylene-mg/L	0001761-02			<0.001		
o-Xylene-mg/L	0001761-02			<0.001		
MS WATER	**LAB-ID #**	**Sample Concentr.**	**Spike Concentr.**	**QC Test Result**	**Pct (%) Recovery**	**RPD**
Benzene-mg/L	0203378-01	0	0.1	0.104	104.%	
Ethylbenzene-mg/L	0203378-01	0	0.1	0.104	104.%	
Toluene-mg/L	0203378-01	0	0.1	0.105	105.%	
p/m-Xylene-mg/L	0203378-01	0	0.2	0.210	105.%	
o-Xylene-mg/L	0203378-01	0	0.1	0.104	104.%	
MSD WATER	**LAB-ID #**	**Sample Concentr.**	**Spike Concentr.**	**QC Test Result**	**Pct (%) Recovery**	**RPD**
Benzene-mg/L	0203378-01	0	0.1	0.101	101.%	2.9%
Ethylbenzene-mg/L	0203378-01	0	0.1	0.101	101.%	2.9%
Toluene-mg/L	0203378-01	0	0.1	0.103	103.%	1.9%
p/m-Xylene-mg/L	0203378-01	0	0.2	0.205	102.5%	2.4%
o-Xylene-mg/L	0203378-01	0	0.1	0.101	101.%	2.9%
SRM WATER	**LAB-ID #**	**Sample Concentr.**	**Spike Concentr.**	**QC Test Result**	**Pct (%) Recovery**	**RPD**
Benzene-mg/L	0001761-05		0.1	0.102	102.%	
Ethylbenzene-mg/L	0001761-05		0.1	0.102	102.%	
Toluene-mg/L	0001761-05		0.1	0.104	104.%	
p/m-Xylene-mg/L	0001761-05		0.2	0.208	104.%	
o-Xylene-mg/L	0001761-05		0.1	0.102	102.%	

ENVIRONMENTAL LAB OF TEXAS

QUALITY CONTROL REPORT

Anions

Order#: G0203377

BLANK WATER	LAB-ID #	Sample Concentr.	Spike Concentr.	QC Test Result	Pct (%) Recovery	RPD
Bicarbonate Alkalinity-mg/L	0001754-01			<2.00		
Carbonate Alkalinity-mg/L	0001755-01			<0.10		
Chloride-mg/L	0001753-01			<5.00		
Hydroxide Alkalinity-mg/L	0001756-01			<0.10		
SULFATE, 375.4-mg/L	0001741-01			<0.50		

DUPLICATE WATER	LAB-ID #	Sample Concentr.	Spike Concentr.	QC Test Result	Pct (%) Recovery	RPD
Bicarbonate Alkalinity-mg/L	0203375-01	503		505		0.4%
Carbonate Alkalinity-mg/L	0203375-01	0		<0.10		0.%
Hydroxide Alkalinity-mg/L	0203375-01	0		<0.10		0.%
SULFATE, 375.4-mg/L	0203355-01	610		610		0.%

MS WATER	LAB-ID #	Sample Concentr.	Spike Concentr.	QC Test Result	Pct (%) Recovery	RPD
Chloride-mg/L	0203375-01	3720	5000	8600	97.6%	

MSD WATER	LAB-ID #	Sample Concentr.	Spike Concentr.	QC Test Result	Pct (%) Recovery	RPD
Chloride-mg/L	0203375-01	3720	5000	8680	99.2%	0.9%

SRM WATER	LAB-ID #	Sample Concentr.	Spike Concentr.	QC Test Result	Pct (%) Recovery	RPD
Bicarbonate Alkalinity-mg/L	0001754-04		0.05	0.0496	99.2%	
Carbonate Alkalinity-mg/L	0001755-04		0.05	0.0496	99.2%	
Chloride-mg/L	0001753-04		5000	5050	101.%	
Hydroxide Alkalinity-mg/L	0001756-04		0.05	0.0496	99.2%	
SULFATE, 375.4-mg/L	0001741-04		50	49.9	99.8%	

ENVIRONMENTAL LAB OF TEXAS

QUALITY CONTROL REPORT

Cations

Order#: G0203377

BLANK WATER	LAB-ID #	Sample Concentr.	Spike Concentr.	QC Test Result	Pct (%) Recovery	RPD
Calcium-mg/L	0001757-02			<0.01		
Magnesium-mg/L	0001757-02			<0.001		
Potassium-mg/L	0001757-02			<0.05		
Sodium-mg/L	0001757-02			<0.01		
DUPLICATE WATER	**LAB-ID #**	**Sample Concentr.**	**Spike Concentr.**	**QC Test Result**	**Pct (%) Recovery**	**RPD**
Calcium-mg/L	0203375-01	240		258		7.2%
Magnesium-mg/L	0203375-01	93.4		96.4		3.2%
Potassium-mg/L	0203375-01	13.4		13.5		0.7%
Sodium-mg/L	0203375-01	2120		1970		7.3%
SRM WATER	**LAB-ID #**	**Sample Concentr.**	**Spike Concentr.**	**QC Test Result**	**Pct (%) Recovery**	**RPD**
Calcium-mg/L	0001757-05		2	2.06	103.%	
Magnesium-mg/L	0001757-05		2	2.11	105.5%	
Potassium-mg/L	0001757-05		2	2.07	103.5%	
Sodium-mg/L	0001757-05		2	2.1	105.%	

ENVIRONMENTAL LAB OF TEXAS

QUALITY CONTROL REPORT

Test Parameters

Order#: G0203377

BLANK WATER	LAB-ID #	Sample Concentr.	Spike Concentr.	QC Test Result	Pct (%) Recovery	RPD
Total Dissolved Solids (TDS)-mg/L	0001764-01			<5.00		

Environmental Lab of Texas, Inc.

12600 West I-20 East
Odessa, Texas 79763
Phone: 915-563-1800
Fax: 915-563-1713

CHAIN OF CUSTODY RECORD AND ANALYSIS REQUEST

Project Manager: Kristin Farris
Company Name: Rice Operating
Company Address: 122 W. Taylor
City/State/Zip: Hobbs, NM 88240
Telephone No: (505)393-9174
Fax No: (505)397-1471
Sampler Signature: Kristin Farris

Project Name: O-12
Project #:
Project Loc: BD SWD
PO #: 715

LAB # (lab use only)	FIELD CODE	Date Sampled	Time Sampled	No. of Containers	Preservative: Ice	HNO_3	HCl	NaOH	H_2SO_4	None	Other (Specify)	Matrix: Water	Sludge	Soil	Other (specify):	Analyze For: ~~TDS/Cl/SAR/EC~~	TPH 418.1	TPH TX 1005/1006	TPH 8015M GRO/DRO	Metals: As Ag Ba Cd Cr Pb Hg Se	Volatiles	Semivolatiles	BTEX 8021B/5030	RUSH TAT (Pre-Schedule)	Standard TAT
0203377-01	MW 1	5-15-02	10:00am	1								✓				✓									
↓	MW 1	5-15-02	10:00am	2	✓		✓					✓											✓		

TCLP:
TOTAL:

Special Instructions: Major anions/cations; Fax results to K. Farris

Relinquished by:	Date	Time	Received by:	Date	Time
Kristin Farris	5-16-02	4:30pm			
Relinquished by: C. Hayes	5-16-02	19:45	Received by ELOT: [illegible]	5/16/02	19:45

Sample Containers Intact? Y N
Temperature Upon Receipt:
Laboratory Comments:
1°C – 40mL glass
25°C – L HDPE