1R - 425-93

WORKPLANS

Date:

8-2-13

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

20055 Laredo Ln
Monument, CO 80132
E-mail: lpg@texerra.com, Tel: 719-339-6791

August 2nd, 2013

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

RE: **Corrective Action Plan (CAP)**
Rice Operating Company – Vacuum SWD System
Vacuum J-32 EOL: UL J, Sec. 32, T17S, R35E
NMOCD Case Number: 1R425-93

Sent via Certified U.S. Mail w/ Return Receipt No. 7007 2560 0001 9729 0676

Mr. Hansen:

RICE Operating Company (ROC) has retained Texerra to address potential environmental concerns at the above-referenced site in the abandoned Vacuum Salt Water Disposal (SWD) system. An Investigation and Characterization Plan (ICP) Report to NMOCD on June 3rd, 2013, recommending further soil sampling to delineate the lateral extent of residual soil chlorides and review of historical photos. (Residual petroleum hydrocarbons had been found to be insignificant). However, upon further evaluation of the soil chloride data that was submitted in the ICP Report, *the lateral extent of residual soil chlorides has, in fact, been defined by samples taken from soil bores SB-2 through SB-5* and that *the area underlain by chloride-impacted soils is encompassed by the impermeable 20-mil reinforced synthetic liner installed by ROC in 2010.*

This former junction box is located within a production lease pad and is encompassed by active production activities. Historical aerial photographs document widespread oilfield activity and facilities across this location, as well as, across the broader surrounding area (see dated aerial photographs in Appendix). Stepping out from the former junction box location toward the production well northeast of the site, residual soil chlorides in the surface layer from SB-4 (3,859 mg/kg) are higher than in any of the samples taken beneath the former junction box from SB-1 (maximum 1,187 mg/kg at 45 ft bgs; see Soil Bore Installation plate in Appendix). These data strongly suggest that the residual soil chlorides beneath the former junction box were likely contributed in part from off-site sources. Nevertheless, chloride concentrations decreased with depth to concentrations near or below 250 mg/kg in each of the bores, excluding SB-1.

The Multimed model was ran in order to determine if chloride concentrations at depth in SB-1 pose a threat to the groundwater quality. Based on the installed liner, the model predicted a maximum elevation in groundwater chlorides to be 78 mg/l, 92 yrs into the future. We thus believe that the likelihood of future groundwater impacts from these residual, capped (by the installed impermeable

liner) soil chlorides is low and that neither additional soil sampling, nor a monitor well, are warranted. We therefore propose the following final remedy to serve as the Corrective Action Plan (CAP) for this project:

> Import clean (< 500 mg Cl-/kg, PID < 100 ppm) caliche to bring the area underlain by the synthetic liner to lease pad grade. The caliche will be compacted to provide an additional barrier to downward water flow. Upon completion, a report with photographs documenting this work will be submitted to NMOCD and to request remediation termination or similar regulatory closure status.

ROC is the service provider (agent) for the Vacuum SWD System and has no ownership of any portion of the pipeline, well, or facility. The system is owned by a consortium of oil producers, System Parties, who provide all operating capital on a percentage/usage basis. Environmental projects of this nature require System Party AFE approval prior to work commencing at the site. In general, project funding is not forthcoming until NMOCD approves the work plan. Therefore, your timely review of this submission is greatly appreciated.

Thank you for your consideration of this report. Please call Hack Conder at (575) 393-2967 or myself if you have any questions or wish to discuss this project.

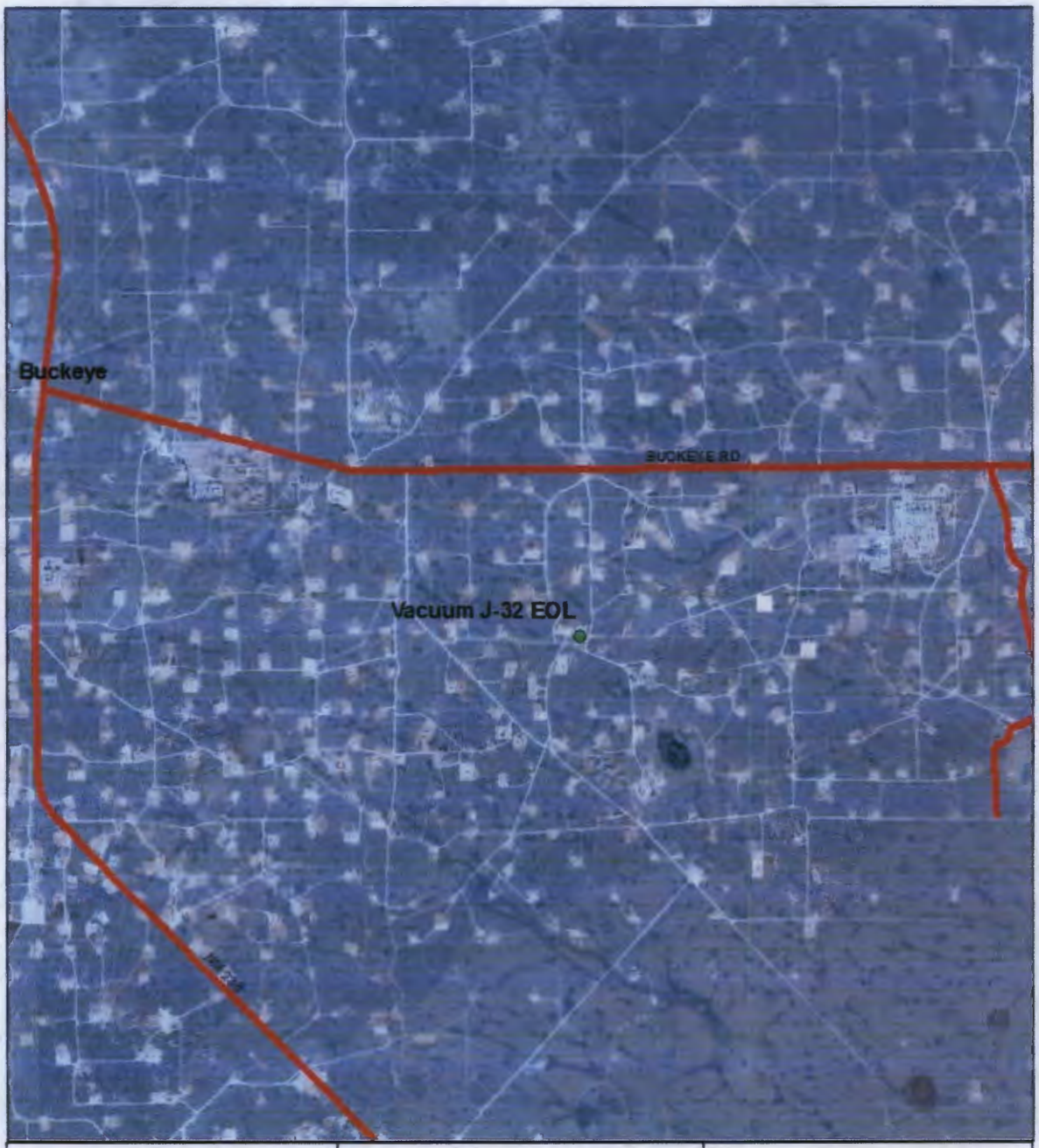
Sincerely,

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

Copy: Rice Operating Company

Attachments:

- ✓ Site Location Map
- ✓ Soil Bore Installation (map and soil bore results summary)
- ✓ Site Photograph
- ✓ Aerial Photographs (including historicals)
- ✓ MultiMed Report & Graph



RICE ENVIRONMENTAL RECS CONSULTING & SAFETY, LLC

Vacuum J-32 EOL

Unit J, Section 32, T17S, R35E
LEA COUNTY, NM
NMOCD Case #: 1R425-93

N W E S

0 0.15 0.3 0.6
Miles

Drawing date: 7-25-12
Drafted by: L. Weinheimer

Soil Bore Installation

SB-1

Depth	Cl-	PID	LAB Cl-	GRO	DRO
15'	641	5.1			
20'	948	3.3			
25'	864	2.6			
30'	845	2.8			
35'	729	7.7			
40'	805	4.3			
45'	1187	3.4	1090	<10	<10
50'	965	4.6			
55'	894	5.1			
60'	954	5.0	992	<10	<10

SB-2

Depth	Cl-	PID	LAB Cl-	GRO	DRO
SS	415	0.8			
5'	500	1.3			
10'	552	1.1			
15'	445	1.6			
20'	616	1.1	880	<10	<10
25'	354	1.6			
30'	405	1.4			
35'	369	1.4			
40'	287	1.5	288	<10	<10

SB-3

Depth	Cl-	PID	LAB Cl-	GRO	DRO
SS	787	0.6	960	<10	<10
5'	374	2.7			
10'	147	2.7	112	<10	<10

SB-4

Depth	Cl-	PID	LAB Cl-	GRO	DRO
SS	3859	0.5	4280	<10	14.7
5'	204	1.5			
10'	89	2.3	48	<10	<10

SB-5

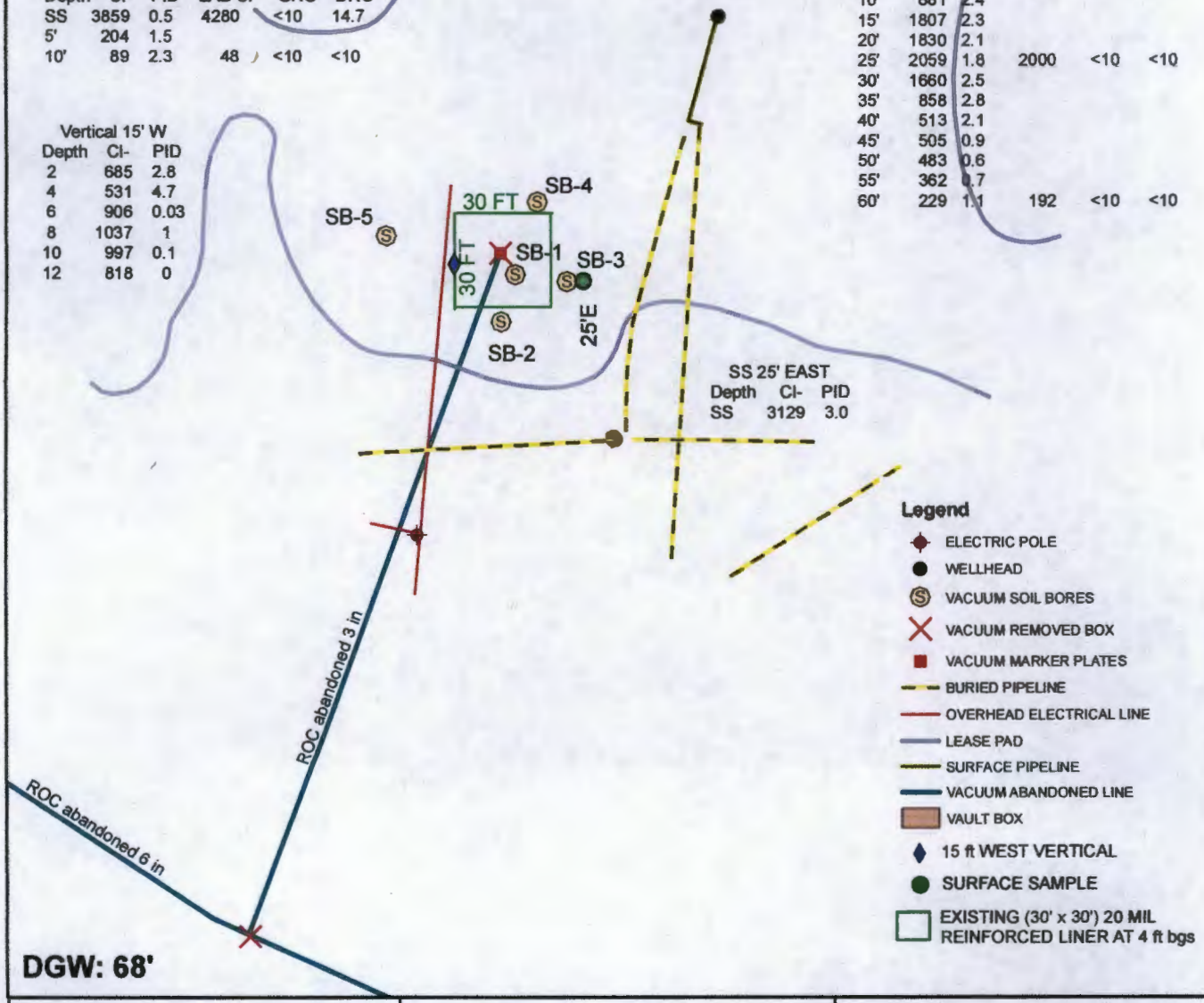
Depth	Cl-	PID	LAB Cl-	GRO	DRO
SS	1414	2.2			
5'	497	2.0			
10'	881	2.4			
15'	1807	2.3			
20'	1830	2.1			
25'	2059	1.8	2000	<10	<10
30'	1660	2.5			
35'	858	2.8			
40'	513	2.1			
45'	505	0.9			
50'	483	0.6			
55'	362	0.7			
60'	229	1.1	192	<10	<10

Vertical 15' W

Depth	Cl-	PID
2	685	2.8
4	531	4.7
6	906	0.03
8	1037	1
10	997	0.1
12	818	0

SS 25' EAST

Depth	Cl-	PID
SS	3129	3.0



RICE ENVIRONMENTAL RECS CONSULTING & SAFETY, LLC

Vacuum J-32 EOL

Unit J, Section 32, T17S, R35E

NMOCD Case #: 1R425-93

N W E S

0 25 50 100 Feet

Drawing date: 7-26-13
Drawn by: LS

2013

RICE ENVIRONMENTAL RECS CONSULTING & SAFETY, LLC

Vacuum J-32 EOL

Unit J, Section 32, T17S, R35E
LEA COUNTY, NM

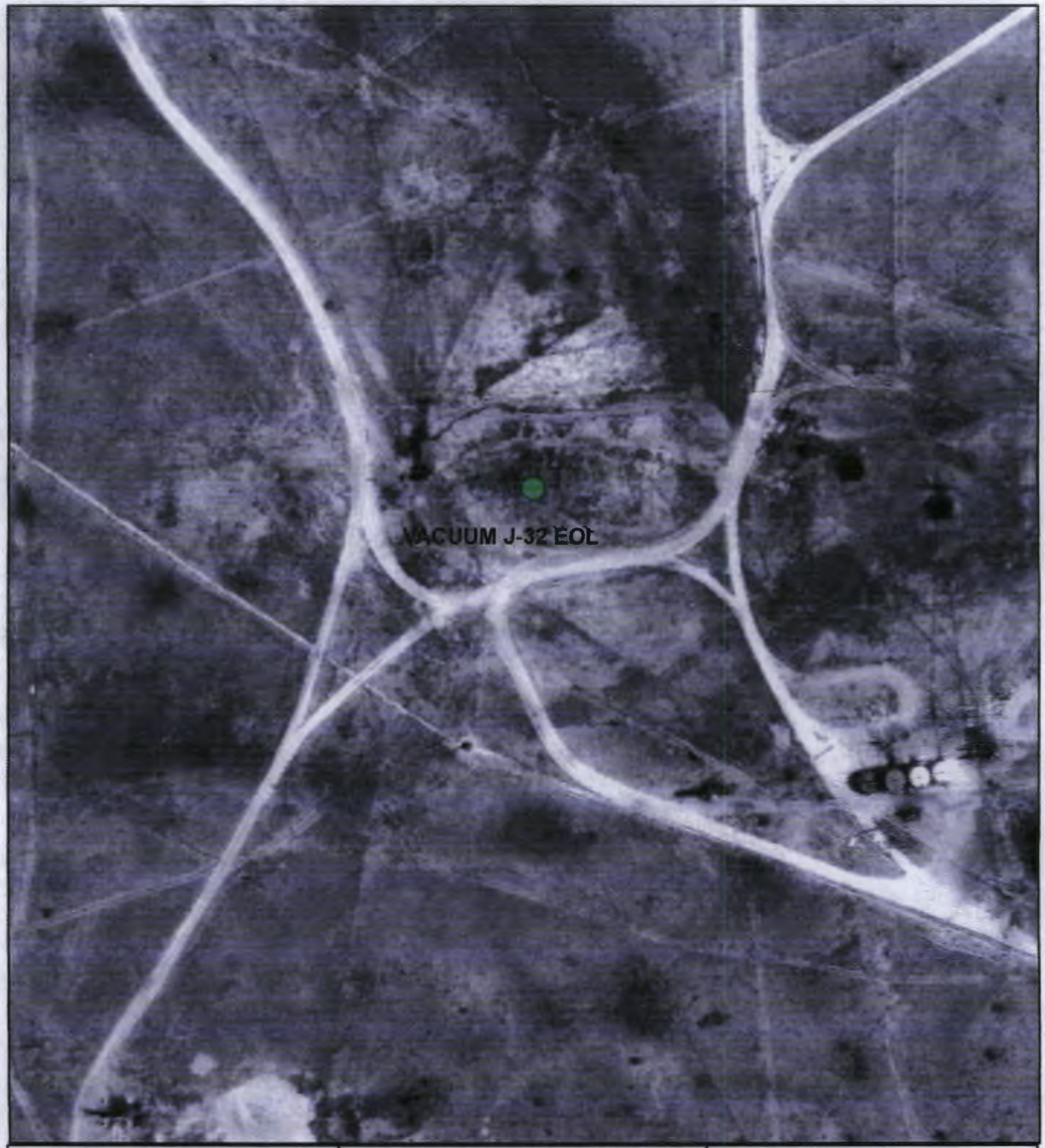
NMOCD Case #: 1R425-93

N
W E
S

0 50 100 200
Feet

Drawing date: 7-31-2013
Drafted by: LS

1978



RICE ENVIRONMENTAL
RECS
CONSULTING & SAFETY, LLC

Vacuum J-32 EOL

Unit J, Section 32, T17S, R35E
LEA COUNTY, NM

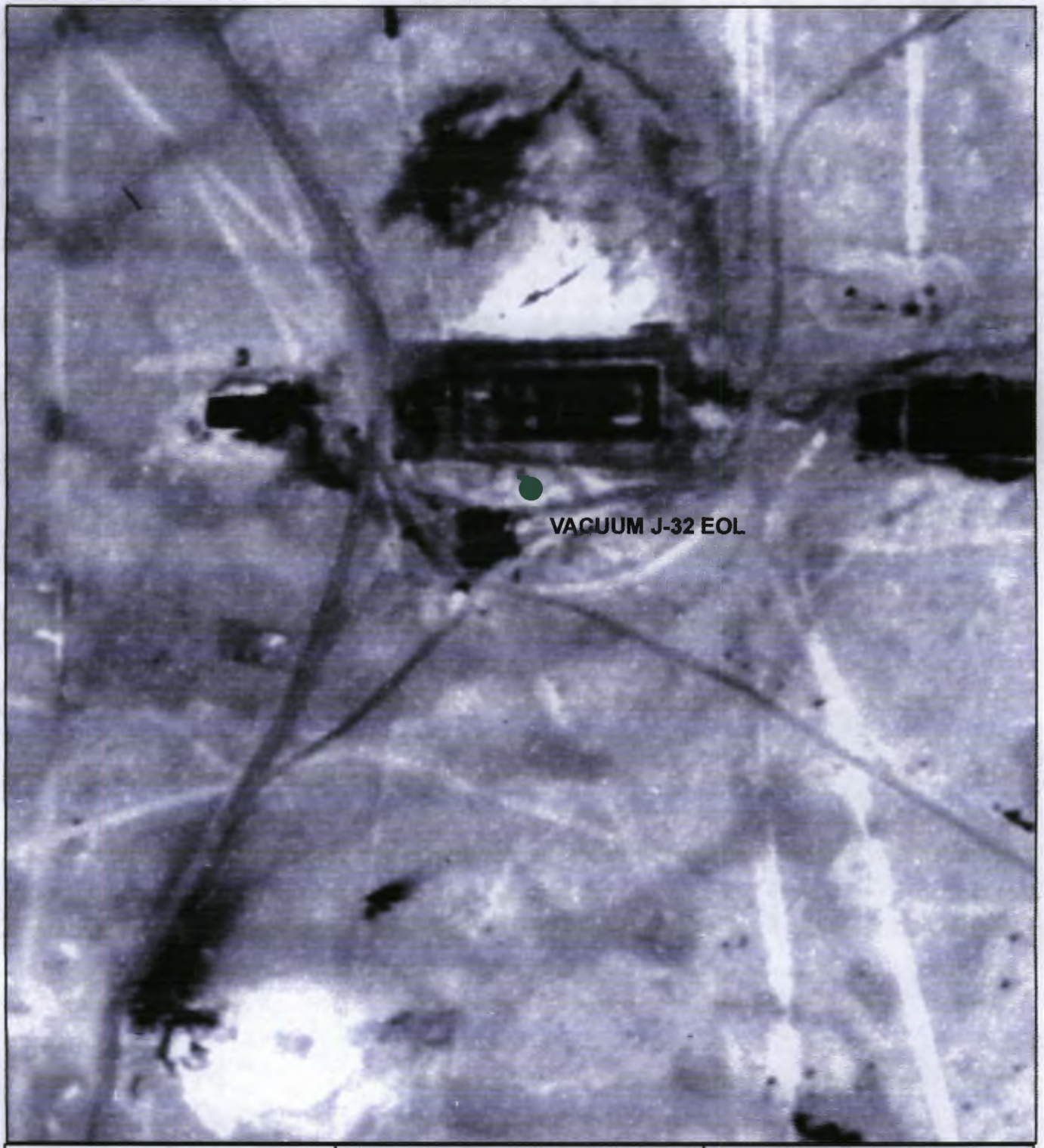
NMOCD Case #: 1R425-93

N
W E
S

0 50 100 200
Feet

Drawing date: 7-31-2013
Drafted by: LS

1949



RICE ENVIRONMENTAL
RECS
CONSULTING & SAFETY, LLC

Vacuum J-32 EOL

Unit J, Section 32, T17S, R35E
LEA COUNTY, NM
NMOCD Case #: 1R425-93

N
W E
S

0 50 100 200
Feet

Drawing date: 7-31-2013
Drafted by: LS

MULTIMED V1.01 DATE OF CALCULATIONS: 30-JUL-2013 TIME: 10:21: 9

U. S. E N V I R O N M E N T A L P R O T E C T I O N A G E N C Y

E X P O S U R E A S S E S S M E N T

M U L T I M E D I A M O D E L

MULTIMED (Version 1.50, 2005)

1
Run options
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Vacuum J-32 EOL

1R425-93
Chemical simulated is Chloride

Option Chosen Saturated and unsaturated zone models
Run was DETERMIN
Infiltration Specified By User: 7.620E-03 m/yr
Run was transient
Well Times: Entered Explicitly
Reject runs if Y coordinate outside plume
Reject runs if Z coordinate outside plume
Gaussian source used in saturated zone model
1
1
UNSATURATED ZONE FLOW MODEL PARAMETERS
(input parameter description and value)

NP	- Total number of nodal points	240
NMAT	- Number of different porous materials	1
KPROP	- Van Genuchten or Brooks and Corey	1
IMSHGN	- Spatial discretization option	1
NVFLAYR	- Number of layers in flow model	1

OPTIONS CHOSEN
------- ------
Van Genuchten functional coefficients
User defined coordinate system
1

Layer information

LAYER NO.	LAYER THICKNESS	MATERIAL PROPERTY
1	2.44	1

DATA FOR MATERIAL 1

VADOSE ZONE MATERIAL VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	PARAMETERS STD DEV	LIMITS MIN	LIMITS MAX
Saturated hydraulic conductivity	cm/hr	CONSTANT	3.60	-999.	-999.	-999.
Unsaturated zone porosity	--	CONSTANT	0.250	-999.	-999.	-999.
Air entry pressure head	m	CONSTANT	0.700	-999.	-999.	-999.
Depth of the unsaturated zone	m	CONSTANT	2.44	0.000	0.000	0.000

DATA FOR MATERIAL 1

VADOSE ZONE FUNCTION VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	PARAMETERS STD DEV	LIMITS MIN	LIMITS MAX
Residual water content	--	CONSTANT	0.116	-999.	-999.	-999.
Brook and Corey exponent,EN	--	CONSTANT	-999.	-999.	-999.	-999.
ALFA coefficient	1/cm	CONSTANT	0.500E-02	-999.	-999.	-999.
Van Genuchten exponent, ENN	--	CONSTANT	1.09	-999.	-999.	-999.

UNSATURATED ZONE TRANSPORT MODEL PARAMETERS

NLAY	- Number of different layers used		1
NTSTPS	- Number of time values concentration calc		40
DUMMY	- Not presently used		1
ISOL	- Type of scheme used in unsaturated zone		2
N	- Stehfest terms or number of increments		18
NTEL	- Points in Lagrangian interpolation		3
NGPTS	- Number of Gauss points		104
NIT	- Convolution integral segments		2
IBOUND	- Type of boundary condition		3
ITSGEN	- Time values generated or input		1
TMAX	- Max simulation time	--	0.0
WTFUN	- Weighting factor	--	1.2

OPTIONS CHOSEN

Convolution integral approach
Exponentially decaying continuous source
Computer generated times for computing concentrations

DATA FOR LAYER 1

VADOSE TRANSPORT VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS		LIMITS	
			MEAN	STD DEV	MIN	MAX
Thickness of layer	m	CONSTANT	2.44	-999.	-999.	-999.
Longitudinal dispersivity of layer	m	DERIVED	-999.	-999.	-999.	-999.
Percent organic matter	--	CONSTANT	0.000	-999.	-999.	-999.
Bulk density of soil for layer	g/cc	CONSTANT	1.99	-999.	-999.	-999.
Biological decay coefficient	1/yr	CONSTANT	0.000	-999.	-999.	-999.

1

CHEMICAL SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS		LIMITS	
			MEAN	STD DEV	MIN	MAX
Solid phase decay coefficient	1/yr	DERIVED	-999.	-999.	-999.	-999.
Dissolved phase decay coefficient	1/yr	DERIVED	-999.	-999.	-999.	-999.
Overall chemical decay coefficient	1/yr	DERIVED	-999.	-999.	-999.	-999.
Acid catalyzed hydrolysis rate	l/M-yr	CONSTANT	0.000	-999.	-999.	-999.
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000	-999.	-999.	-999.
Base catalyzed hydrolysis rate	l/M-yr	CONSTANT	0.000	-999.	-999.	-999.
Reference temperature	C	CONSTANT	25.0	-999.	-999.	-999.
Normalized distribution coefficient	ml/g	CONSTANT	0.000	-999.	-999.	-999.
Distribution coefficient	--	DERIVED	-999.	-999.	-999.	-999.
Biodegradation coefficient (sat. zone)	1/yr	CONSTANT	0.000	-999.	-999.	-999.
Air diffusion coefficient	cm2/s	CONSTANT	-999.	-999.	-999.	-999.
Reference temperature for air diffusion	C	CONSTANT	-999.	-999.	-999.	-999.
Molecular weight	g/M	CONSTANT	-999.	-999.	-999.	-999.
Mole fraction of solute	--	CONSTANT	-999.	-999.	-999.	-999.
Vapor pressure of solute	mm Hg	CONSTANT	-999.	-999.	-999.	-999.
Henry`s law constant	atm-m^3/M	CONSTANT	-999.	-999.	-999.	-999.
Overall 1st order decay sat. zone	1/yr	DERIVED	0.000	0.000	0.000	1.00
Not currently used		CONSTANT	0.000	0.000	0.000	0.000
Not currently used		CONSTANT	0.000	0.000	0.000	0.000

1

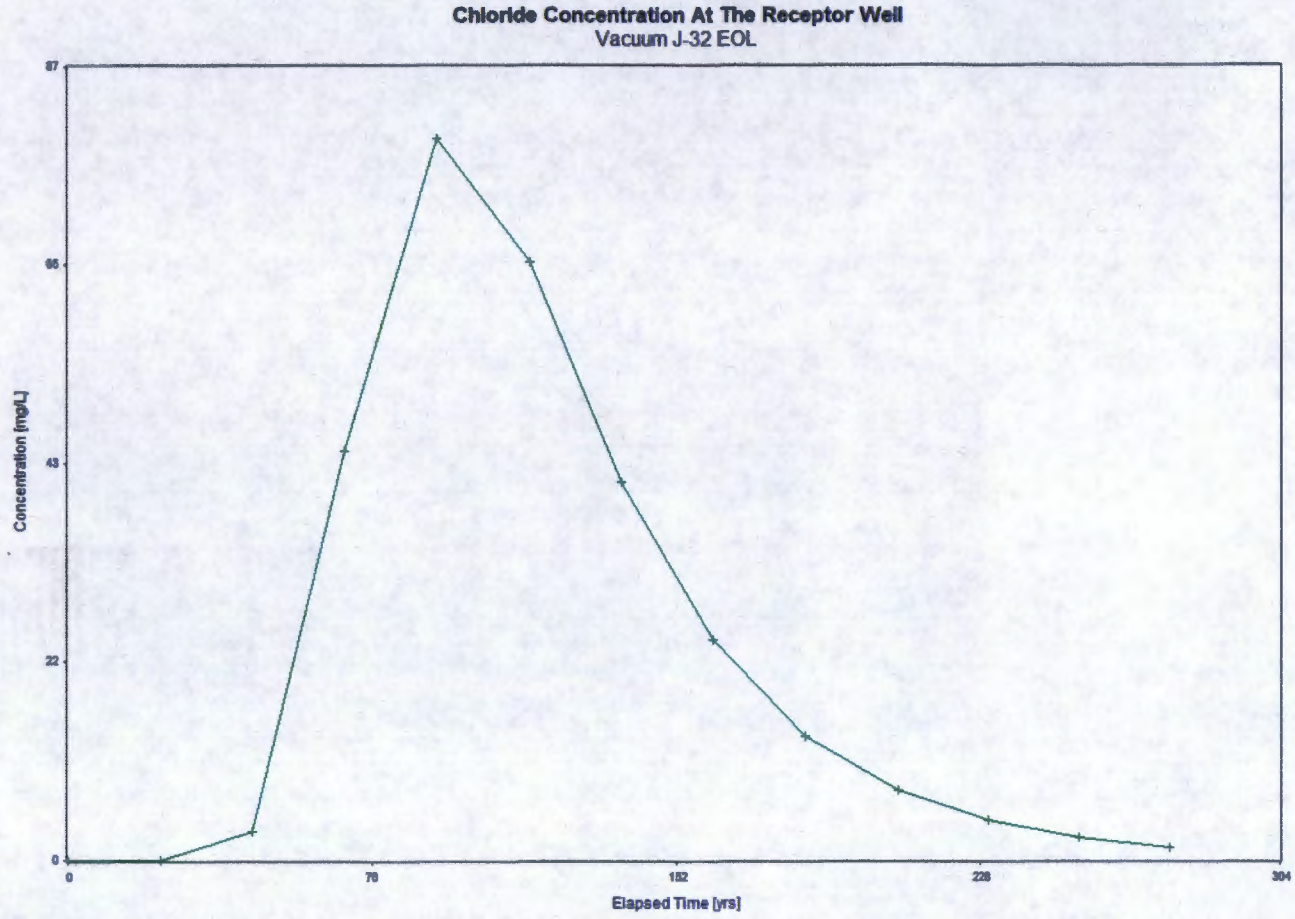
SOURCE SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS		LIMITS	
			MEAN	STD DEV	MIN	MAX
Infiltration rate	m/yr	CONSTANT	0.762E-02	-999.	-999.	-999.
Area of waste disposal unit	m^2	DERIVED	83.6	-999.	-999.	-999.
Duration of pulse	yr	DERIVED	50.0	-999.	-999.	-999.
Spread of contaminant source	m	DERIVED	-999.	-999.	-999.	-999.
Recharge rate	m/yr	CONSTANT	0.000	-999.	-999.	-999.
Source decay constant	1/yr	CONSTANT	0.250E-01	0.000	0.000	0.000
Initial concentration at landfill	mg/l	CONSTANT	992.	-999.	-999.	-999.
Length scale of facility	m	CONSTANT	9.14	-999.	-999.	-999.
Width scale of facility	m	CONSTANT	9.14	-999.	-999.	-999.
Near field dilution		DERIVED	1.00	0.000	0.000	1.00

AQUIFER SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS		LIMITS	
			MEAN	STD DEV	MIN	MAX
Particle diameter	cm	CONSTANT	-999.	-999.	-999.	-999.
Aquifer porosity	--	CONSTANT	0.300	-999.	-999.	-999.
Bulk density	g/cc	CONSTANT	1.86	-999.	-999.	-999.
Aquifer thickness	m	CONSTANT	6.10	-999.	-999.	-999.
Source thickness (mixing zone depth)	m	DERIVED	-999.	-999.	-999.	-999.
Conductivity (hydraulic)	m/yr	CONSTANT	315.	-999.	-999.	-999.
Gradient (hydraulic)		CONSTANT	0.300E-02	-999.	-999.	-999.
Groundwater seepage velocity	m/yr	DERIVED	-999.	-999.	-999.	-999.
Retardation coefficient	--	DERIVED	-999.	-999.	-999.	-999.
Longitudinal dispersivity	m	FUNCTION OF X	-999.	-999.	-999.	-999.
Transverse dispersivity	m	FUNCTION OF X	-999.	-999.	-999.	-999.
Vertical dispersivity	m	FUNCTION OF X	-999.	-999.	-999.	-999.
Temperature of aquifer	C	CONSTANT	20.0	-999.	-999.	-999.
pH	--	CONSTANT	7.00	-999.	-999.	-999.
Organic carbon content (fraction)		CONSTANT	0.000	-999.	-999.	-999.
Well distance from site	m	CONSTANT	1.00	-999.	-999.	-999.
Angle off center	degree	CONSTANT	0.000	-999.	-999.	-999.
Well vertical distance	m	CONSTANT	0.000	-999.	-999.	-999.

TIME	CONCENTRATION
0.000E+00	0.00000E+00
0.230E+02	0.00000E+00
0.460E+02	0.31115E+01
0.690E+02	0.44652E+02
0.920E+02	0.78795E+02
0.115E+03	0.65304E+02
0.138E+03	0.41237E+02
0.161E+03	0.23969E+02
0.184E+03	0.13565E+02
0.207E+03	0.76504E+01
0.230E+03	0.43062E+01
0.253E+03	0.24201E+01
0.276E+03	0.13582E+01


Chloride Concentration At The Receptor Well
Vacuum J-32 EOL
87
65
43
22
0
Concentration [mg/L]
0
76
152
228
304
Elapsed Time [yrs]