1R - 428-59

REPORTS

DATE:

2-18-13

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

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

February 18th, 2013

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

Re: **Remediation Termination Request**
Rice Operating Company – Hobbs A-6 vent
UL A, Section 6, T19S, R38E
OCD Case No. 1R428-59

Sent via Certified Mail w/ Return Receipt No. 7011 0110 0002 5197 1334

Mr. Hansen:

This letter summarizes the results of groundwater monitoring over the past several years for Rice Operating Company's Hobbs A-6 vent project.

Data that have been collected for this site since 2008 support the following observations:

- The direction of groundwater flow is believed to be toward the southeast based upon regional groundwater gradient, which generally parallels the ground surface topography (Appendix – Figure 1). The depth to groundwater (water table) is approximately 51 ft bgs.
- Residual soil chloride concentrations from a deep soil bore, SB-1 (Appendix – Figure 2) taken near the former vent location were ranged from 476 to 1,036 mg/kg from 0 to 35 ft bgs then dropped to 598 mg/kg at 45 ft bgs. Residual soil hydrocarbon levels were also elevated, measuring 3,738 mg/kg (PID) at 40 ft bgs but dropping to 169 mg/kg at 45 ft bgs. It is important to note, however, that these concentrations are from a point sample and may not be indicative of a widely affected *area*. Thus, the actual mass of residual contaminants may be less than these point-values suggest.
- Groundwater chloride concentrations have been low (< 100 mg/L) and BTEX below laboratory detection limits for the near-source monitor well (MW-1) located approximately 85 ft SE of the former vent location (Appendix – Figure 3).

The A-6 vent location had been in operation for approximately 40 years prior to its removal from service in 2008. It is therefore reasonable to believe that enough time has transpired to affect groundwater chloride or dissolved hydrocarbon (BTEX) concentrations in the near-source monitor well if the former junction box had contributed

sufficient chloride or hydrocarbon mass to do so. The fact that that this well has been clean since samples have been taken (beginning in 2009) indicates that the former junction box has not contributed sufficient contaminant mass to substantially affect groundwater quality.

The MultiMed simulation model was run to estimate the potential elevation in groundwater chloride and BTEX concentrations. Key input parameters for the chloride and BTEX simulations are given in the Appendix (Figure 4). The chloride model was run based on an initial soil chloride concentration of 598 mg/kg at 45 ft bgs moving through the lower 6+/- ft (2.0 m) of the unsaturated zone to the water table. The maximum predicted elevation in the concentration of chloride in groundwater 1 m down-gradient from the former junction box was 235 mg/liter 20 yrs from present (Appendix – Figures 5, 6). This is below the present WQCC groundwater standard of 250 mg/liter and it is consistent with the most recent (December 2012) observed groundwater chloride concentration of 52 mg/liter in the near-source monitor well (MW-1).

The BTEX models were run based on their initial soil concentrations (benzene 2.8, toluene 3.3, ethylbenzene 12.4 and xylene 44.7 mg/kg) at 40 ft bgs moving through the lower 11+/- ft (3.35 m) of the unsaturated zone to the water table. The maximum predicted elevation in groundwater BTEX 1m down-gradient from the former junction box was 0.00353 mg/l for benzene, 0.0041 mg/l for toluene, 0.0158 mg/l for ethylbenzene, and 0.0568 mg/l for xylene, below WQCC groundwater standards of 0.01 mg/l for benzene, 0.75 mg/l for toluene and ethylbenzene, and 0.62 mg/l for xylene (Appendix – Figures 5, 7-10).

Given that this former junction box is likely not the cause of present or potential future impact to groundwater quality and vegetation at the site has recovered (Appendix – Figure 11), we respectfully request that OCD grant remediation termination or similar regulatory closure status to this project.

ROC is the service provider (agent) for the Hobbs 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 ownership/usage basis.

Please do not hesitate to contact either Rice Operating Company or myself if you have any questions or need additional information.

Thank you for your consideration.

Sincerely,

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

Copy: Rice Operating Company

Attachments: Appendices as noted, above.

APPENDIX

Site Map

Figure 1

RICE ENVIRONMENTAL RECS CONSULTING & SAFETY, LLC

HOBBS A-6 VENT

UL/A SECTION 6
T-19-S R-38-E
LEA COUNTY, NM

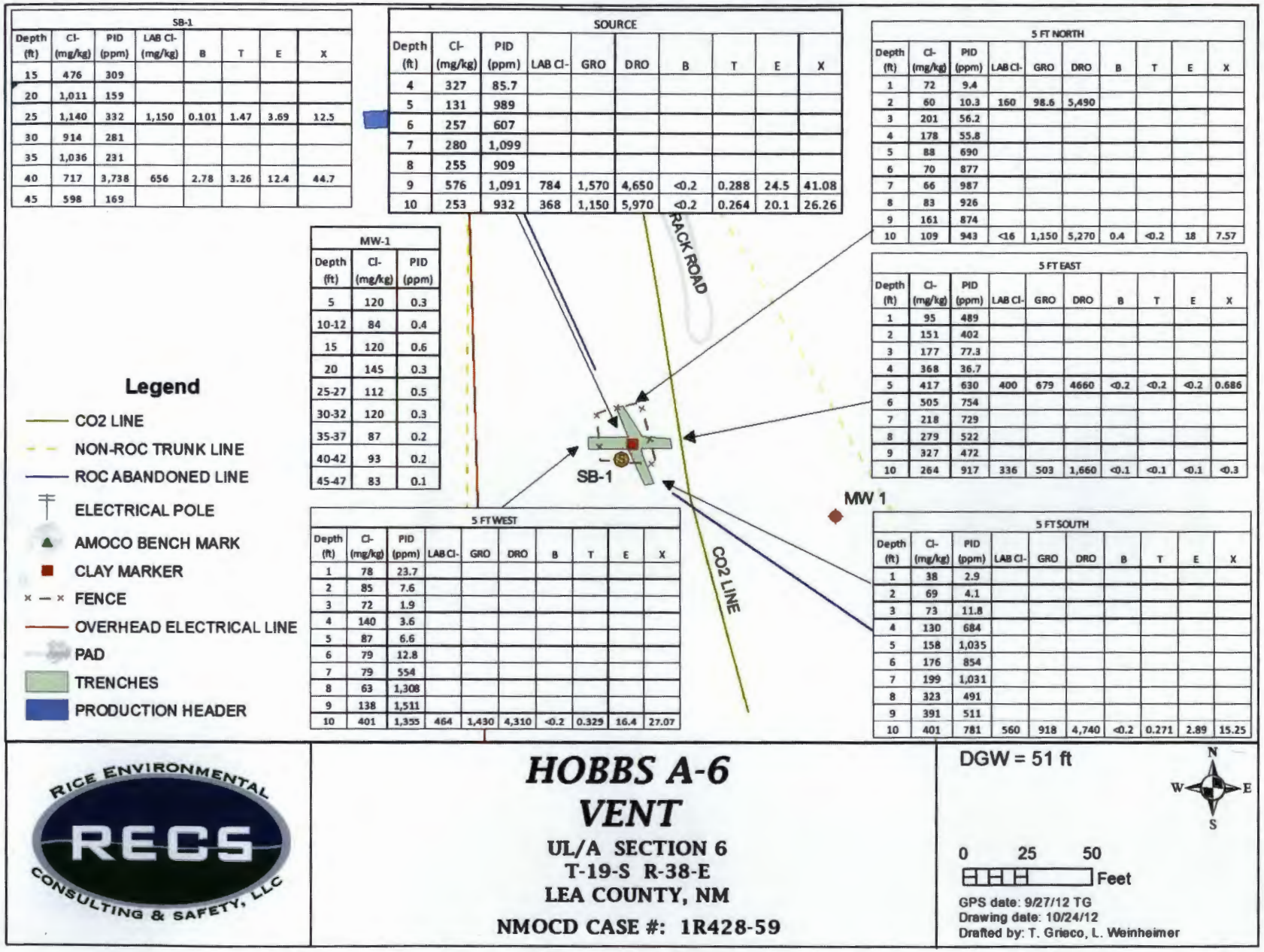
NMOCD CASE #: 1R428-59

N
W E
S

0 410 820
Feet

Drawing date: 10/23/12
Drafted by: L. Weinheimer

Figure 2



RICE ENVIRONMENTAL RECS CONSULTING & SAFETY, LLC

Figure 3

ROC Hobbs A-6 vent Groundwater Monitoring Results													
MW	Depth to Water	Total Depth	Well Volume	Volume Purged	Sample Date	Cl	TDS	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Sulfate	Comments
1	49.56	67.44	2.9	10	3/31/09	44	609	<0.001	<0.001	<0.001	<0.003	136	Clear No Odor
1	49.74	67.44	2.8	10	6/10/09	40	654	<0.001	<0.001	<0.001	<0.003	123	Clear No Odor
1	49.83	67.44	2.8	10	9/14/09	40	645	<0.001	<0.001	<0.001	<0.003	113	Clear No odor
1	49.92	67.44	2.8	10	11/20/09	40	611	<0.001	<0.001	<0.001	<0.003	90.6	Clear No odor
1	50.11	67.46	2.8	10	3/17/10	40	661	<0.001	<0.001	<0.001	<0.003	146	Clear No odor
1	50.26	67.46	2.8	10	6/8/10	44	673	<0.001	<0.001	<0.001	<0.003	130	Clear No odor
1	49.97	67.46	2.8	10	7/14/10	44	644	<0.001	<0.001	<0.001	<0.003	115	Clear No odor
1	49.23	67.46	2.9	10	12/7/10	44	537	<0.001	<0.001	<0.001	<0.003	109	Clear No odor
1	50.45	67.46	2.7	10	6/24/11	44	646	<0.001	<0.001	<0.001	<0.003	146	Clear No odor
1	50.82	67.46	2.7	10	12/14/11	44	676	<0.001	<0.001	<0.001	<0.003	168	Clear No odor
1	51.75	67.46	2.5	10	6/15/12	44	543	<0.001	<0.001	<0.001	<0.003	96	Clear No Odor
1	51.41	67.46	2.6	10	12/12/12	52	550	<0.001	<0.001	<0.001	<0.003	94	Clear No Odor

Figure 4a

MultiMed Key Parameter Values
Rice Operating Company
Texerra LLC
February 5, 2013
Facility: Hobbs Vent A-6 Chloride Model

Source

parameter	unit	value	justification/notes
Source area	m2	25	... estimated.
Source length	m		
Source width	m		
Source infiltration rate	m/yr	0.03048	... for facility w/ no subsurface liner.
Initial concentration	mg/l	598	... concentration @ 45 ft bgs from SB-1.
Source decay coeff	per year	2.5%	... assumed.

Unsat Zone Flow

parameter	unit	value	justification/notes
Flow layer thickness	m	2	... unsaturated depth beneath deepest chloride measurement in SB-1.
Sat hydraulic conductivity	cm/hr	3.6	... assumed.
Effective porosity	fraction	0.25	... assumed.

Unsat Zone Transport

parameter	unit	value	justification/notes
Transport layer thickness	m	2	... unsaturated depth beneath deepest chloride measurement in SB-1.
Bulk density	g/cm3	1.99	... calculated based on porosity.

Saturated Zone

parameter	unit	value	justification/notes
Aquifer thickness	m	6.10	... equivalent to 20 ft.
Mixing zone thickness	m		... let model derive value.
Effective porosity	fraction	0.3	... assumed.
Bulk density	g/cm3	1.855	... calculated based on porosity.
Sat hydraulic conductivity	m/yr	315	... representative for Ogalalla aquifer.
Hydraulic gradient	m/m	0.003	... estimated from regional surface topography.

Wel Loc and Time

parameter	unit	value	justification/notes
Radial distance to well	m	1	... prescribed by NMOCD.
Time step option	yrs	500 yrs @ 10 yr increments	... encompasses projected peak concentration.

Figure 4b

MultiMed Key Parameter Values
Rice Operating Company
Texerra LLC
February 5, 2013
Facility: Hobbs Vent A-6 BTEX Model

Source

parameter	unit	value	justification/notes
Source area	m2	25	... estimated.
Source length	m		
Source width	m		
Source infiltration rate	m/yr	0.03048	... for facility w/ no subsurface liner.
Initial concentrations	mg/l	2.8; 3.3; 12.4; 44.7	... benzene, toluene. ethylbenzene & xylene @ 40 ft bgs from SB-1
Source decay coeff	per year	2.5%	... assumed.
Sorbed phase biodecay rate	per year	25.0%	... assumed.
Dissolved phase biodecay rate	per year	25.0%	... assumed.

Unsat Zone Flow

parameter	unit	value	justification/notes
Flow layer thickness	m	3.35	... unsaturated depth beneath deepest BTEX measurement in SB-1.
Sat hydraulic conductivity	cm/hr	3.6	... assumed.
Effective porosity	fraction	0.25	... assumed.

Unsat Zone Transport

parameter	unit	value	justification/notes
Transport layer thickness	m	3.35	... unsaturated depth beneath deepest BTEX measurement in SB-1.
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Hydraulic gradient	m/m	0.003	... estimated from regional surface topography.

Wel Loc and Time

parameter	unit	value	justification/notes
Radial distance to well	m	1	... prescribed by NMOCD.
Time step option	yrs	500 yrs @ 10 yr increments	... encompasses projected peak concentration.

Rice Operating Company
Hobbs A-6 Vent
MultiMed Chloride & BTEX Initial Concentrations and Model
February 5, 2013

Intial Measured Soil CHLORIDE & BTEX Concentrations

	mg/kg	
Chloride	598	... @ 45 ft bgs from SB-1
Benzene	2.7800	... @ 40 ft bgs from SB-1
Toluene	3.2600	... @ 40 ft bgs from SB-1
Ethylbenzene	12.4000	... @ 40 ft bgs from SB-1
Xylene	44.7000	... @ 40 ft bgs from SB-1

MultiMed Projected Groundwater CHLORIDE & BTEX Concentrations 1m Downgradient

	mg/kg	... at year	WQCC Drinking Water Standard (mg/kg)	% of WQCC Standard
Chloride	235.00	20	250	94%
Benzene	0.0035	30	0.0100	35%
Toluene	0.0041	30	0.7500	1%
Ethylbenzene	0.0158	30	0.7500	2%
Xylene	0.0568	30	0.6200	9%

Projected Chloride Concentration 1m Downgradient from Source
[WQCC Standard is 250 mg/l]

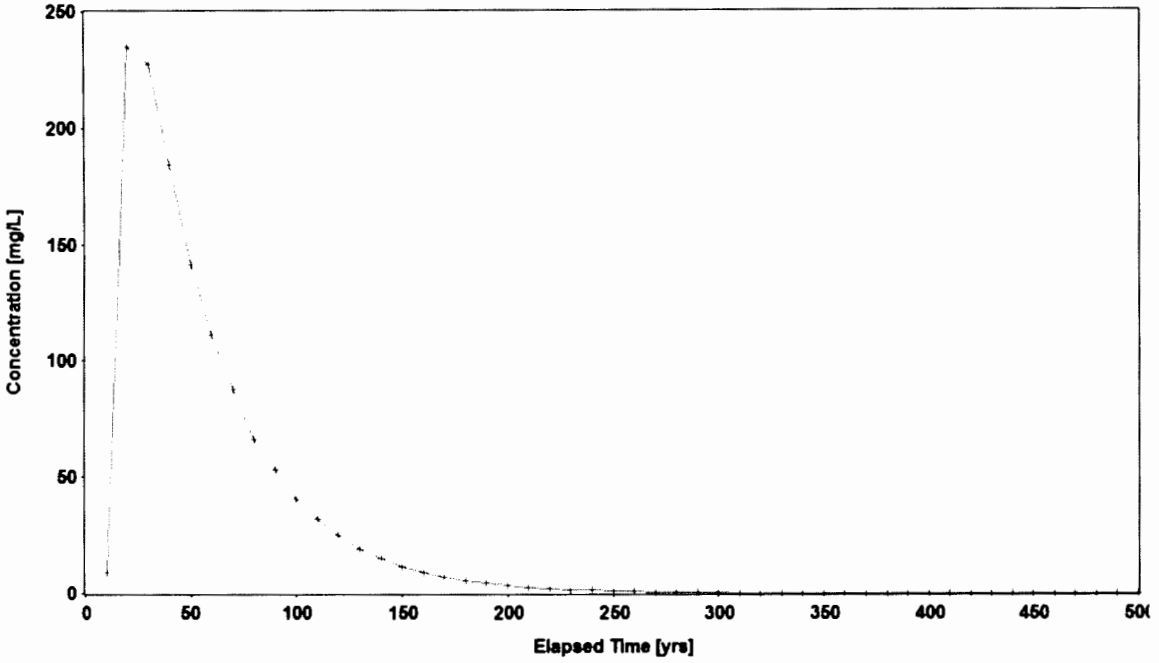


Figure 6b

U. S. ENVIRONMENTAL PROTECTION AGENCY

EXPOSURE ASSESSMENT

MULTIMEDIA MODEL

MULTIMED (Version 1.50, 2005)

1
Run options
--- -------

Chemical simulated is Chloride

Option Chosen Saturated and unsaturated zone models
Run was DETERMIN
Infiltration Specified By User: 3.048E-02 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	2.00	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	2.00	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.

1

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

1

DATA FOR LAYER 1

VADOSE TRANSPORT VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	PARAMETERS STD DEV	LIMITS MIN	LIMITS MAX
Thickness of layer	m	CONSTANT	2.00	-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 MEAN	STD DEV	LIMITS MIN	MAX
Solid phase decay coefficient	1/yr	CONSTANT	0.000	-999.	-999.	-999.
Dissolved phase decay coefficient	1/yr	CONSTANT	0.000	-999.	-999.	-999.
Overall chemical decay coefficient	1/yr	CONSTANT	0.000	-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 MEAN	STD DEV	LIMITS MIN	MAX
Infiltration rate	m/yr	CONSTANT	0.305E-01	-999.	-999.	-999.
Area of waste disposal unit	m^2	CONSTANT	25.0	-999.	-999.	-999.
Duration of pulse	yr	DERIVED	10.0	-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	598.	-999.	-999.	-999.
Length scale of facility	m	DERIVED	1.00	-999.	-999.	-999.
Width scale of facility	m	DERIVED	1.00	-999.	-999.	-999.
Near field dilution		DERIVED	1.00	0.000	0.000	1.00

1

AQUIFER SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	STD DEV	LIMITS 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	3.00	-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.

1

TIME	CONCENTRATION
0.100E+02	0.87825E+01
0.200E+02	0.23513E+03
0.300E+02	0.22735E+03
0.400E+02	0.18433E+03
0.500E+02	0.14172E+03
0.600E+02	0.11105E+03
0.700E+02	0.87647E+02
0.800E+02	0.65817E+02
0.900E+02	0.53194E+02
0.100E+03	0.40599E+02
0.110E+03	0.31868E+02
0.120E+03	0.25092E+02
0.130E+03	0.18896E+02
0.140E+03	0.15248E+02
0.150E+03	0.11602E+02
0.160E+03	0.91444E+01
0.170E+03	0.71823E+01
0.180E+03	0.54262E+01
0.190E+03	0.43704E+01
0.200E+03	0.33146E+01
0.210E+03	0.26237E+01
0.220E+03	0.20556E+01
0.230E+03	0.15582E+01
0.240E+03	0.12525E+01
0.250E+03	0.94682E+00
0.260E+03	0.75271E+00
0.270E+03	0.58823E+00
0.280E+03	0.44739E+00
0.290E+03	0.35889E+00
0.300E+03	0.27039E+00
0.310E+03	0.21591E+00
0.320E+03	0.16829E+00
0.330E+03	0.12844E+00
0.340E+03	0.10281E+00
0.350E+03	0.77191E-01
0.360E+03	0.61913E-01
0.370E+03	0.48126E-01
0.380E+03	0.36854E-01
0.390E+03	0.29436E-01
0.400E+03	0.22017E-01
0.410E+03	0.17738E-01
0.420E+03	0.13746E-01
0.430E+03	0.10560E-01
0.440E+03	0.84121E-02
0.450E+03	0.62642E-02

Hobbs A-6 vent (1R428-59) MultiMed Chloride 11.1.12

0.460E+03	0.50668E-02
0.470E+03	0.39111E-02
0.480E+03	0.30111E-02
0.490E+03	0.23892E-02
0.500E+03	0.17673E-02

Projected BENZENE Concentration 1m Downgradient from Source
[WQCC Standard is 0.01 mg/l]

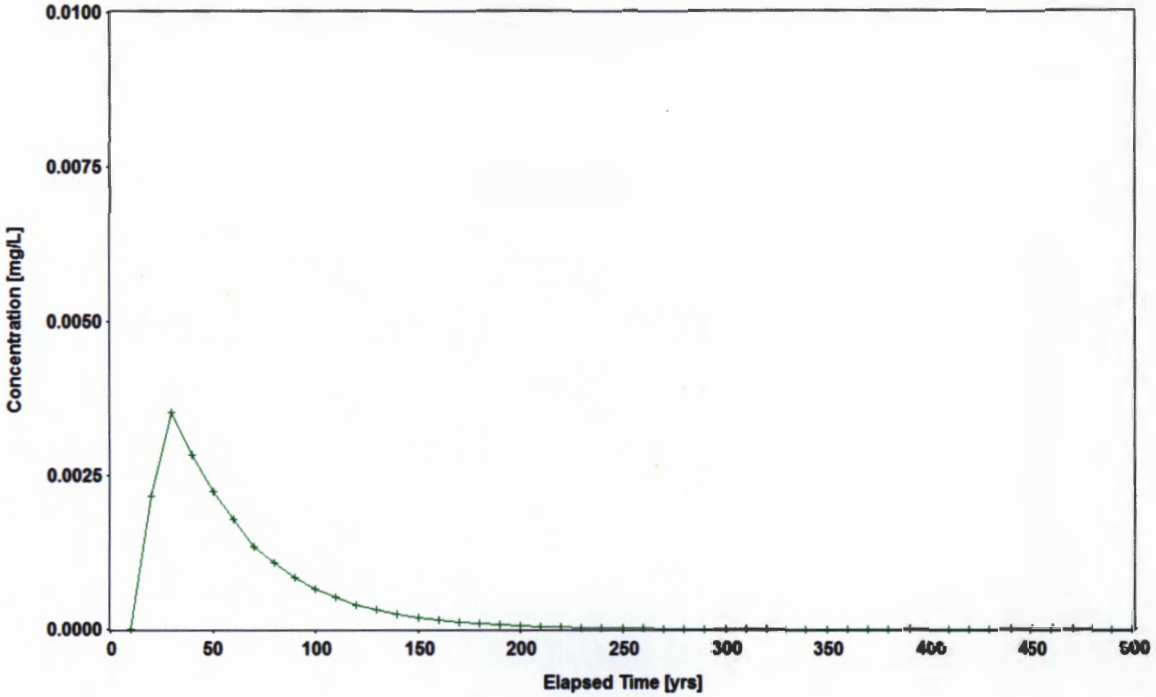


Figure 7b

MULTIMED V1.01 DATE OF CALCULATIONS: 5-FEB-2013 TIME: 14:38:38

U. S. ENVIRONMENTAL PROTECTION AGENCY

EXPOSURE ASSESSMENT

MULTIMEDIA MODEL

MULTIMED (Version 1.50, 2005)

1
Run options
--- -------

Chemical simulated is BENZENE

Option Chosen Saturated and unsaturated zone models
Run was DETERMIN
Infiltration Specified By User: 3.048E-02 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	3.35	1

DATA FOR MATERIAL 1

VADOSE ZONE MATERIAL VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	STD DEV	LIMITS MIN	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	3.35	0.000	0.000	0.000

DATA FOR MATERIAL 1

VADOSE ZONE FUNCTION VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	STD DEV	LIMITS MIN	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.

1

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

1

DATA FOR LAYER 1

VADOSE TRANSPORT VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	STD DEV	LIMITS MIN	MAX
Thickness of layer	m	CONSTANT	3.35	-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 MEAN	STD DEV	LIMITS MIN	MAX
Solid phase decay coefficient	1/yr	CONSTANT	0.250	-999.	-999.	-999.
Dissolved phase decay coefficient	1/yr	CONSTANT	0.250	-999.	-999.	-999.
Overall chemical decay coefficient	1/yr	CONSTANT	0.000	-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 MEAN	STD DEV	LIMITS MIN	MAX
Infiltration rate	m/yr	CONSTANT	0.305E-01	-999.	-999.	-999.
Area of waste disposal unit	m^2	CONSTANT	25.0	-999.	-999.	-999.
Duration of pulse	yr	DERIVED	10.0	-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	2.78	-999.	-999.	-999.
Length scale of facility	m	DERIVED	1.00	-999.	-999.	-999.
Width scale of facility	m	DERIVED	1.00	-999.	-999.	-999.
Near field dilution		DERIVED	1.00	0.000	0.000	1.00

1

AQUIFER SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	STD DEV	LIMITS 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	3.00	-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.

1

TIME	CONCENTRATION
0.100E+02	0.32359E-05
0.200E+02	0.21663E-02
0.300E+02	0.35333E-02
0.400E+02	0.28394E-02
0.500E+02	0.22489E-02
0.600E+02	0.17980E-02
0.700E+02	0.13472E-02
0.800E+02	0.10861E-02
0.900E+02	0.83772E-03
0.100E+03	0.65089E-03
0.110E+03	0.51410E-03
0.120E+03	0.38758E-03
0.130E+03	0.31216E-03
0.140E+03	0.23681E-03
0.150E+03	0.18789E-03
0.160E+03	0.14638E-03
0.170E+03	0.11225E-03
0.180E+03	0.89389E-04
0.190E+03	0.66756E-04
0.200E+03	0.54038E-04
0.210E+03	0.41445E-04
0.220E+03	0.32386E-04
0.230E+03	0.25449E-04
0.240E+03	0.19259E-04
0.250E+03	0.15438E-04

Hobbs A-6 vent (1R428-59) MultiMed BENZENE 02.05.2013 lpg

0.260E+03	0.11617E-04
0.270E+03	0.92621E-05
0.280E+03	0.71576E-05
0.290E+03	0.54960E-05
0.300E+03	0.43368E-05
0.310E+03	0.32313E-05
0.320E+03	0.25823E-05
0.330E+03	0.19438E-05
0.340E+03	0.15054E-05
0.350E+03	0.11537E-05
0.360E+03	0.85138E-06
0.370E+03	0.65765E-06
0.380E+03	0.46393E-06
0.390E+03	0.35086E-06
0.400E+03	0.24416E-06
0.410E+03	0.16340E-06
0.420E+03	0.10463E-06
0.430E+03	0.50020E-07
0.440E+03	0.17599E-07
0.450E+03	0.00000E+00
0.460E+03	0.00000E+00
0.470E+03	0.00000E+00
0.480E+03	0.00000E+00
0.490E+03	0.00000E+00
0.500E+03	0.00000E+00

Projected TOLUENE Concentration 1m Downgradient from Source
[WQCC Standard is 0.75 mg/l]

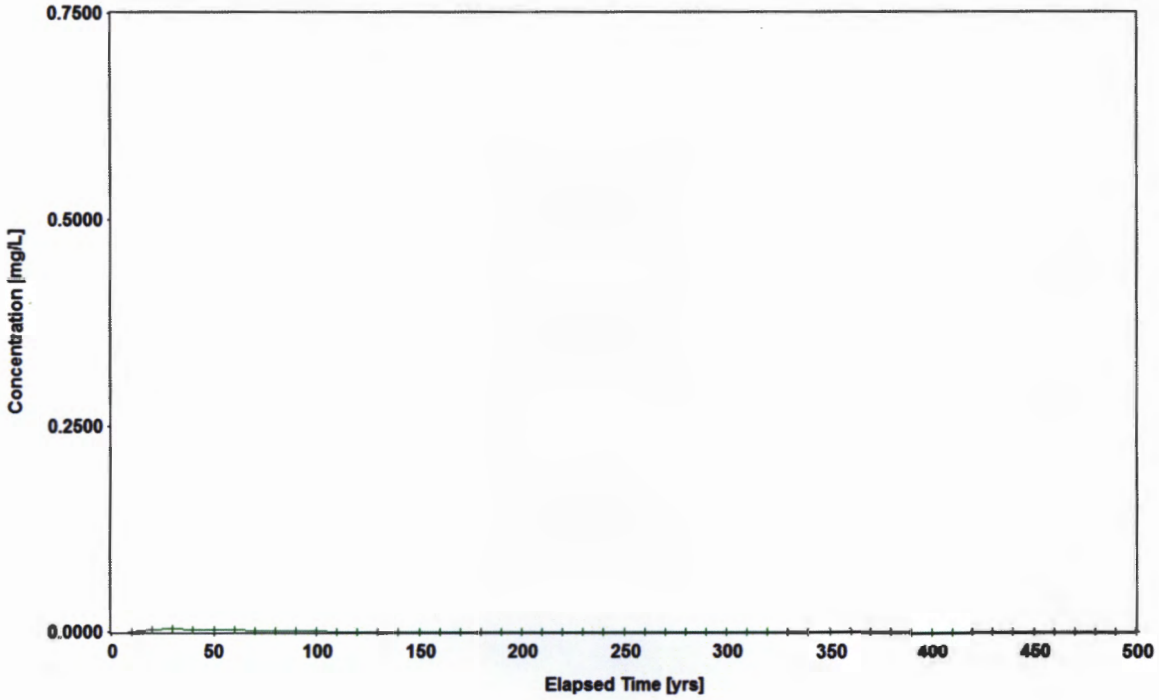


Figure 8b

```
                                                Hobbs A-6 vent (1R428-59) MultiMed TOLUENE 02.05.2013 lpg
   MULTIMED  V1.01   DATE OF CALCULATIONS:  5-FEB-2013  TIME: 14:41:11

                        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
 --- -------



 Chemical simulated is TOLUENE


 Option Chosen                          Saturated and unsaturated zone models
 Run was                                DETERMIN
 Infiltration Specified By User: 3.048E-02 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                  3.35              1

                                        DATA FOR MATERIAL  1
                                        ---- --- --------
                                    VADOSE ZONE MATERIAL VARIABLES

-------------------------------------------------------------------------------------------------------------------------------
                                                Page 1
```

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	3.35	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.

1

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

1

DATA FOR LAYER 1

VADOSE TRANSPORT VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	PARAMETERS STD DEV	LIMITS MIN	LIMITS MAX
Thickness of layer	m	CONSTANT	3.35	-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 MEAN	PARAMETERS STD DEV	LIMITS MIN	LIMITS MAX
Solid phase decay coefficient	1/yr	CONSTANT	0.250	-999.	-999.	-999.
Dissolved phase decay coefficient	1/yr	CONSTANT	0.250	-999.	-999.	-999.
Overall chemical decay coefficient	1/yr	CONSTANT	0.000	-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 MEAN	PARAMETERS STD DEV	LIMITS MIN	LIMITS MAX
Infiltration rate	m/yr	CONSTANT	0.305E-01	-999.	-999.	-999.
Area of waste disposal unit	m^2	CONSTANT	25.0	-999.	-999.	-999.
Duration of pulse	yr	DERIVED	10.0	-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	3.26	-999.	-999.	-999.
Length scale of facility	m	DERIVED	1.00	-999.	-999.	-999.
Width scale of facility	m	DERIVED	1.00	-999.	-999.	-999.
Near field dilution		DERIVED	1.00	0.000	0.000	1.00

1

AQUIFER SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	PARAMETERS STD DEV	LIMITS MIN	LIMITS 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	3.00	-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.

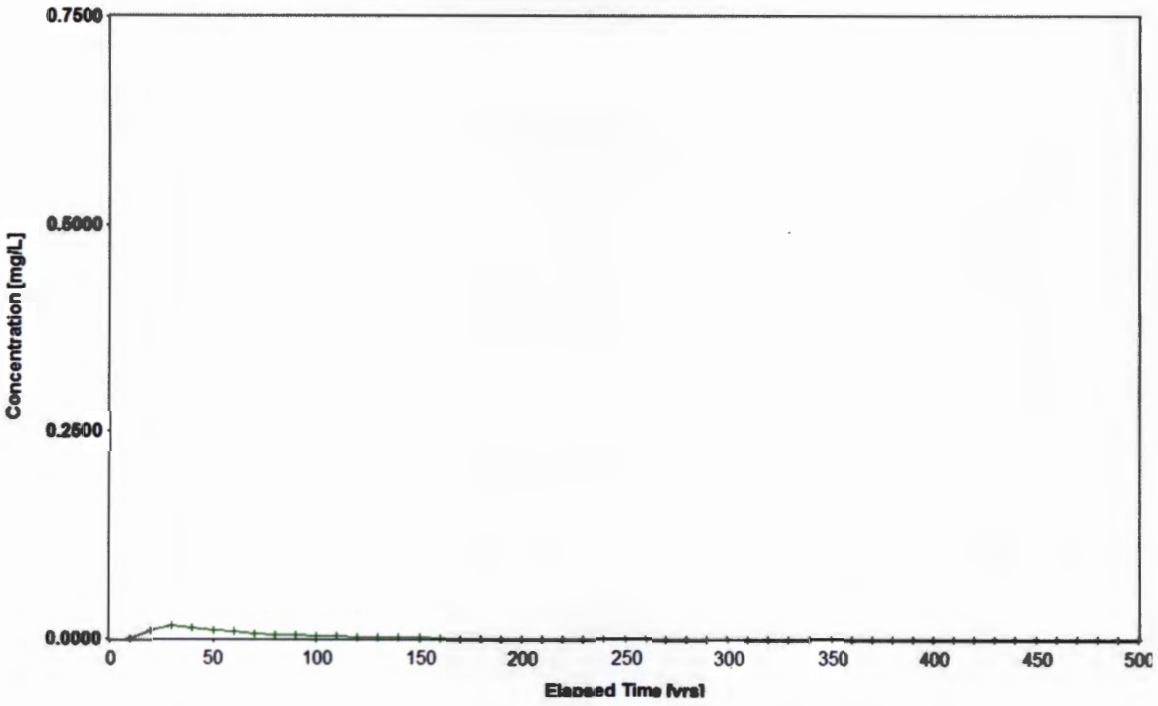
1

TIME	CONCENTRATION
0.100E+02	0.37946E-05
0.200E+02	0.25404E-02
0.300E+02	0.41433E-02
0.400E+02	0.33297E-02
0.500E+02	0.26372E-02
0.600E+02	0.21085E-02
0.700E+02	0.15798E-02
0.800E+02	0.12736E-02
0.900E+02	0.98236E-03
0.100E+03	0.76328E-03
0.110E+03	0.60286E-03
0.120E+03	0.45451E-03
0.130E+03	0.36606E-03
0.140E+03	0.27770E-03
0.150E+03	0.22033E-03
0.160E+03	0.17166E-03
0.170E+03	0.13163E-03
0.180E+03	0.10482E-03
0.190E+03	0.78282E-04
0.200E+03	0.63368E-04
0.210E+03	0.48601E-04
0.220E+03	0.37977E-04
0.230E+03	0.29844E-04
0.240E+03	0.22584E-04
0.250E+03	0.18104E-04
0.260E+03	0.13623E-04
0.270E+03	0.10861E-04
0.280E+03	0.83935E-05
0.290E+03	0.64449E-05
0.300E+03	0.50856E-05
0.310E+03	0.37892E-05
0.320E+03	0.30282E-05
0.330E+03	0.22795E-05
0.340E+03	0.17654E-05
0.350E+03	0.13529E-05
0.360E+03	0.99838E-06
0.370E+03	0.77120E-06
0.380E+03	0.54403E-06
0.390E+03	0.41144E-06
0.400E+03	0.28631E-06
0.410E+03	0.19162E-06
0.420E+03	0.12269E-06
0.430E+03	0.58657E-07
0.440E+03	0.20638E-07
0.450E+03	0.00000E+00

Hobbs A-6 vent (1R428-59) MultiMed TOLUENE 02.05.2013 lpg

0.460E+03	0.00000E+00
0.470E+03	0.00000E+00
0.480E+03	0.00000E+00
0.490E+03	0.00000E+00
0.500E+03	0.00000E+00

Projected ETHYLBENZENE Concentration 1m Downgradient from Source
[WQCC Standard is 0.75 mg/l]



MULTIMED V1.01 DATE OF CALCULATIONS: 5-FEB-2013 TIME: 14:42:21

Figure 9b

U. S. ENVIRONMENTAL PROTECTION AGENCY

EXPOSURE ASSESSMENT

MULTIMEDIA MODEL

MULTIMED (Version 1.50, 2005)

1

Run options

--- -------

Chemical simulated is ETHYLBENZENE

Option Chosen Saturated and unsaturated zone models
Run was DETERMIN
Infiltration Specified By User: 3.048E-02 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	3.35	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	3.35	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.

1

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

1

DATA FOR LAYER 1

VADOSE TRANSPORT VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	PARAMETERS STD DEV	LIMITS MIN	LIMITS MAX
Thickness of layer	m	CONSTANT	3.35	-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 MEAN	PARAMETERS STD DEV	LIMITS MIN	LIMITS MAX
Solid phase decay coefficient	1/yr	CONSTANT	0.250	-999.	-999.	-999.
Dissolved phase decay coefficient	1/yr	CONSTANT	0.250	-999.	-999.	-999.
Overall chemical decay coefficient	1/yr	CONSTANT	0.000	-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 MEAN	PARAMETERS STD DEV	LIMITS MIN	LIMITS MAX
Infiltration rate	m/yr	CONSTANT	0.305E-01	-999.	-999.	-999.
Area of waste disposal unit	m^2	CONSTANT	25.0	-999.	-999.	-999.
Duration of pulse	yr	DERIVED	10.0	-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	12.4	-999.	-999.	-999.
Length scale of facility	m	DERIVED	1.00	-999.	-999.	-999.
Width scale of facility	m	DERIVED	1.00	-999.	-999.	-999.
Near field dilution		DERIVED	1.00	0.000	0.000	1.00

1

AQUIFER SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	PARAMETERS STD DEV	LIMITS MIN	LIMITS 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	3.00	-999.	-999.	-999.
Conductivity (hydraulic)	m/yr	CONSTANT	315.	-999.	-999.	-999.
Gradient (hydraulic)		CONSTANT	0.300E-02	-999.	-999.	-999.

Hobbs A-6 vent (1R428-59) MultiMed ETHYLBENZENE 02.05.2013 lpg

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.

1

TIME	CONCENTRATION
0.100E+02	0.14434E-04
0.200E+02	0.96627E-02
0.300E+02	0.15760E-01
0.400E+02	0.12665E-01
0.500E+02	0.10031E-01
0.600E+02	0.80200E-02
0.700E+02	0.60091E-02
0.800E+02	0.48443E-02
0.900E+02	0.37366E-02
0.100E+03	0.29033E-02
0.110E+03	0.22931E-02
0.120E+03	0.17288E-02
0.130E+03	0.13924E-02
0.140E+03	0.10563E-02
0.150E+03	0.83806E-03
0.160E+03	0.65293E-03
0.170E+03	0.50068E-03
0.180E+03	0.39871E-03
0.190E+03	0.29776E-03
0.200E+03	0.24103E-03
0.210E+03	0.18486E-03
0.220E+03	0.14445E-03
0.230E+03	0.11352E-03
0.240E+03	0.85903E-04
0.250E+03	0.68860E-04
0.260E+03	0.51819E-04
0.270E+03	0.41313E-04
0.280E+03	0.31926E-04
0.290E+03	0.24514E-04
0.300E+03	0.19344E-04
0.310E+03	0.14413E-04
0.320E+03	0.11518E-04
0.330E+03	0.86704E-05
0.340E+03	0.67149E-05
0.350E+03	0.51462E-05
0.360E+03	0.37975E-05
0.370E+03	0.29334E-05
0.380E+03	0.20693E-05
0.390E+03	0.15650E-05
0.400E+03	0.10890E-05
0.410E+03	0.72886E-06
0.420E+03	0.46669E-06
0.430E+03	0.22311E-06
0.440E+03	0.78499E-07
0.450E+03	0.00000E+00

Hobbs A-6 vent (1R428-59) MultiMed ETHYLBENZENE 02.05.2013 lpg
0.460E+03 0.00000E+00
0.470E+03 0.00000E+00
0.480E+03 0.00000E+00
0.490E+03 0.00000E+00
0.500E+03 0.00000E+00

Projected XYLENE Concentration 1m Downgradient from Source
[WQCC Standard is 0.62 mg/l]

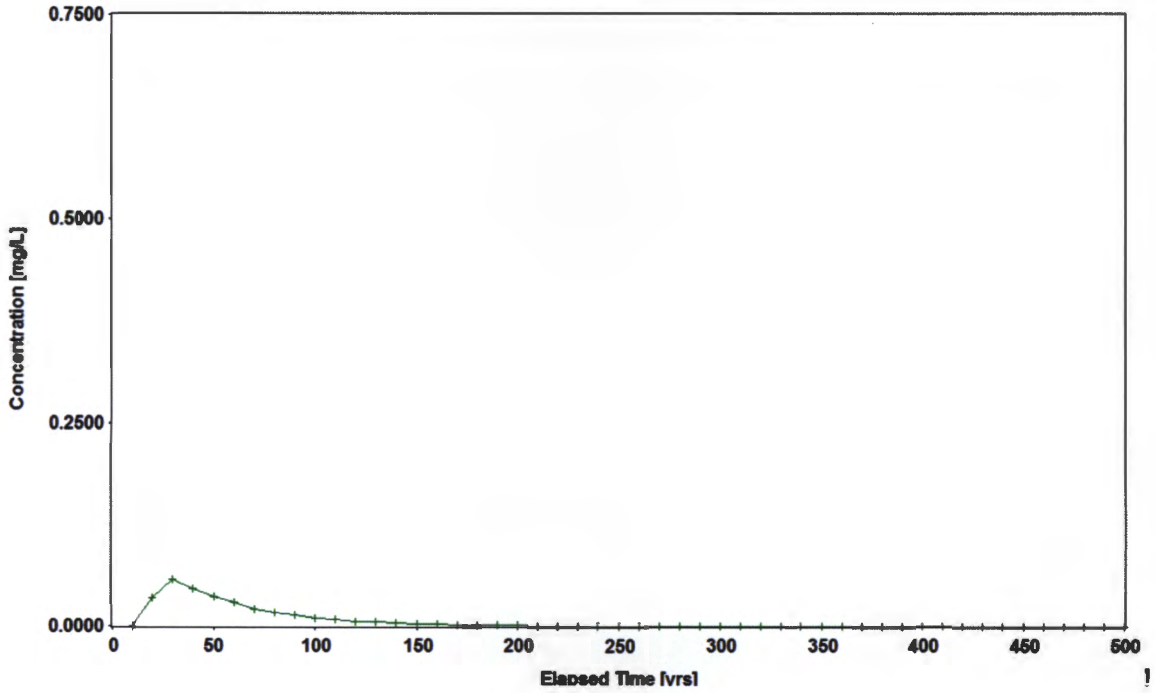


Figure 10b

MULTIMED V1.01 DATE OF CALCULATIONS: 5-FEB-2013 TIME: 14:43:19

U. S. ENVIRONMENTAL PROTECTION AGENCY

EXPOSURE ASSESSMENT

MULTIMEDIA MODEL

MULTIMED (Version 1.50, 2005)

1
Run options
--- -------

Chemical simulated is XYLENE

Option Chosen Saturated and unsaturated zone models
Run was DETERMIN
Infiltration Specified By User: 3.048E-02 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	3.35	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	3.35	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.

1

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

1

DATA FOR LAYER 1

VADOSE TRANSPORT VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	PARAMETERS STD DEV	LIMITS MIN	LIMITS MAX
Thickness of layer	m	CONSTANT	3.35	-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 MEAN	PARAMETERS STD DEV	LIMITS MIN	LIMITS MAX
Solid phase decay coefficient	1/yr	CONSTANT	0.250	-999.	-999.	-999.
Dissolved phase decay coefficient	1/yr	CONSTANT	0.250	-999.	-999.	-999.
Overall chemical decay coefficient	1/yr	CONSTANT	0.000	-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 MEAN	PARAMETERS STD DEV	LIMITS MIN	LIMITS MAX
Infiltration rate	m/yr	CONSTANT	0.305E-01	-999.	-999.	-999.
Area of waste disposal unit	m^2	CONSTANT	25.0	-999.	-999.	-999.
Duration of pulse	yr	DERIVED	10.0	-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	44.7	-999.	-999.	-999.
Length scale of facility	m	DERIVED	1.00	-999.	-999.	-999.
Width scale of facility	m	DERIVED	1.00	-999.	-999.	-999.
Near field dilution		DERIVED	1.00	0.000	0.000	1.00

1

AQUIFER SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS MEAN	PARAMETERS STD DEV	LIMITS MIN	LIMITS 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	3.00	-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.

1

TIME	CONCENTRATION
0.100E+02	0.52030E-04
0.200E+02	0.34833E-01
0.300E+02	0.56812E-01
0.400E+02	0.45656E-01
0.500E+02	0.36160E-01
0.600E+02	0.28911E-01
0.700E+02	0.21662E-01
0.800E+02	0.17463E-01
0.900E+02	0.13470E-01
0.100E+03	0.10466E-01
0.110E+03	0.82662E-02
0.120E+03	0.62320E-02
0.130E+03	0.50193E-02
0.140E+03	0.38077E-02
0.150E+03	0.30211E-02
0.160E+03	0.23537E-02
0.170E+03	0.18049E-02
0.180E+03	0.14373E-02
0.190E+03	0.10734E-02
0.200E+03	0.86888E-03
0.210E+03	0.66640E-03
0.220E+03	0.52073E-03
0.230E+03	0.40921E-03
0.240E+03	0.30967E-03
0.250E+03	0.24823E-03
0.260E+03	0.18680E-03
0.270E+03	0.14893E-03
0.280E+03	0.11509E-03
0.290E+03	0.88370E-04
0.300E+03	0.69732E-04
0.310E+03	0.51956E-04
0.320E+03	0.41522E-04
0.330E+03	0.31255E-04
0.340E+03	0.24206E-04
0.350E+03	0.18551E-04
0.360E+03	0.13689E-04
0.370E+03	0.10574E-04
0.380E+03	0.74596E-05
0.390E+03	0.56416E-05
0.400E+03	0.39258E-05
0.410E+03	0.26274E-05
0.420E+03	0.16823E-05
0.430E+03	0.80428E-06
0.440E+03	0.28298E-06
0.450E+03	0.00000E+00

Hobbs A-6 vent (1R428-59) MultiMed XYLENE 02.05.2013 lpg

0.460E+03	0.00000E+00
0.470E+03	0.00000E+00
0.480E+03	0.00000E+00
0.490E+03	0.00000E+00
0.500E+03	0.00000E+00

Hobbs A-6 vent (1R428-59)

Unit A, Section 6, T19S, R38E

Facing West 10/10/2012

Facing South 10/10/2012

CARDINAL Laboratories

Figure 12

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

December 21, 2012

Hack Conder

Rice Operating Company

112 W. Taylor

Hobbs, NM 88240

RE: HOBBS A-6 VENT

Enclosed are the results of analyses for samples received by the laboratory on 12/17/12 12:21.

Cardinal Laboratories is accredited through Texas NELAP under certificate number T104704398-11-3. Accreditation applies to drinking water, non-potable water and solid and chemical materials. All accredited analytes are denoted by an asterisk (*). For a complete list of accredited analytes and matrices visit the TCEQ website at www.tceq.texas.gov/field/qa/lab_accred_certif.html.

Cardinal Laboratories is accreditated through the State of Colorado Department of Public Health and Environment for:

Method EPA 552.2	Haloacetic Acids (HAA-5)
Method EPA 524.2	Total Trihalomethanes (TTHM)
Method EPA 524.4	Regulated VOCs (V1, V2, V3)

Accreditation applies to public drinking water matrices.

This report meets NELAP requirements and is made up of a cover page, analytical results, and a copy of the original chain-of-custody. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Celey D. Keene

Celey D. Keene

Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

Analytical Results For:

Rice Operating Company
Hack Conder
112 W. Taylor
Hobbs NM, 88240
Fax To: (575) 397-1471

Received:	12/17/2012	Sampling Date:	12/12/2012
Reported:	12/21/2012	Sampling Type:	Water
Project Name:	HOBBS A-6 VENT	Sampling Condition:	Cool & Intact
Project Number:	NONE GIVEN	Sample Received By:	Jodi Henson
Project Location:	T19S R38E SEC6 A-LEA CTY., NM		

Sample ID: MONITOR WELL #1 (H203019-01)

BTEX 8021B mg/L **Analyzed By: AP**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.001	0.001	12/17/2012	ND	0.047	94.1	0.0500	11.4	
Toluene*	<0.001	0.001	12/17/2012	ND	0.051	102	0.0500	10.1	
Ethylbenzene*	<0.001	0.001	12/17/2012	ND	0.050	99.1	0.0500	10.2	
Total Xylenes*	<0.003	0.003	12/17/2012	ND	0.151	101	0.150	10.9	
Total BTEX	<0.006	0.006	12/17/2012	ND					

Surrogate: 4-Bromofluorobenzene (PIL *117 %* *89.5-126*

Chloride, SM4500Cl-B mg/L **Analyzed By: AP**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride*	**52.0**	4.00	12/18/2012	ND	128	128	100	20.7	

Sulfate 375.4 mg/L **Analyzed By: AP**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Sulfate*	**94.0**	10.0	12/18/2012	ND	19.4	96.8	20.0	17.5	

TDS 160.1 mg/L **Analyzed By: AP**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
TDS*	**550**	5.00	12/18/2012	ND	223	92.9	240	5.13	

TPH 8015M mg/L **Analyzed By: MS**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<1.00	1.00	12/18/2012	ND	44.8	89.5	50.0	1.17	
DRO >C10-C28	<1.00	1.00	12/18/2012	ND	50.5	101	50.0	0.671	
EXT DRO >C28-C35	<1.00	1.00	12/18/2012	ND	ND		0.00		

Cardinal Laboratories

*=Accredited Analyte

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

Analytical Results For:

Rice Operating Company
Hack Conder
112 W. Taylor
Hobbs NM, 88240
Fax To: (575) 397-1471

Received:	12/17/2012	Sampling Date:	12/12/2012
Reported:	12/21/2012	Sampling Type:	Water
Project Name:	HOBBS A-6 VENT	Sampling Condition:	Cool & Intact
Project Number:	NONE GIVEN	Sample Received By:	Jodi Henson
Project Location:	T19S R38E SEC6 A-LEA CTY., NM		

Sample ID: MONITOR WELL #1 (H203019-01)

TPH 8015M **mg/L** **Analyzed By: MS**

Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Surrogate: 1-Chlorooctane	*82.7 %*	*48.7-164*							
Surrogate: 1-Chlorooctadecane	*95.5 %*	*54.8-165*							

Cardinal Laboratories

*=Accredited Analyte

Celey D. Keene, Lab Director/Quality Manager

CARDINAL Laboratories

PHONE (575) 393-2326 ° 101 E. MARLAND ° HOBBS, NM 88240

Notes and Definitions

ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference
**	Samples not received at proper temperature of 6°C or below.
***	Insufficient time to reach temperature.
-	Chloride by SM4500Cl-B does not require samples be received at or below 6°C
	Samples reported on an as received basis (wet) unless otherwise noted on report

Celey D. Keene, Lab Director/Quality Manager

101 East Marland - Hobbs, New Mexico
88240 Tel
(575) 393-2326 Fax
(575) 393-2476

Cardinal Laboratories, Inc.

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

LAB Order ID # _____

Company Name: RICE Operating Company	BILL TO Company: RICE Operating Company PO#
Project Manager: Hack Conder	Address: (Street, City, Zip) 122 W Taylor Street ~ Hobbs, New Mexico 88240
Address: (Street, City, Zip) 122 W Taylor Street ~ Hobbs, New Mexico 88240	Phone#: (575) 393-9174 Fax#: (575)397-1471
Phone #: (575) 393-9174	Fax #: (575) 397-1471
Project #:	Project Name: Hobbs A-6 Vent
Project Location: T19S R38E Sec 6A ~ Lea County - New Mexico	Sampler Signature: Rozanne Johnson (575)631-9310

ANALYSIS REQUEST
(Circle or Specify Method No.)

LAB # (LAB USE ONLY)	FIELD CODE	(G)rab or (C)omp	# CONTAINERS	MATRIX: WATER	SOIL	AIR	SLUDGE	PRESERVATIVE METHOD: HCL (2 40ml VOA)	HNO_3	$NaHSO_4$	H_2SO_4	ICE (1-500ml HDPE)	NONE	SAMPLING: DATE (2012)	TIME
1	Monitor Well #1	G	6	X				5				1		12-12	15:45

MTBE 8021B/602	BTEX 8021B/602	TPH 418.1/TX1005 / TX1005 Extended (C35)	TPH 8015 Extended DRO	Total Metals Ag As Ba Cd Cr Pb Se Hg 6010B/200.7	TCLP Metals Ag As Ba Cd Cr Pb Se Hg	TCLP Volatiles	TCLP Semi Volatiles	TCLP Pesticides	RCI	GC/MS Vol. 8260B/624	GC/MS Semi. Vol. 8270C/625	PCB's 8082/608	Pesticides 8081A/608	BOD, TSS, pH	Moisture Content	Cations (Ca, Mg, Na, K)	Anions (Cl, SO4, CO3, HCO3)	Sulfates	Total Dissolved Solids	Chlorides	Turn Around Time ~ 24 Hours
	X		X															X	X	X	

Relinquished by: Rozanne Johnson	Date: 12-17-2012	Time: 10:10	Received by:	Date: 12-17-2012	Time: 10:11
Relinquished by:	Date: 12-17-12	Time: 12:26	Received By: (Laboratory Staff)	Date: 12/17/12	Time: 12:26

Phone Results: ☐ Yes ☐ No
Fax Results: ☐ Yes ☐ No Additional Fax Number:

REMARKS:

Email Results to: hconder@riceswd.com
rozanne@valornet.com

Delivered By: (Circle One)
Sampler - UPS - Bus - Other:

Sample Condition: Cool: Yes ☑ No ☐ Intact: Yes ☑ No ☐

CHECKED BY: (Initials)