

1R - 2565

REPORTS

DATE:

8-30-12

Hansen, Edward J., EMNRD

From: Laura Pena <lpena@riceswd.com>
Sent: Thursday, August 30, 2012 9:58 AM
To: Hansen, Edward J., EMNRD
Cc: Hack Conder; Katie Jones
Subject: ROC - Justis E-23 AD (1RP-2565) Multimed
Attachments: Justis E-23 AD (1RP-2565) Soil Data.jpg; Justis E-23 AD (1RP-2565) Multimed.inp; Justis E-23 AD (1RP-2565) Multimed.pdf; Justis E-23 AD (1RP-2565) Chloride Graph.pdf; Justis E-23 AD Soil Data.xlsx

Mr. Hansen,

The following details the attached Multimed file for the Justis E-23 AD (1R-2565), as requested during the meeting between ROC and NMOCD on August 7th, 2012.

This file uses the parameters submitted to NMOCD in the Multimed Study report. Site specific parameters are as follows:

- Initial Concentration: an average of all vertical and soil bore in and near the installed liner (SB-1, SB-2, SB-3, SB-4, SB-5 and Vertical 3) data of 2,200 mg/L. The top 5 ft of SB-1, SB-2, SB-3, and Vertical 3 were excavated and replaced with soil containing a chloride concentration of <250 mg/L; therefore, 250 mg/L was used at those depths to calculate the average concentration.
- Layer Thickness: an average of all soil bore depths subtracted from the depth to groundwater (75 ft – 49 ft) to yield 26 ft or 8 meters.
- An estimated area of 35 ft x 67 ft (2345 ft² or 218 m²).
- An aquifer thickness of 20 ft (6.10 meters).

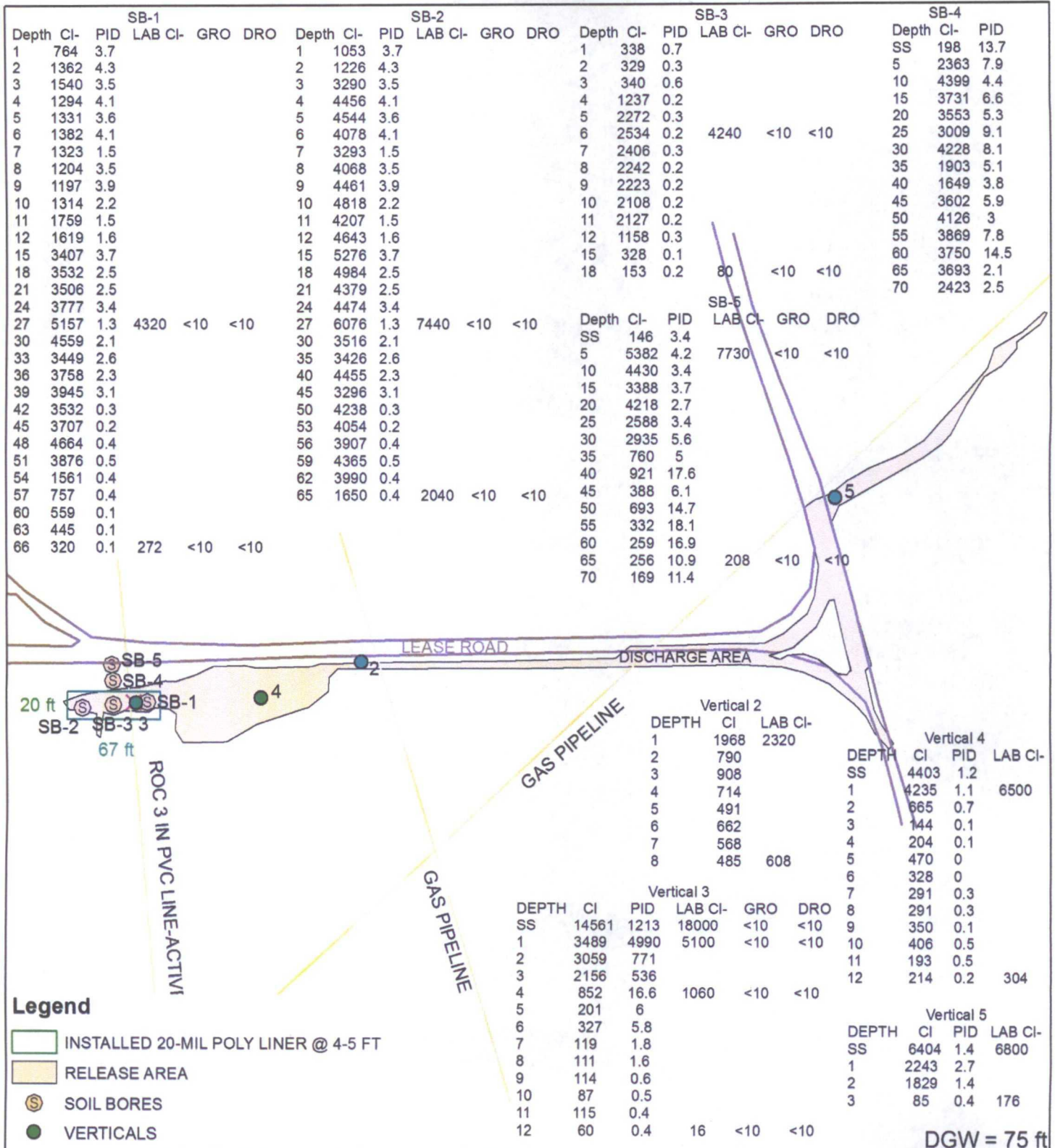
The result of this model indicates that the maximum chloride concentration is approximately 212.4 mg/L at 143 years, falling below the WQCC standard of 250 mg/L. A graph depicting chloride concentration over time is attached.

Let Hack Conder, Katie Jones or me know if you have any questions or require any additional information.

Thank you,

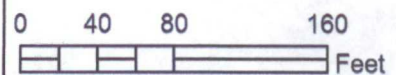
Laura Peña
Environmental Project Scientist
RICE Operating Company

Vertical & SB Bore Installation and Liner



JUSTIS E-23 AD

Legals: UL/E SEC. 23
T-24-S R-37-E
Case number: 1RP-2565



Drawing date: 5/22/12
Drafted by: L. Weinheimer

Justis E-23 AD (1RP-2565)

Unit E, Section 23, T24S, R37E

Depth to GW: 75 ft

Inside Liner

SB-1		SB-2		SB-3		Vert 3	
						SS	250
1	250	1	250	1	250	1	250
2	250	2	250	2	250	2	250
3	250	3	250	3	250	3	250
4	250	4	250	4	250	4	250
5	250	5	250	5	250	5	250
6	1,382	6	4,078	6	2,534	6	327
7	1,323	7	3,293	7	2,406	7	119
8	1,204	8	4,068	8	2,242	8	111
9	1,197	9	4,461	9	2,223	9	114
10	1,314	10	4,818	10	2,108	10	87
11	1,759	11	4,207	11	2,127	11	115
12	1,619	12	4,643	12	1,158	12	60
15	3,407	15	5,276	15	328		
18	3,532	18	4,984	18	153		
21	3,506	21	4,379				
24	3,777	24	4,474				
27	5,157	27	6,076				
30	4,559	30	3,516				
33	3,449	35	3,426				
36	3,758	40	4,455				
39	3,945	45	3,296				
42	3,532	50	4,238				
45	3,707	53	4,054				
48	4,664	56	3,907				
51	3,876	59	4,365				
54	1,561	62	3,990				
57	757	65	1,650				
60	559						
63	445						
66	320						

Outside Liner

SB-4		SB-5		Vert 2		Vert 4		Vert 5	
SS	198	SS	146			SS	250	SS	250
5	2,363	5	5,382	1	250	1	250	1	250
10	4,399	10	4,430	2	790	2	665	2	1,829
15	3,731	15	4,218	3	908	3	144	3	85
20	3,553	20	3,388	4	714	4	204		
25	3,009	25	2,935	5	491	5	470		
30	4,228	30	2,588	6	662	6	328		
35	1,903	35	921	7	568	7	291		
40	1,649	40	760	8	485	8	291		
45	3,602	45	693			9	350		
50	4,126	50	388			10	406		
55	3,869	55	332			11	193		
60	3,750	60	259			12	214		
65	3,693	65	256						
70	2,423	70	169						

Average 2,185 3,441 1,181 187 3,100 1,791 609 312 604

Average Chloride Concentration 2,200

Average SB Depth 49

Average SB Depth minus Depth to GW 26

Justis E-23 AD (1RP-2565) Multimed.out
MULTIMED V1.01 DATE OF CALCULATIONS: 29-AUG-2012 TIME: 9:21:56

U. S. ENVIRONMENTAL PROTECTION AGENCY

EXPOSURE ASSESSMENT

MULTIMEDIA MODEL

MULTIMED (Version 1.50, 2005)

1
Run options

Justis E-23 AD

Chemical simulated is Chloride

Option Chosen Saturated and unsaturated zone models
Run was DETERMIN
Infiltration Specified By User: 1.524E-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	8.00	1

DATA FOR MATERIAL 1

Justis E-23 AD (1RP-2565) Multimed.out

VADOSE ZONE MATERIAL VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS		LIMITS	
			MEAN	STD DEV	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	8.00	0.000	0.000	0.000

DATA FOR MATERIAL 1

VADOSE ZONE FUNCTION VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS		LIMITS	
			MEAN	STD DEV	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

Justis E-23 AD (1RP-2565) Multimed.out

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS		LIMITS	
			MEAN	STD DEV	MIN	MAX
Thickness of layer	m	CONSTANT	8.00	-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.

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	1/M-yr	CONSTANT	0.000	-999.	-999.	-999.
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000	-999.	-999.	-999.
Base catalyzed hydrolysis rate	1/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

SOURCE SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS		LIMITS	
			MEAN	STD DEV	MIN	MAX
Infiltration rate	m/yr	CONSTANT	0.152E-01	-999.	-999.	-999.
Area of waste disposal unit	m ²	CONSTANT	218.	-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	0.220E+04	-999.	-999.	-999.
Length scale of facility	m	DERIVED	-999.	-999.	-999.	-999.
Width scale of facility	m	DERIVED	-999.	-999.	-999.	-999.
Near field dilution		DERIVED	1.00	0.000	0.000	1.00

1

Justis E-23 AD (1RP-2565) Multimed.out

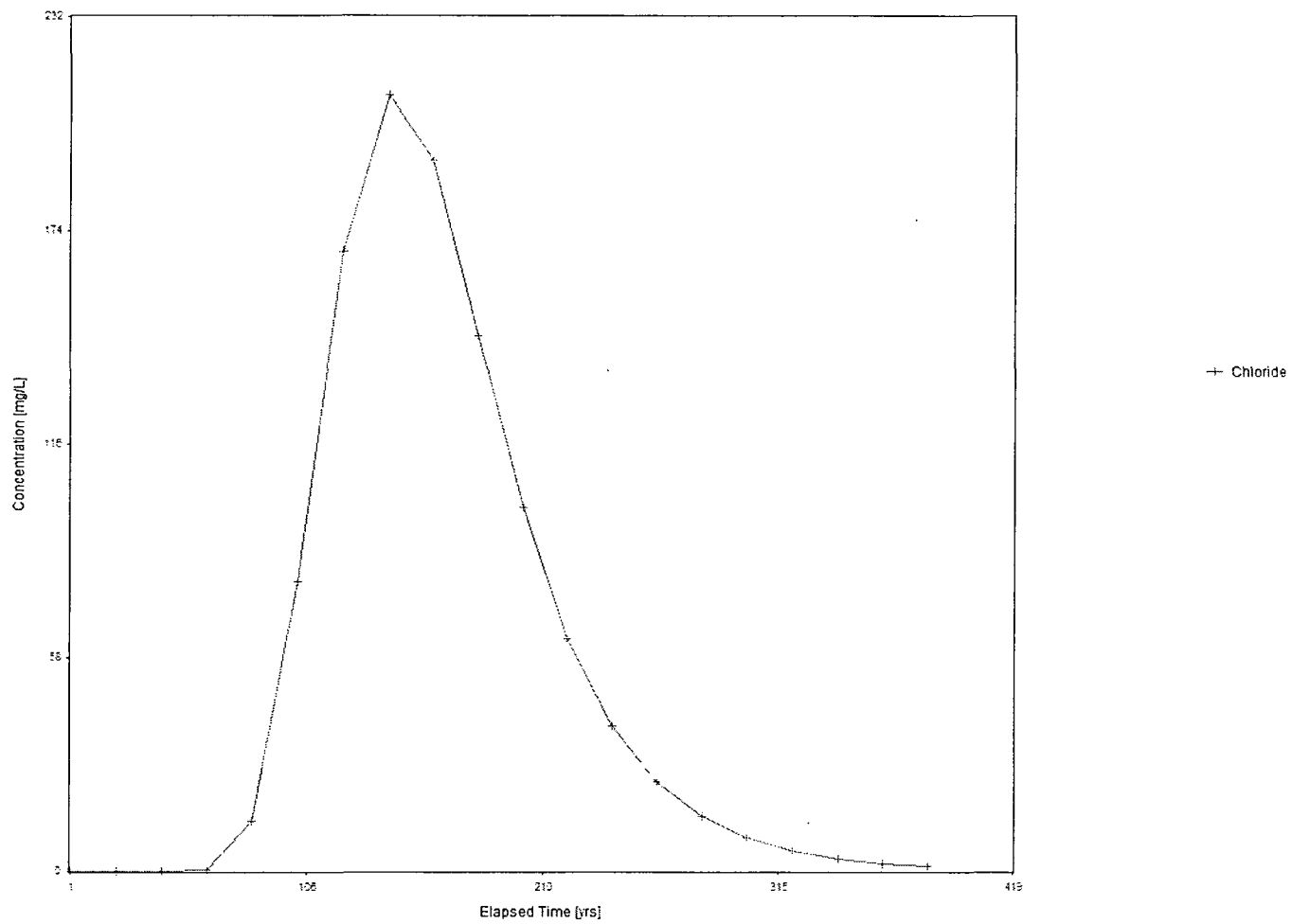
AQUIFER SPECIFIC VARIABLES

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	0.400E-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+01	0.00000E+00
0.210E+02	0.00000E+00
0.410E+02	0.00000E+00
0.610E+02	0.44725E+00
0.810E+02	0.13733E+02
0.101E+03	0.78736E+02
0.121E+03	0.16853E+03
0.141E+03	0.21079E+03
0.161E+03	0.19292E+03
0.181E+03	0.14529E+03
0.201E+03	0.98873E+02
0.221E+03	0.63317E+02
0.241E+03	0.39444E+02
0.261E+03	0.24262E+02
0.281E+03	0.14781E+02
0.301E+03	0.89460E+01
0.321E+03	0.54436E+01
0.341E+03	0.33092E+01
0.361E+03	0.20045E+01
0.381E+03	0.12094E+01

Chloride Concentration At The Receptor Well
Justis E-23 AD



From: Laura Pena
To: Edward J. Hansen, EMNRD
Cc: Hack Conder
Subject: ROC - Justis E-23 AD (1RP-2565) Multimed Files
Date: Friday, July 20, 2012 1:36:00 PM
Attachments: [Justis E-23 AD Multimed 1.inp](#)
[Justis E-23 AD Multimed 1.pdf](#)
[Justis E-23 AD MultiMed 1 Chloride Graph.pdf](#)
[Justis E-23 AD Multimed 2 Chloride Graph.pdf](#)
[Justis E-23 AD Multimed 2.inp](#)
[Justis E-23 AD Multimed 2.pdf](#)
[JUSTIS E-23 SB Installation.jpg](#)

Mr. Hansen,

Hack asked me to send you the Multimed files ran on the Justis E-23 AD (1RP-2565) site. Two Multimed input files have been attached:

Justis E-23 AD Multimed 1:

This file uses the parameters submitted to NMOCD in the Multimed Study report. An average of all soil bore data (2,763 mg/L) was used for the initial concentration and an infiltration rate of 0.01524 m (clay/poor liner) was used. Multimed yielded a maximum concentration of 100.9 mg/L at 375 years.

Justis E-23 AD Multimed 2:

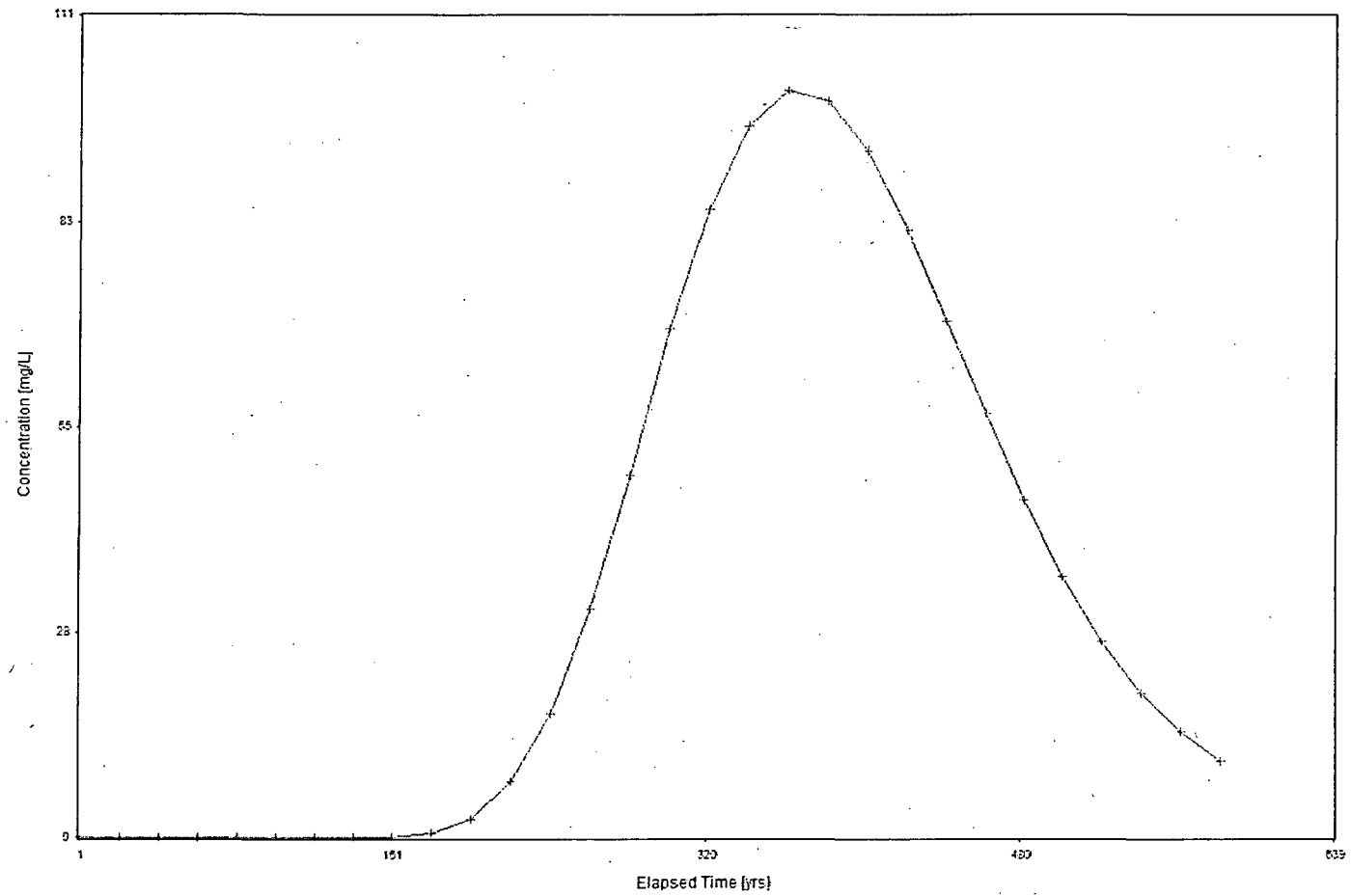
Another Multimed file was created to demonstrate a maximum concentration with no liner (an infiltration rate of 0.03048 m). Please note, two soil bores were drilled on July 10th, 2012 (see attached plat). For this Multimed calculation, the soil bores and vertical located within the excavation (SB-1, SB-2, SB-3 and Vertical 3) and the two recently installed soil bores (SB-4, SB-5) were averaged together. For the sites where data did not reach 70' bgs, the data for the last field test was extrapolated throughout. The calculated average was 1,917 mg/L. The maximum concentration would be 217 mg/L at 200 years.

Taking into account that Justis E-23 AD does have a good/plastic liner (installed the week of July 2nd) and by with using conservative parameters of no liner and extrapolated field data, this site passes NMOCD guidelines.

If you have any questions or need further information, please contact Hack Conder at 575-393-9174.

Thank you.
Laura

Chloride Concentration At The Receptor Well
Justis E-23 AD



U. S. ENVIRONMENTAL PROTECTION AGENCY

EXPOSURE ASSESSMENT

MULTIMEDIA MODEL

MULTIMED (Version 1.50, 2005)

1

Run options

Justis E-23 AD

Multimed 1

Chemical simulated is Chloride

Option Chosen Saturated and unsaturated zone models
Run was DETERMIN
Infiltration Specified By User: 1.524E-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	23.00	1

VADOSE ZONE MATERIAL VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS		LIMITS	
			MEAN	STD DEV	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	23.0	0.000	0.000	0.000

DATA FOR MATERIAL 1

VADOSE ZONE FUNCTION VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS		LIMITS	
			MEAN	STD DEV	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.

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	23.0	-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.

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	1/M-yr	CONSTANT	0.000	-999.	-999.	-999.
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000	-999.	-999.	-999.
Base catalyzed hydrolysis rate	1/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

SOURCE SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS		LIMITS	
			MEAN	STD DEV	MIN	MAX
Infiltration rate	m/yr	CONSTANT	0.152E-01	-999.	-999.	-999.
Area of waste disposal unit	m^2	DERIVED	124.	-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	0.276E+04	-999.	-999.	-999.
Length scale of facility	m	CONSTANT	20.0	-999.	-999.	-999.
Width scale of facility	m	CONSTANT	67.0	-999.	-999.	-999.
Near field dilution		DERIVED	1.00	0.000	0.000	1.00

AQUIFER SPECIFIC VARIABLES

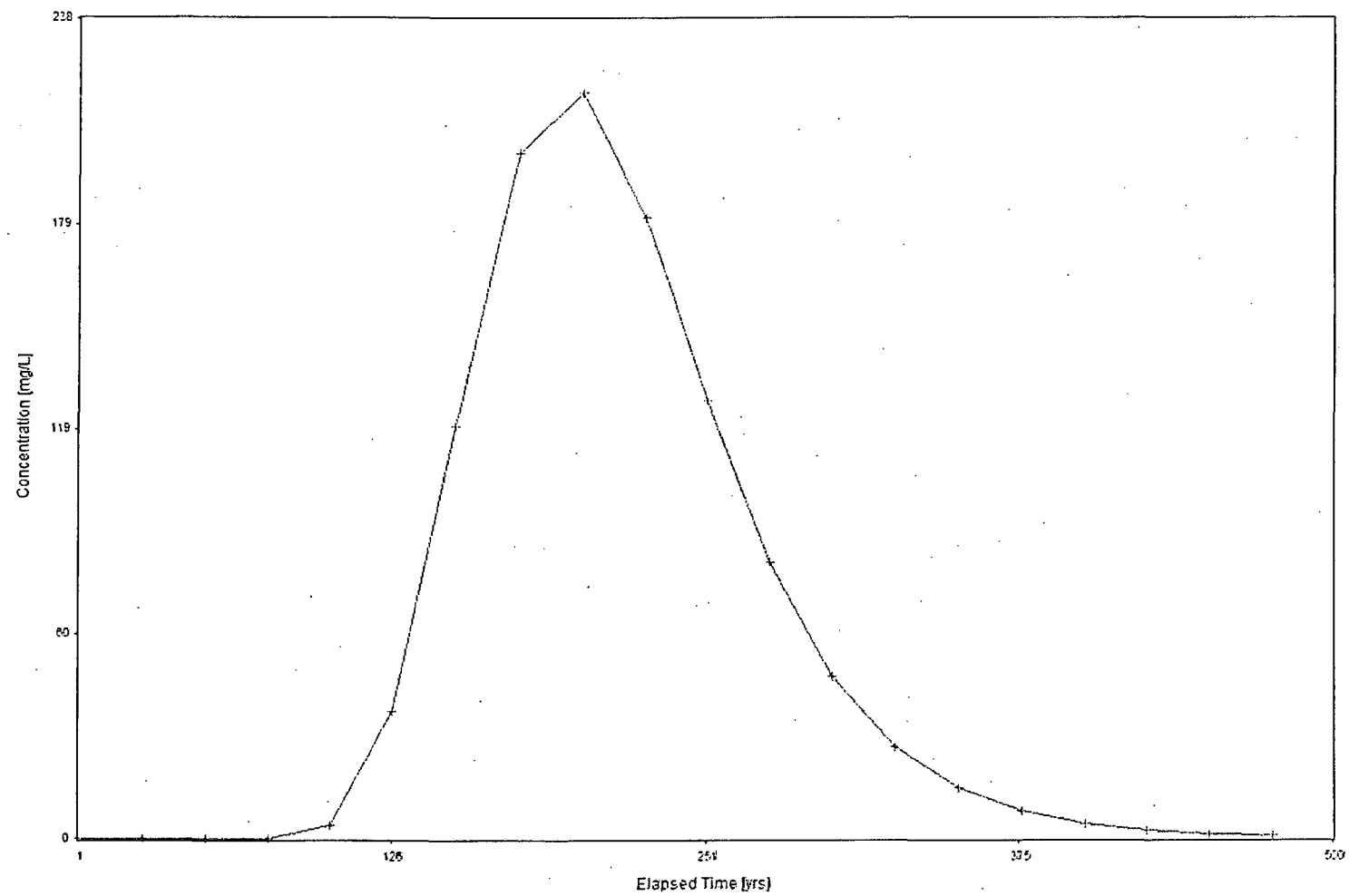
VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS		LIMITS	
			MEAN	STD DEV	MIN	MAX
Particle diameter	cm	CONSTANT	-999.	-999.	-999.	-999.
Aquifer porosity	--	CONSTANT	0.300	-999.	-999.	-999.
Bulk density	g/cc	CONSTANT	1.86	-999.	-999.	-999.
Aquifer thickness	m	CONSTANT	6.10	-999.	-999.	-999.
Source thickness (mixing zone depth)	m	DERIVED	-999.	-999.	-999.	-999.
Conductivity (hydraulic)	m/yr	CONSTANT	315.	-999.	-999.	-999.
Gradient (hydraulic)		CONSTANT	0.400E-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

0.100E+01	0.00000E+00
0.210E+02	0.00000E+00
0.410E+02	0.00000E+00
0.610E+02	0.00000E+00
0.810E+02	0.00000E+00
0.101E+03	0.00000E+00
0.121E+03	0.00000E+00
0.141E+03	0.57129E-02
0.161E+03	0.59166E-01
0.181E+03	0.54564E+00
0.201E+03	0.25088E+01
0.221E+03	0.74658E+01
0.241E+03	0.16722E+02
0.261E+03	0.30825E+02
0.281E+03	0.48818E+02
0.301E+03	0.68396E+02
0.321E+03	0.84678E+02
0.341E+03	0.95713E+02
0.361E+03	0.10051E+03
0.381E+03	0.99106E+02
0.401E+03	0.92430E+02
0.421E+03	0.81858E+02
0.441E+03	0.69516E+02
0.461E+03	0.57116E+02
0.481E+03	0.45505E+02

0.501E+03 0.35219E+02
0.521E+03 0.26527E+02
0.541E+03 0.19520E+02
0.561E+03 0.14199E+02
0.581E+03 0.10190E+02

Chloride Concentration At The Receptor Well
Justis E-23 AD



U. S. ENVIRONMENTAL PROTECTION AGENCY

EXPOSURE ASSESSMENT

MULTIMEDIA MODEL

MULTIMED (Version 1.50, 2005)

1
Run options

Justis E-23 AD

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 23.00 1

VADOSE ZONE MATERIAL VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS		LIMITS	
			MEAN	STD DEV	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	23.0	0.000	0.000	0.000

DATA FOR MATERIAL 1

VADOSE ZONE FUNCTION VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS		LIMITS	
			MEAN	STD DEV	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		LIMITS	
			MEAN	STD DEV	MIN	MAX
Thickness of layer	m	CONSTANT	23.0	-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.

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	1/M-yr	CONSTANT	0.000	-999.	-999.	-999.
Neutral hydrolysis rate constant	1/yr	CONSTANT	0.000	-999.	-999.	-999.
Base catalyzed hydrolysis rate	1/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	cm ² /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

SOURCE SPECIFIC VARIABLES

VARIABLE NAME	UNITS	DISTRIBUTION	PARAMETERS		LIMITS	
			MEAN	STD DEV	MIN	MAX
Infiltration rate	m/yr	CONSTANT	0.305E-01	-999.	-999.	-999.
Area of waste disposal unit	m ²	DERIVED	124.	-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	0.192E+04	-999.	-999.	-999.
Length scale of facility	m	CONSTANT	20.0	-999.	-999.	-999.
Width scale of facility	m	CONSTANT	67.0	-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	0.400E-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

TIME	CONCENTRATION
0.100E+01	0.00000E+00
0.260E+02	0.00000E+00
0.510E+02	0.00000E+00
0.760E+02	0.46774E-01
0.101E+03	0.37386E+01
0.126E+03	0.36998E+02
0.151E+03	0.11970E+03
0.176E+03	0.19870E+03
0.201E+03	0.21641E+03
0.226E+03	0.18033E+03
0.251E+03	0.12699E+03
0.276E+03	0.80213E+02
0.301E+03	0.47152E+02
0.326E+03	0.26581E+02
0.351E+03	0.14621E+02
0.376E+03	0.79678E+01
0.401E+03	0.42792E+01
0.426E+03	0.23028E+01
0.451E+03	0.12345E+01
0.476E+03	0.65563E+00