

POLLUTE

Version 8

Example 20: Sensitivity Analysis



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Version 8

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Description

In this example, Sensitivity Analysis will be used to examine the effect of uncertainty in the service life of a Primary Leachate Collection system. The landfill from Cases 15 and 16 will be used, except the time that the Primary Leachate Collection system begins to fail will range from 15 to 50 years. Cases 15 and 16 should be reviewed prior to reading this example, where the implementation of the Variable Properties and Passive Sink special features are described in detail.

The parameters for this example are the same as in Case 15, except for the addition of the Sensitivity Analysis parameters.

Property	Symbol	Value	Units
Darcy Velocity	v_a	variable	m/a
Sink Outflow Velocity	v_s	variable	m/a
Diffusion Coefficient	D	0.02	m ² /a
Dispersivity		0.4	m
Distribution Coefficient	K	0	cm ³ /g
Soil Porosity	n	0.3	-
Granular Layer Porosity	n	0.3	-
Dry Density		1.5	g/cm ³
Layer 1 Thickness	H	1	m
Layer 2 Thickness	H	0.3	m
Layer 3 Thickness	H	2	m
Source Concentration	c_0	1000	mg/L
Ref. Height of Leachate	H_r	7.5	cm ³ /g
Vol. of Leachate Collected	Q_c	variable	m/a
Landfill Length	L	200	m
Landfill Width	W	1	m
Aquifer Thickness	h	1	m
Aquifer Porosity	n_b	0.3	-
Aquifer Outflow Velocity	v_b	4	m/a
Minimum Failure Start Time		15	a
Maximum Failure Start Time		50	a

This example is for a hypothetical landfill and is used to illustrate how to prepare an input file and run an analysis using the Variable Properties and Passive Sink option. The example is not a prescription for modeling contaminant migration during operation of a landfill. Each landfill has its own unique characteristics and no general prescription can be made. These options should only be used by someone with the hydrogeologic and engineering background necessary to appreciate the subtleties associated with the physical situation and the steps necessary for appropriate modeling of this physical situation. This option should not be used for an actual project of importance without the guidance of the program developers.

Data Entry

Open the Examples project and open Case 20.

General Tab

The screenshot shows the 'General Tab' of a software interface. It includes a menu bar with 'Run', 'Auto', 'On', 'Off', 'Save', and 'Save As'. Below the menu bar are tabs for 'General', 'Layers', 'Boundaries', 'Special Features', and 'Subsurface Model'. The 'General Information' section contains a 'Model Title' field with the text 'Case 20: Sensitivity Analysis', a 'Maximum Depth' field set to '4.3 m', and a 'Darcy Velocity' field set to '1 m/year'. The 'Laplace Transform Parameters' section has fields for 'TAU: 7', 'N: 20', 'SIG: 0', and 'RNU: 2'. The 'Run Parameters' section includes 'Output Units' with dropdowns for 'Time Units: yr', 'Depth Units: m', and 'Concentration Units: mg/L'. There are two radio button options: 'All Depths' (unselected) and 'Specified Depths' (selected). Below these are two tables for specifying depths and times. The first table has columns 'Depth' and 'Units' with one row containing '3.3' and 'm'. The second table has columns 'Time' and 'Units' with one row containing '0' and 'year'.

The general data for this example is the same as for Case 15, except that the title is different. The run parameters for this example are the same as for Case 15, except that the concentrations will be only be calculated at a depth off 3.3 m. This depth corresponds to the base of the aquitard.

Layers Tab

The screenshot shows the 'Layers Tab' of the software interface. It includes a menu bar with 'Run', 'Auto', 'On', 'Off', 'Save', and 'Save As'. Below the menu bar are tabs for 'General', 'Layers', 'Boundaries', 'Special Features', and 'Subsurface Model'. The 'Layers Tab' has a toolbar with '+ Add', 'X Delete', 'Copy', 'Paste', 'Move Down', and 'Move Up'. Below the toolbar is a table with the following data:

Name	Sublayers	Thickness	Thickness Units	Dry Density	Density Units	Porosity	Hydrodynamic Dispersion Coefficient	Dispersion Units	Distribution Coefficient	Distribution Units	Fractures	Symbol
Clay	4	1	m	1.5	g/cm ³	0.4	0.02	m ² /a	0	cm ³ /g	None	
Collection System	4	0.3	m	1.5	g/cm ³	0.3	10	m ² /a	0	cm ³ /g	None	
Aquitard	4	2	m	1.5	g/cm ³	0.4	0.02	m ² /a	0	cm ³ /g	None	

The layer data for this example is the same as for Case 15.

Boundaries Tab

Run Auto On Off Save Save As

General Layers Boundaries Special Features Subsurface Model

Top Boundary

Zero Flux
 Constant Concentration
 Finite Mass

Initial Source Concentration: 1000 mg/L
 Rate of Concentration Increase: 0 mg/L/yr
 Volume of Leachate Collected: 0 m/a

Specify

Reference Height of Leachate
 Waste Properties

Waste Thickness: 0 m
 Waste Density: 0 g/cm³
 Proportion of Mass: 0
 Volumetric Water Content: 0
 Conversion Rate Half Life: 0 year

Bottom Boundary

Zero Flux
 Constant Concentration
 Fixed Outflow Velocity
 Infinite Thickness

Landfill Length: 200 m
 Landfill Width: 1 m
 Base Thickness: 1 m
 Base Porosity: 0.3
 Base Outflow Velocity: 4 m/a

Base Symbol

The boundary conditions for this example is the same as for Case 15.

Special Features

The time-varying data, passive sink, and sensitivity analysis data for this model can be entered using the Time-varying Data and Passive Sink menu items in the Special Features menu.

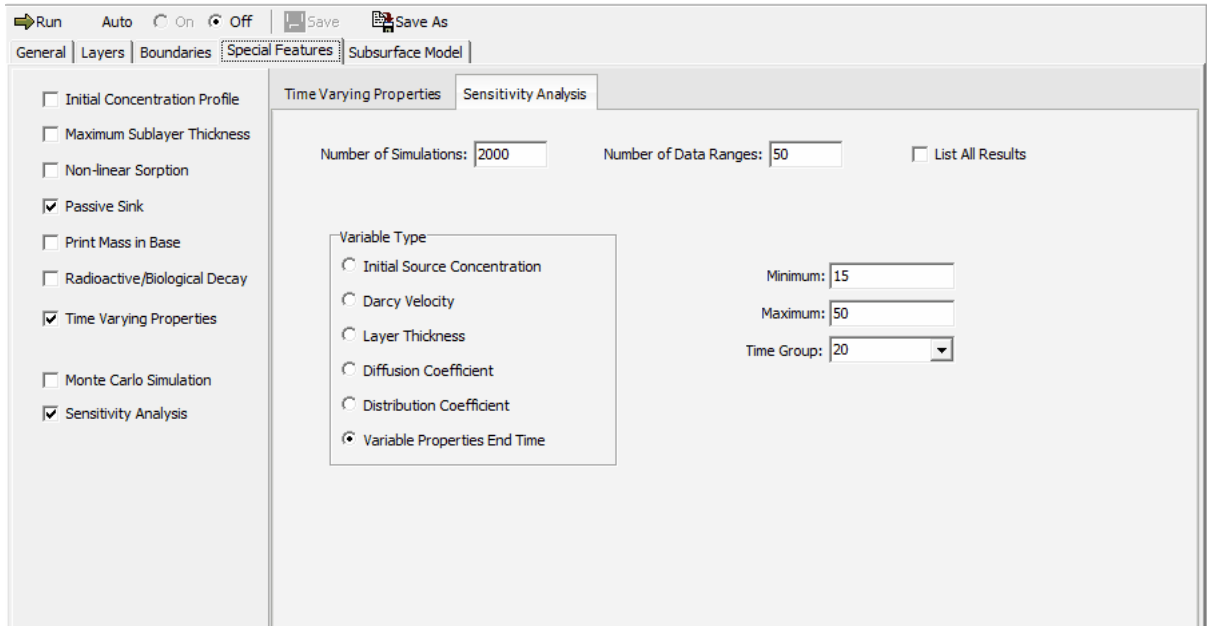
Time-Varying Properties

The time-varying properties for this example is the same as for Case 15.

Passive Sink

The passive sink data for this example is the same as for Case 15.

Sensitivity Analysis



The sensitivity analysis data can be specified by checking the Sensitivity Analysis box on the Special Features tab. The number of simulations is usually between 1000 and 10000. However, the time to compute this many simulations may be quite large. It is suggested as a trial to use less than 50 simulations. To vary the failure time of the Primary Leachate Collection system, the Variable Properties end time that corresponds to the time of failure in the input data set is used.

Model Execution



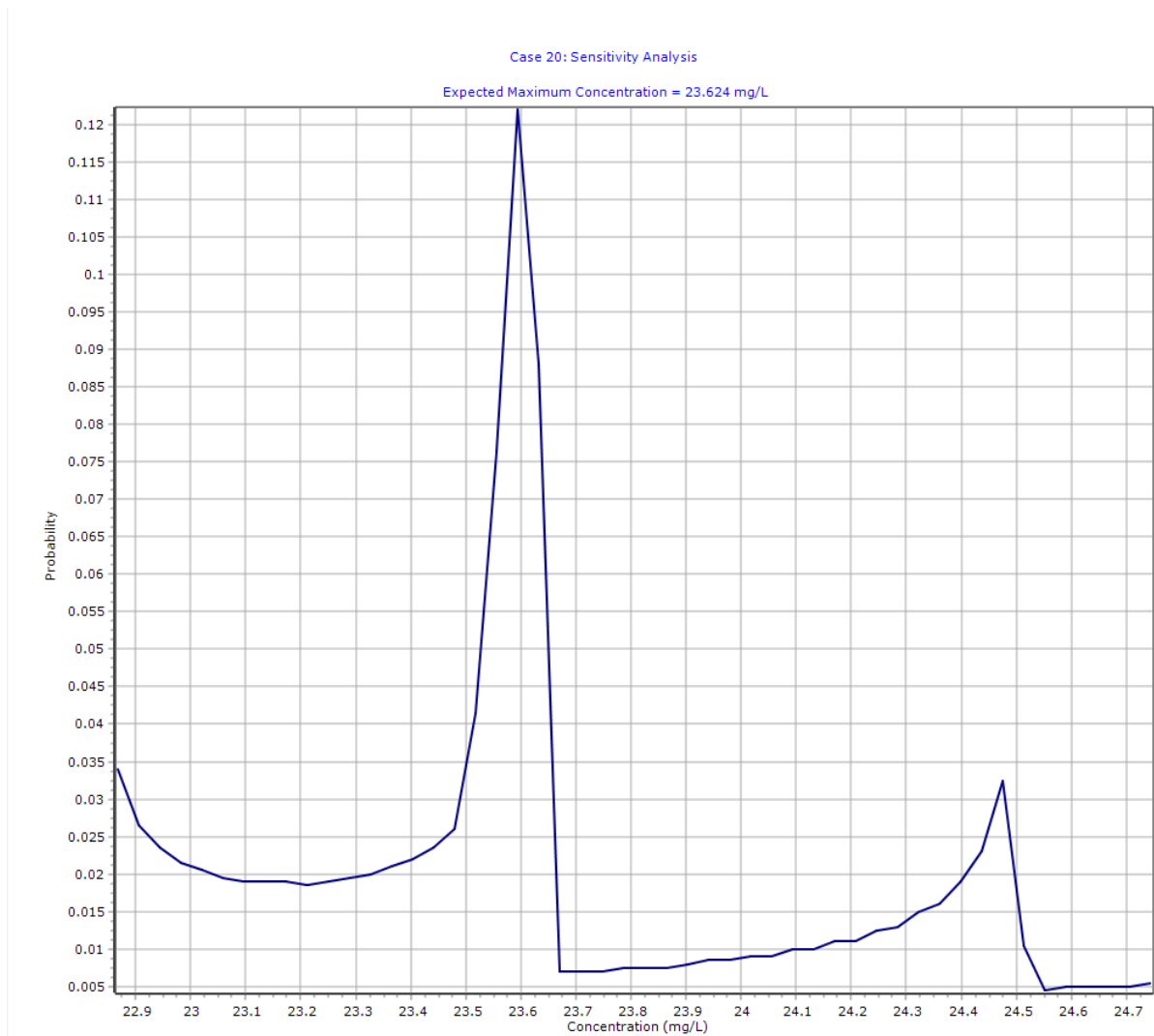
To run the model and calculate the concentrations press the Run button on the toolbar.

Model Output

After the model has been executed, the output for the model will be displayed.

Probability vs Concentration

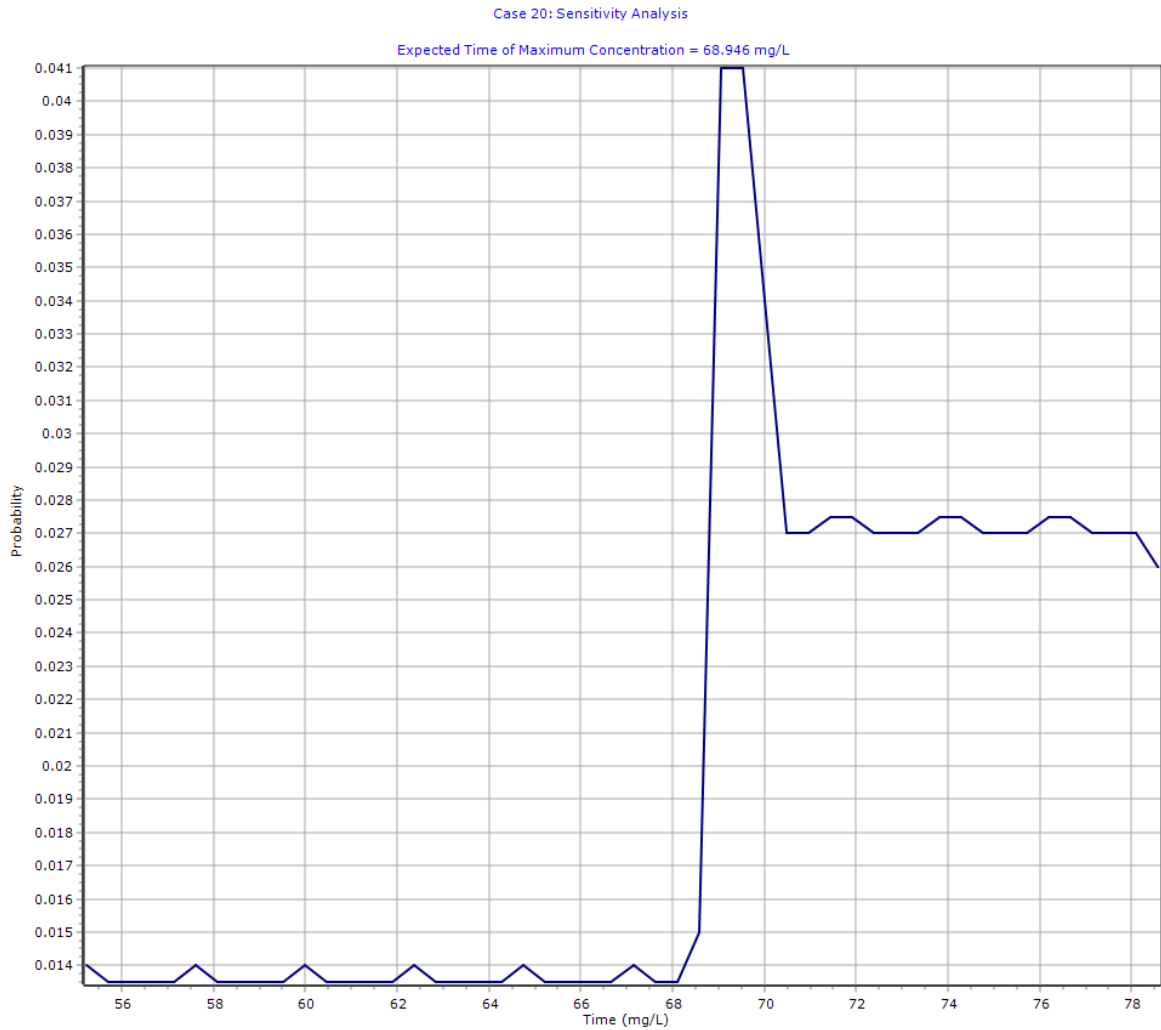
The Probability vs Concentration chart can be displayed by selecting the Probability vs Concentration item for the Chart Type.



Using the chart of the probability vs peak chloride concentration predictions can be made about the concentration in the aquifer. For example, in this case, the expected maximum concentration is 23.6 mg/L.

Probability vs Time

The Probability vs Time chart can be displayed by selecting the Probability vs Time item for the Chart Type.



Using this chart the expected time of the maximum concentration can be predicted. In this example, the expected time is 68.9 years.

Output Listing

To display the output as a text listing that will show the calculated concentrations as numbers, click on the List tab.

POLLUTEv8

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Case 20: Sensitivity Analysis

THE VARIABLE VELOCITY AND/OR CONCENTRATION OPTION HAS BEEN USED. NOTE THAT THE ACCURACY OF THE CALCULATIONS WITH THIS OPTION WILL DEPEND ON THE NUMBER OF SUBLAYERS USED.

THE PASSIVE SINK OPTION HAS BEEN USED. NOTE THE USER IS RESPONSIBLE FOR ENSURING THAT VELOCITY CHANGES ARE CONSISTENT WITH THE PASSIVE SINK.

Layer Properties

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Case 20: Sensitivity Analysis

THE VARIABLE VELOCITY AND/OR CONCENTRATION OPTION HAS BEEN USED. NOTE THAT THE ACCURACY OF THE CALCULATIONS WITH THIS OPTION WILL DEPEND ON THE NUMBER OF SUBLAYERS USED.

THE PASSIVE SINK OPTION HAS BEEN USED. NOTE THE USER IS RESPONSIBLE FOR ENSURING THAT VELOCITY CHANGES ARE CONSISTENT WITH THE PASSIVE SINK.

Layer Properties

Layer	Thickness	Number of Sublayers	Coefficient of Hydrodynamic Dispersion	Matrix Porosity	Distribution Coefficient	Dry Density
Clay	1 m	4	0.02 m ² /a	0.4	0 cm ³ /g	1.5 g/cm ³
Collection System	0.3 m	4	10 m ² /a	0.3	0 cm ³ /g	1.5 g/cm ³
Aquitard	2 m	4	0.02 m ² /a	0.4	0 cm ³ /g	1.5 g/cm ³

Boundary Conditions

Finite Mass Top Boundary

Fixed Outflow Bottom Boundary

Landfill Length = 200 m
Landfill Width = 1 m
Base Thickness = 1 m
Base Porosity = 0.3

Variation in Properties with Time

Time Periods with the same Source and Velocity

Period	Start Time	No. of Steps	Time Step	Source Conc	Rate of Change	Height of Leachate	Volume Collected
1	0 yr	1	20 yr	1000 mg/L	0	7.5 m	0.29 m/a
2	20 yr	5	2 yr	-1 mg/L	0	7.5 m	0.2 m/a
3	30 yr	2	10 yr	-1 mg/L	0	7.5 m	0.2 m/a
4	50 yr	5	10 yr	-1 mg/L	0	7.5 m	0.2 m/a
5	100 yr	5	20 yr	-1 mg/L	0	7.5 m	0.2 m/a

Period	Start Time	End Time	Proportion Mass	Dispersivity	Base Velocity
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1	0 yr	20 yr	1 m/a	0.4 m	4 m/a
2	20 yr	30 yr	1 m/a	0.4 m	4 m/a
3	30 yr	50 yr	1 m/a	0.4 m	4 m/a
4	50 yr	100 yr	1 m/a	0.4 m	4 m/a
5	100 yr	200 yr	1 m/a	0.4 m	4 m/a

Velocity and Sink Profile

Time Period	Minimum Depth	Maximum Depth	Vertical Velocity	Horizontal Outflow
1 / 1	0 m	1 m	0.01 m/a	0 m/a
	1 m	1.3 m	0.01 m/a	6.67 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
2 / 1	0 m	1 m	0.028 m/a	0 m/a
	1 m	1.3 m	0.028 m/a	18.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
2 / 2	0 m	1 m	0.046 m/a	0 m/a
	1 m	1.3 m	0.046 m/a	30.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
2 / 3	0 m	1 m	0.064 m/a	0 m/a
	1 m	1.3 m	0.064 m/a	42.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
2 / 4	0 m	1 m	0.082 m/a	0 m/a
	1 m	1.3 m	0.082 m/a	54.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
2 / 5	0 m	1 m	0.1 m/a	0 m/a
	1 m	1.3 m	0.1 m/a	66.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
3 / 1	0 m	1 m	0.1 m/a	0 m/a
	1 m	1.3 m	0.1 m/a	66.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
3 / 2	0 m	1 m	0.1 m/a	0 m/a
	1 m	1.3 m	0.1 m/a	66.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
4 / 1	0 m	1 m	0.1 m/a	0 m/a
	1 m	1.3 m	0.1 m/a	66.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
4 / 2	0 m	1 m	0.1 m/a	0 m/a
	1 m	1.3 m	0.1 m/a	66.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
4 / 3	0 m	1 m	0.1 m/a	0 m/a
	1 m	1.3 m	0.1 m/a	66.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
4 / 4	0 m	1 m	0.1 m/a	0 m/a
	1 m	1.3 m	0.1 m/a	66.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
4 / 5	0 m	1 m	0.1 m/a	0 m/a
	1 m	1.3 m	0.1 m/a	66.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
5 / 1	0 m	1 m	0.1 m/a	0 m/a
	1 m	1.3 m	0.1 m/a	66.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a

5 / 2	0 m	1 m	0.1 m/a	0 m/a
	1 m	1.3 m	0.1 m/a	66.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
5 / 3	0 m	1 m	0.1 m/a	0 m/a
	1 m	1.3 m	0.1 m/a	66.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
5 / 4	0 m	1 m	0.1 m/a	0 m/a
	1 m	1.3 m	0.1 m/a	66.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
5 / 5	0 m	1 m	0.1 m/a	0 m/a
	1 m	1.3 m	0.1 m/a	66.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a

Laplace Transform Parameters

TAU = 7 N = 20 SIG = 0 RNU = 2

Sensitivity Analysis Results

Number of Simulations = 2000
 Number of Data Ranges = 50
 Variable Properties End Time
 Time Period = 1
 Uniform Distribution (Minimum = 15 Maximum = 50)

NOTICE

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Layer	Thickness	Number of Sublayers	Coefficient of Hydrodynamic Dispersion	Matrix Porosity	Distributon Coefficient	Dry Density
Clay	1 m	4	0.02 m ² /a	0.4	0 cm ³ /g	1.5 g/cm ³
Collection System	0.3 m	4	10 m ² /a	0.3	0 cm ³ /g	1.5 g/cm ³
Aquitard	2 m	4	0.02 m ² /a	0.4	0 cm ³ /g	1.5 g/cm ³

Boundary Conditions

Finite Mass Top Boundary

Fixed Outflow Bottom Boundary

Landfill Length = 200 m
 Landfill Width = 1 m
 Base Thickness = 1 m
 Base Porosity = 0.3

Variation in Properties with Time

Time Periods with the same Source and Velocity

Period	Start Time	No. of	Time Step	Source Conc	Rate of	Height of	Volume
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		Steps			Change	Leachate	Collected
1	0 yr	1	20 yr	1000 mg/L	0	7.5 m	0.29 m/a
2	20 yr	5	2 yr	-1 mg/L	0	7.5 m	0.2 m/a
3	30 yr	2	10 yr	-1 mg/L	0	7.5 m	0.2 m/a
4	50 yr	5	10 yr	-1 mg/L	0	7.5 m	0.2 m/a
5	100 yr	5	20 yr	-1 mg/L	0	7.5 m	0.2 m/a

Period	Start Time	End Time	Proportion Mass	Dispersivity	Base Velocity
1	0 yr	20 yr	1 m/a	0.4 m	4 m/a
2	20 yr	30 yr	1 m/a	0.4 m	4 m/a
3	30 yr	50 yr	1 m/a	0.4 m	4 m/a
4	50 yr	100 yr	1 m/a	0.4 m	4 m/a
5	100 yr	200 yr	1 m/a	0.4 m	4 m/a

Velocity and Sink Profile

Time Period	Minimum Depth	Maximum Depth	Vertical Velocity	Horizontal Outflow
1 / 1	0 m	1 m	0.01 m/a	0 m/a
	1 m	1.3 m	0.01 m/a	6.67 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
2 / 1	0 m	1 m	0.028 m/a	0 m/a
	1 m	1.3 m	0.028 m/a	18.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
2 / 2	0 m	1 m	0.046 m/a	0 m/a
	1 m	1.3 m	0.046 m/a	30.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
2 / 3	0 m	1 m	0.064 m/a	0 m/a
	1 m	1.3 m	0.064 m/a	42.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
2 / 4	0 m	1 m	0.082 m/a	0 m/a
	1 m	1.3 m	0.082 m/a	54.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
2 / 5	0 m	1 m	0.1 m/a	0 m/a
	1 m	1.3 m	0.1 m/a	66.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
3 / 1	0 m	1 m	0.1 m/a	0 m/a
	1 m	1.3 m	0.1 m/a	66.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
3 / 2	0 m	1 m	0.1 m/a	0 m/a
	1 m	1.3 m	0.1 m/a	66.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
4 / 1	0 m	1 m	0.1 m/a	0 m/a
	1 m	1.3 m	0.1 m/a	66.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
4 / 2	0 m	1 m	0.1 m/a	0 m/a
	1 m	1.3 m	0.1 m/a	66.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a
4 / 3	0 m	1 m	0.1 m/a	0 m/a
	1 m	1.3 m	0.1 m/a	66.7 m/a
	1.3 m	3.3 m	0 m/a	0 m/a

4 / 4	0 m 1 m 1.3 m	1 m 1.3 m 3.3 m	0.1 m/a 0.1 m/a 0 m/a	0 m/a 66.7 m/a 0 m/a
4 / 5	0 m 1 m 1.3 m	1 m 1.3 m 3.3 m	0.1 m/a 0.1 m/a 0 m/a	0 m/a 66.7 m/a 0 m/a
5 / 1	0 m 1 m 1.3 m	1 m 1.3 m 3.3 m	0.1 m/a 0.1 m/a 0 m/a	0 m/a 66.7 m/a 0 m/a
5 / 2	0 m 1 m 1.3 m	1 m 1.3 m 3.3 m	0.1 m/a 0.1 m/a 0 m/a	0 m/a 66.7 m/a 0 m/a
5 / 3	0 m 1 m 1.3 m	1 m 1.3 m 3.3 m	0.1 m/a 0.1 m/a 0 m/a	0 m/a 66.7 m/a 0 m/a
5 / 4	0 m 1 m 1.3 m	1 m 1.3 m 3.3 m	0.1 m/a 0.1 m/a 0 m/a	0 m/a 66.7 m/a 0 m/a
5 / 5	0 m 1 m 1.3 m	1 m 1.3 m 3.3 m	0.1 m/a 0.1 m/a 0 m/a	0 m/a 66.7 m/a 0 m/a

Laplace Transform Parameters

TAU = 7 N = 20 SIG = 0 RNU = 2

Sensitivity Analysis Results

Number of Simulations = 2000
 Number of Data Ranges = 50
 Variable Properties End Time
 Time Period = 1
 Uniform Distribution (Minimum = 15 Maximum = 50)

Depth = 3.3

DISTRIBUTION OF PEAK CONCENTRATION

Minimum Value	Maximum Value	Number Occur.	Probability	Cumulative Probability	Expected Value
2.285E+01	2.289E+01	68	0.03	0.03	7.775E-01
2.289E+01	2.293E+01	53	0.03	0.06	6.070E-01
2.293E+01	2.296E+01	47	0.02	0.08	5.392E-01
2.296E+01	2.300E+01	43	0.02	0.11	4.941E-01
2.300E+01	2.304E+01	41	0.02	0.13	4.719E-01
2.304E+01	2.308E+01	39	0.02	0.15	4.497E-01
2.308E+01	2.312E+01	38	0.02	0.16	4.389E-01
2.312E+01	2.315E+01	38	0.02	0.18	4.396E-01
2.315E+01	2.319E+01	38	0.02	0.20	4.403E-01
2.319E+01	2.323E+01	37	0.02	0.22	4.294E-01
2.323E+01	2.327E+01	38	0.02	0.24	4.418E-01
2.327E+01	2.331E+01	39	0.02	0.26	4.541E-01
2.331E+01	2.335E+01	40	0.02	0.28	4.665E-01
2.335E+01	2.338E+01	42	0.02	0.30	4.907E-01

2.338E+01	2.342E+01	44	0.02	0.32	5.149E-01
2.342E+01	2.346E+01	47	0.02	0.35	5.509E-01
2.346E+01	2.350E+01	52	0.03	0.37	6.105E-01
2.350E+01	2.354E+01	83	0.04	0.41	9.760E-01
2.354E+01	2.358E+01	153	0.08	0.49	1.802E+00
2.358E+01	2.361E+01	244	0.12	0.61	2.879E+00
2.361E+01	2.365E+01	176	0.09	0.70	2.080E+00
2.365E+01	2.369E+01	14	0.01	0.71	1.657E-01
2.369E+01	2.373E+01	14	0.01	0.71	1.660E-01
2.373E+01	2.377E+01	14	0.01	0.72	1.662E-01
2.377E+01	2.381E+01	15	0.01	0.73	1.784E-01
2.381E+01	2.384E+01	15	0.01	0.74	1.787E-01
2.384E+01	2.388E+01	15	0.01	0.74	1.790E-01
2.388E+01	2.392E+01	16	0.01	0.75	1.912E-01
2.392E+01	2.396E+01	17	0.01	0.76	2.035E-01
2.396E+01	2.400E+01	17	0.01	0.77	2.038E-01
2.400E+01	2.403E+01	18	0.01	0.78	2.161E-01
2.403E+01	2.407E+01	18	0.01	0.79	2.165E-01
2.407E+01	2.411E+01	20	0.01	0.80	2.409E-01
2.411E+01	2.415E+01	20	0.01	0.81	2.413E-01
2.415E+01	2.419E+01	22	0.01	0.82	2.659E-01
2.419E+01	2.423E+01	22	0.01	0.83	2.663E-01
2.423E+01	2.426E+01	25	0.01	0.84	3.031E-01
2.426E+01	2.430E+01	26	0.01	0.85	3.157E-01
2.430E+01	2.434E+01	30	0.01	0.87	3.648E-01
2.434E+01	2.438E+01	32	0.02	0.88	3.898E-01
2.438E+01	2.442E+01	38	0.02	0.90	4.636E-01
2.442E+01	2.446E+01	46	0.02	0.93	5.620E-01
2.446E+01	2.449E+01	65	0.03	0.96	7.954E-01
2.449E+01	2.453E+01	21	0.01	0.97	2.574E-01
2.453E+01	2.457E+01	9	0.00	0.97	1.105E-01
2.457E+01	2.461E+01	10	0.01	0.98	1.229E-01
2.461E+01	2.465E+01	10	0.01	0.98	1.231E-01
2.465E+01	2.469E+01	10	0.01	0.99	1.233E-01
2.469E+01	2.472E+01	10	0.01	0.99	1.235E-01
2.472E+01	2.476E+01	11	0.01	1.00	1.361E-01

Expected Maximum Concentration = 2.362E+01

DISTRIBUTION OF TIME OF PEAK CONCENTRATION

Minimum Value	Maximum Value	Number Occur.	Probability	Cumulative Probability	Expected Value
5.500E+01	5.548E+01	28	0.01	0.01	7.733E-01
5.548E+01	5.595E+01	27	0.01	0.03	7.521E-01
5.595E+01	5.643E+01	27	0.01	0.04	7.586E-01
5.643E+01	5.690E+01	27	0.01	0.05	7.650E-01
5.690E+01	5.738E+01	27	0.01	0.07	7.714E-01
5.738E+01	5.786E+01	28	0.01	0.08	8.067E-01
5.786E+01	5.833E+01	27	0.01	0.10	7.843E-01
5.833E+01	5.881E+01	27	0.01	0.11	7.907E-01
5.881E+01	5.929E+01	27	0.01	0.12	7.971E-01
5.929E+01	5.976E+01	27	0.01	0.14	8.036E-01
5.976E+01	6.024E+01	28	0.01	0.15	8.400E-01
6.024E+01	6.071E+01	27	0.01	0.16	8.164E-01
6.071E+01	6.119E+01	27	0.01	0.18	8.229E-01
6.119E+01	6.167E+01	27	0.01	0.19	8.293E-01

6.167E+01	6.214E+01	27	0.01	0.20	8.357E-01
6.214E+01	6.262E+01	28	0.01	0.22	8.733E-01
6.262E+01	6.310E+01	27	0.01	0.23	8.486E-01
6.310E+01	6.357E+01	27	0.01	0.25	8.550E-01
6.357E+01	6.405E+01	27	0.01	0.26	8.614E-01
6.405E+01	6.452E+01	27	0.01	0.27	8.679E-01
6.452E+01	6.500E+01	28	0.01	0.29	9.067E-01
6.500E+01	6.548E+01	27	0.01	0.30	8.807E-01
6.548E+01	6.595E+01	27	0.01	0.31	8.871E-01
6.595E+01	6.643E+01	27	0.01	0.33	8.936E-01
6.643E+01	6.690E+01	27	0.01	0.34	9.000E-01
6.690E+01	6.738E+01	28	0.01	0.35	9.400E-01
6.738E+01	6.786E+01	27	0.01	0.37	9.129E-01
6.786E+01	6.833E+01	27	0.01	0.38	9.193E-01
6.833E+01	6.881E+01	30	0.01	0.40	1.029E+00
6.881E+01	6.929E+01	82	0.04	0.44	2.831E+00
6.929E+01	6.976E+01	82	0.04	0.48	2.850E+00
6.976E+01	7.024E+01	68	0.03	0.51	2.380E+00
7.024E+01	7.071E+01	54	0.03	0.54	1.903E+00
7.071E+01	7.119E+01	54	0.03	0.57	1.916E+00
7.119E+01	7.167E+01	55	0.03	0.59	1.964E+00
7.167E+01	7.214E+01	55	0.03	0.62	1.977E+00
7.214E+01	7.262E+01	54	0.03	0.65	1.954E+00
7.262E+01	7.310E+01	54	0.03	0.68	1.967E+00
7.310E+01	7.357E+01	54	0.03	0.70	1.980E+00
7.357E+01	7.405E+01	55	0.03	0.73	2.030E+00
7.405E+01	7.452E+01	55	0.03	0.76	2.043E+00
7.452E+01	7.500E+01	54	0.03	0.78	2.019E+00
7.500E+01	7.548E+01	54	0.03	0.81	2.031E+00
7.548E+01	7.595E+01	54	0.03	0.84	2.044E+00
7.595E+01	7.643E+01	55	0.03	0.87	2.095E+00
7.643E+01	7.690E+01	55	0.03	0.89	2.108E+00
7.690E+01	7.738E+01	54	0.03	0.92	2.083E+00
7.738E+01	7.786E+01	54	0.03	0.95	2.096E+00
7.786E+01	7.833E+01	54	0.03	0.97	2.109E+00
7.833E+01	7.881E+01	52	0.03	1.00	2.043E+00

Expected Time of Maximum Concentration = 68.9456445222611

VARIABLE NUMBER: 1

Minimum Value	Maximum Value	Number Occur.	Probability	Cumulative Probability	Expected Value
1.500E+01	1.570E+01	40	0.02	0.02	3.070E-01
1.570E+01	1.640E+01	40	0.02	0.04	3.210E-01
1.640E+01	1.710E+01	40	0.02	0.06	3.350E-01
1.710E+01	1.780E+01	40	0.02	0.08	3.490E-01
1.780E+01	1.850E+01	40	0.02	0.10	3.630E-01
1.850E+01	1.920E+01	40	0.02	0.12	3.770E-01
1.920E+01	1.990E+01	40	0.02	0.14	3.910E-01
1.990E+01	2.060E+01	40	0.02	0.16	4.050E-01
2.060E+01	2.130E+01	40	0.02	0.18	4.190E-01
2.130E+01	2.200E+01	40	0.02	0.20	4.330E-01
2.200E+01	2.270E+01	40	0.02	0.22	4.470E-01
2.270E+01	2.340E+01	40	0.02	0.24	4.610E-01
2.340E+01	2.410E+01	40	0.02	0.26	4.750E-01
2.410E+01	2.480E+01	40	0.02	0.28	4.890E-01

2.480E+01	2.550E+01	40	0.02	0.30	5.030E-01
2.550E+01	2.620E+01	40	0.02	0.32	5.170E-01
2.620E+01	2.690E+01	40	0.02	0.34	5.310E-01
2.690E+01	2.760E+01	40	0.02	0.36	5.450E-01
2.760E+01	2.830E+01	40	0.02	0.38	5.590E-01
2.830E+01	2.900E+01	40	0.02	0.40	5.730E-01
2.900E+01	2.970E+01	40	0.02	0.42	5.870E-01
2.970E+01	3.040E+01	40	0.02	0.44	6.010E-01
3.040E+01	3.110E+01	40	0.02	0.46	6.150E-01
3.110E+01	3.180E+01	40	0.02	0.48	6.290E-01
3.180E+01	3.250E+01	40	0.02	0.50	6.430E-01
3.250E+01	3.320E+01	40	0.02	0.52	6.570E-01
3.320E+01	3.390E+01	40	0.02	0.54	6.710E-01
3.390E+01	3.460E+01	40	0.02	0.56	6.850E-01
3.460E+01	3.530E+01	40	0.02	0.58	6.990E-01
3.530E+01	3.600E+01	40	0.02	0.60	7.130E-01
3.600E+01	3.670E+01	40	0.02	0.62	7.270E-01
3.670E+01	3.740E+01	40	0.02	0.64	7.410E-01
3.740E+01	3.810E+01	40	0.02	0.66	7.550E-01
3.810E+01	3.880E+01	40	0.02	0.68	7.690E-01
3.880E+01	3.950E+01	40	0.02	0.70	7.830E-01
3.950E+01	4.020E+01	40	0.02	0.72	7.970E-01
4.020E+01	4.090E+01	40	0.02	0.74	8.110E-01
4.090E+01	4.160E+01	40	0.02	0.76	8.250E-01
4.160E+01	4.230E+01	40	0.02	0.78	8.390E-01
4.230E+01	4.300E+01	40	0.02	0.80	8.530E-01
4.300E+01	4.370E+01	40	0.02	0.82	8.670E-01
4.370E+01	4.440E+01	40	0.02	0.84	8.810E-01
4.440E+01	4.510E+01	40	0.02	0.86	8.950E-01
4.510E+01	4.580E+01	40	0.02	0.88	9.090E-01
4.580E+01	4.650E+01	40	0.02	0.90	9.230E-01
4.650E+01	4.720E+01	40	0.02	0.92	9.370E-01
4.720E+01	4.790E+01	40	0.02	0.94	9.510E-01
4.790E+01	4.860E+01	40	0.02	0.96	9.650E-01
4.860E+01	4.930E+01	40	0.02	0.98	9.790E-01
4.930E+01	5.000E+01	40	0.02	1.00	9.930E-01
0.000E+00	0.000E+00	0	0.00	0.00	0.000E+00

Expected Value = 3.250E+01

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