

# POLLUTE

Version 8

## Example 2: Pure Diffusion



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**GAEA Technologies Ltd,**

*221 Laurel Street  
Cambridge, Ontario  
Canada  
N3H 3Y6*

*Tel: (613) 900-1950*

*Email:  
sales@gaeatech.com  
support@gaeatech.com*

**www.gaeatech.com**

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## Description

This example illustrates the use of the program for the simple case of pure diffusion of a conservative species (i.e., no sorption). The hydrogeology is comprised of a 4 m thick layer with a constant contaminant concentration source at the top, and an underlying aquifer at the base. There is a sufficiently high flushing velocity in the aquifer that the concentration at the bottom of the layer can be assumed to be zero and the aquifer is not explicitly modelled.

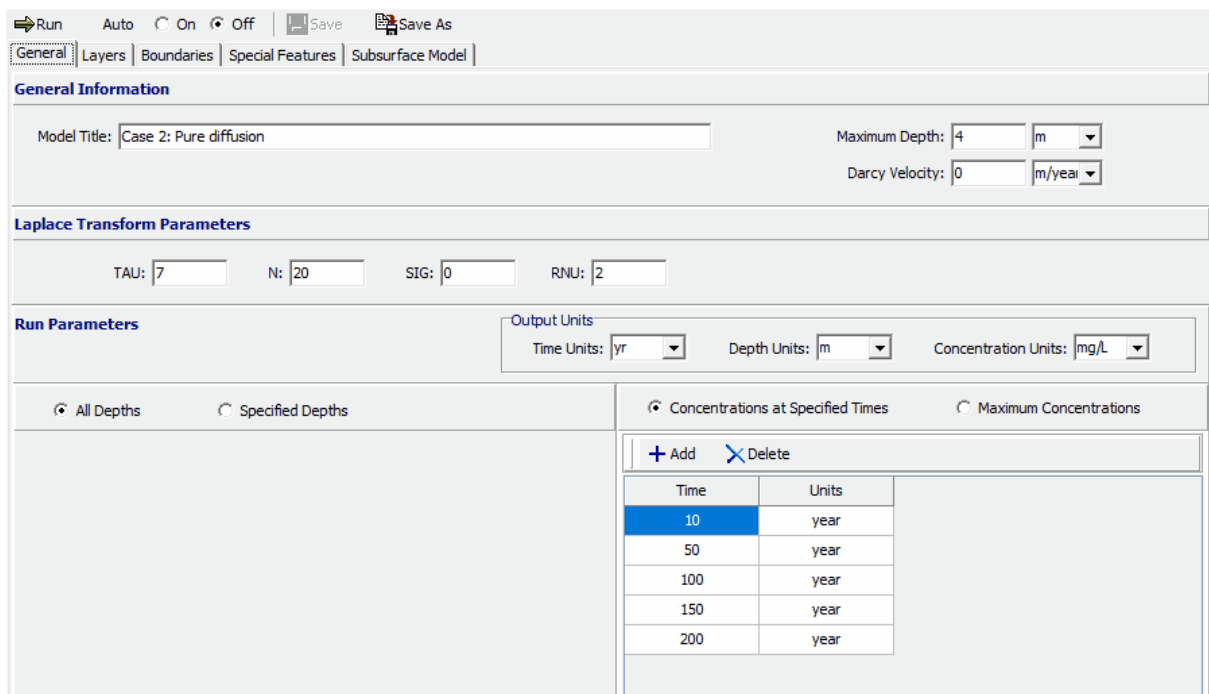
The following parameters are assumed for the example:

Property	Symbol	Value	Units
Darcy Velocity	$v_a$	0	m/a
Diffusion Coefficient		0.01	m <sup>2</sup> /a
Distribution Coefficient	$K_d$	0	cm <sup>3</sup> /g
Soil Porosity	$n$	0.4	-
Dry Density		1.5	g/cm <sup>3</sup>
Soil Layer Thickness	$H$	4	m
Number of Sub-layers		4	-
Base Concentration	$c_b$	0	g/L

## Data Entry

Open the Examples project and open Case 2.

### General Tab



Run Auto On Off Save Save As

General Layers Boundaries Special Features Subsurface Model

**General Information**

Model Title: Case 2: Pure diffusion Maximum Depth: 4 m Darcy Velocity: 0 m/year

**Laplace Transform Parameters**

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

**Run Parameters**

Output Units: Time Units: yr Depth Units: m Concentration Units: mg/L

All Depths Specified Depths Concentrations at Specified Times Maximum Concentrations


+ Add X Delete

Time	Units
10	year
50	year
100	year
150	year
200	year

To edit the general model data either click on the General tab. On the General tab the Title, Number of Layers, Maximum Depth, Darcy velocity, and Laplace Transform parameters can be specified.. In this example there will only be one layer and since it is for diffusion only the Darcy velocity is zero.

The times and depths to calculate the concentrations can be specified in the Run Parameters at the bottom of the tab. In this example, the concentrations will be calculated at 5 times: 10, 50, 100, 150, and 200 years.

### Layers Tab

<div> <div>Run</div> <div>Auto</div> <div>On</div> <div>Off</div> <div>Save</div> <div>Save As</div> </div> <div> <div>General</div> <div>Layers</div> <div>Boundaries</div> <div>Special Features</div> <div>Subsurface Model</div> </div> <div> <div>+ Add</div> <div>✕ Delete</div> <div>📄 Copy</div> <div>📄 Paste</div> <div>↓ Move Down</div> <div>↑ Move Up</div> </div>												
Name	Sublayers	Thickness	Thickness Units	Dry Density	Density Units	Porosity	Hydrodynamic Dispersion Coefficient	Dispersion Units	Distribution Coefficient	Distribution Units	Fractures	Symbol
Aquitard	4	4	m	1.5	g/cm <sup>3</sup>	0.4	0.01	m <sup>2</sup> /a	0	cm <sup>3</sup> /g	None	

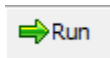
The data for the layer can be specified on the Layer tab. In this example, the diffusion coefficient of 0.01 is specified for the layer.

### Boundaries Tab

The screenshot shows a software interface with a toolbar at the top containing buttons for Run, Auto, On, Off, Save, and Save As. Below the toolbar are tabs for General, Layers, Boundaries, Special Features, and Subsurface Model. The Boundaries tab is active, displaying two panels: Top Boundary and Bottom Boundary. The Top Boundary panel has three radio buttons: Zero Flux, Constant Concentration (selected), and Finite Mass. Below these is a text input field for Concentration with the value 1 and a unit dropdown menu set to mg/L. The Bottom Boundary panel has four radio buttons: Zero Flux, Constant Concentration (selected), Fixed Outflow Velocity, and Infinite Thickness. Below these is a text input field for Concentration with the value 0 and a unit dropdown menu set to mg/L.

The boundary conditions for the model can be specified on the Boundaries tab. In this example, the top boundary has a constant concentration of 1 and the bottom boundary has a constant concentration of 0.

## Model Execution



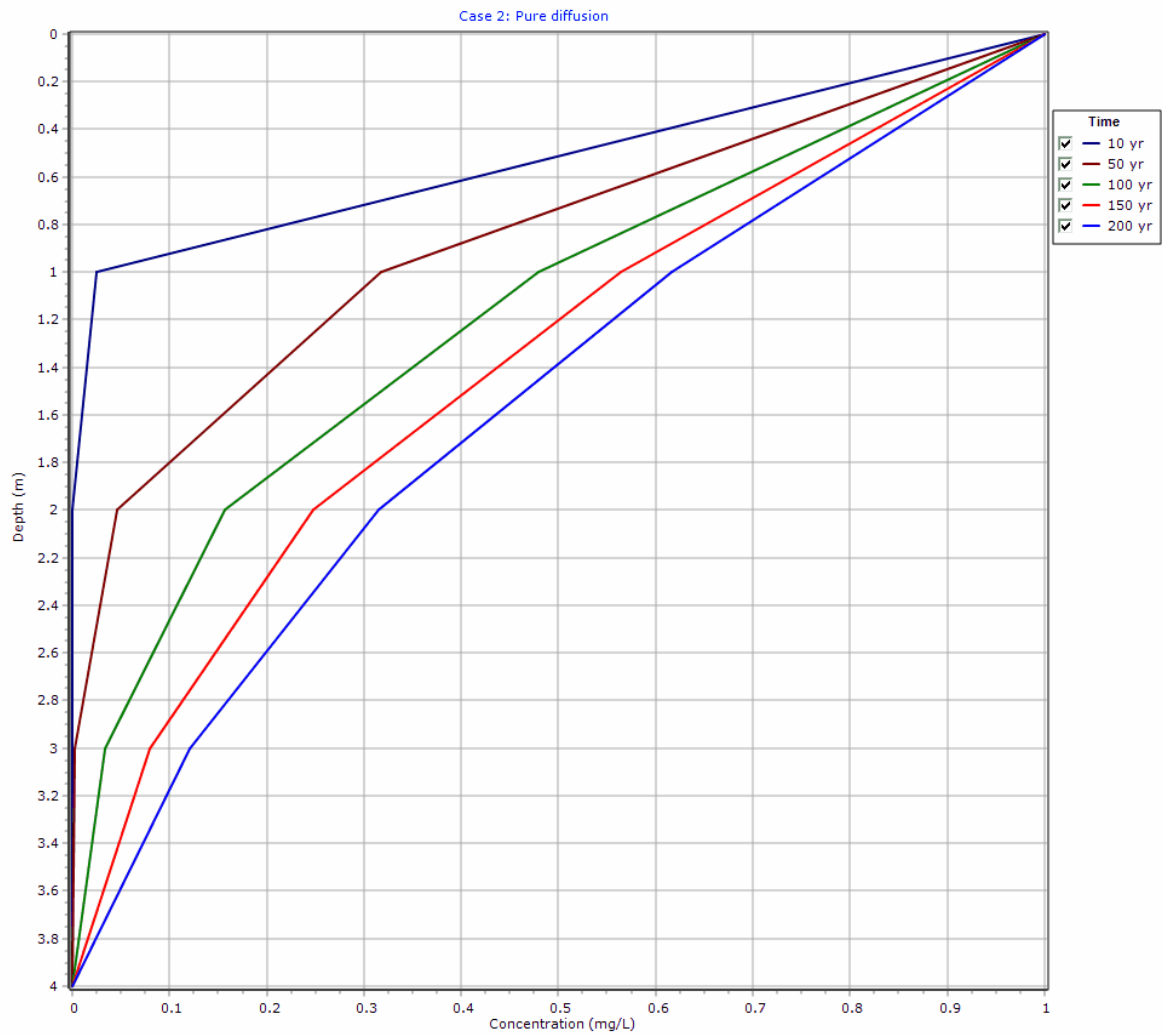
To run the model and calculate the concentrations, press the Run button on the toolbar.

## Model Output

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

### Concentration vs Depth

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



### 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 2: Pure diffusion

THE DARCY VELOCITY (Flux) THROUGH THE LAYERS  $V_a = 0$  m/year

### Layer Properties

Layer	Thickness	Number of Sublayers	Coefficient of Hydrodynamic Dispersion	Matrix Porosity	Distribution Coefficient	Dry Density
Aquitard	4 m	4	0.01 m <sup>2</sup> /a	0.4	0 cm <sup>3</sup> /g	1.5 g/cm <sup>3</sup>

### Boundary Conditions

#### Constant Concentration

Source Concentration = 1 mg/L

#### Constant Concentration Bottom Boundary

Base Concentration = 0 mg/L

### Laplace Transform Parameters

TAU = 7   N = 20   SIG = 0   RNU = 2

### Calculated Concentrations at Selected Times and Depths

Time yr	Depth m	Concentration mg/L
10	0.000E+00	1.000E+00
	1.000E+00	2.535E-02
	2.000E+00	7.744E-06
	3.000E+00	2.011E-11
	4.000E+00	0.000E+00
50	0.000E+00	1.000E+00
	1.000E+00	3.173E-01
	2.000E+00	4.550E-02
	3.000E+00	2.699E-03
	4.000E+00	0.000E+00
100	0.000E+00	1.000E+00
	1.000E+00	4.795E-01
	2.000E+00	1.573E-01
	3.000E+00	3.349E-02
	4.000E+00	0.000E+00
150	0.000E+00	1.000E+00
	1.000E+00	5.636E-01
	2.000E+00	2.477E-01
	3.000E+00	7.937E-02
	4.000E+00	0.000E+00
200	0.000E+00	1.000E+00
	1.000E+00	6.166E-01
	2.000E+00	3.146E-01
	3.000E+00	1.212E-01
	4.000E+00	0.000E+00

### NOTICE

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