

MIGRATEv9

User's Guide

STATE OF ILLINOIS
COUNTY OF KENDALL
- FILED -

OCT 01 2008

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KENDALL COUNTY

KRL Ex 3

NOTICE

Although this software has been tested and the documentation reviewed and experience would indicate that it is accurate within the limits given by the assumptions of the theory implemented, no warranty as to workability of this software or documentation is made. No warranty or representation either expressed or implied (including warranties of fitness) shall apply to this software or documentation. No responsibility is assumed for any errors, mistakes or misrepresentations that may occur from the use of this software or documentation. The user accepts full responsibility for assessing the validity and applicability of the results obtained with this software and documentation for any specific case.

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Distributed by:

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Windsor, Ontario, Canada
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Example 1: Subtitle D Landfill

Description

This example illustrates the use of the MIGRATEv9 program to model a U.S. RCRA Subtitle D landfill. The landfill consists of a composite liner and a primary leachate collection system. The composite liner is composed of a 60 mil (1.5 mm) geomembrane in good contact with a 0.9 m thick compacted clay liner. Small holes with an area of 0.1 cm² and a frequency of 1 per acre (2.5 per hectare) are assumed for the geomembrane. The method proposed by Giroud et al (1992) and Giroud and Bonaparte (1989) is used to calculate the flow (leakage) through the composite liner, these calculations are performed automatically by MIGRATE-GUI.

The landfill has a surface and base width of 200 m in a direction parallel to the groundwater flow in the underlying aquifer. Consideration is being given to a volatile organic contaminant with an initial source concentration of 1500 µg/L, which is assumed to remain constant over the time period being examined in this example. The leachate head on the composite liner is assumed to be constant at 0.3 m. The flow in the aquifer must be established based on hydrogeologic data and is represented in terms of the horizontal Darcy velocity (assumed to be 10 m/a in this example) in the aquifer at the down-gradient edge of the landfill.

For more information regarding:

- Leakage through composite liners - see Giroud et al (1992) and Giroud and Bonaparte (1989).
 - Diffusion through geomembranes - see Rowe et al (1994) and, Rowe et al (1995).
 - Diffusion, sorption, and effective porosity in clays (D , K_d , n) - see Rowe et al (1988, 1994); Barone et al (1992a, 1992b).
 - Modelling, hydrogeology, and engineering interaction - see Rowe (1991a, 1991b), Rowe et al, (1994).
 - Theory used - see Rowe and Booker (1985b, 1991a), Rowe et al (1994).
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**MIGRATE-GUI
Execution**

Start the MIGRATE-GUI program by typing:

MIGRATE

Press any key to remove the title screen and go to the menus.

**Data Entry
→ Leakage Rate
(Subtitle D)
Landfill**

Select the Data Menu and then the Leakage Rate (Subtitle D) Landfill submenu.

[Data Entry] [Leakage Rate (Subtitle D) Landfill]

A warning message will be displayed regarding the use of this option, after reading the message press the OK button. In the Leakage Rate (Subtitle D) Landfill dialog box enter the following information then press the Continue button.

Contact:	Good	<i>Degree of contact between the geomembrane and compacted clay liner.</i>
Hole Type:	Circle	<i>Type of defect in geomembrane.</i>
Permeation:	Yes	<i>Consider leakage due to permeation.</i>

Title: Case 1: Subtitle D Landfill with constant source concentration.

[Continue]

**Geomembrane
Hole Data**

The data for the geomembrane holes is entered in the next dialog box. Enter the data below and then press the Continue button.

Frequency:	1 /acre
Hole Area:	0.1 cm²

[Continue]

Landfill
Source Data

In the next dialog box the source information is entered, and then the Continue button is pressed.

Concentration: 1500 $\mu\text{g/L}$
Landfill Base Width: 200 m
Landfill Surface Width: 200 m
Type: Constant Concentration

[Continue]

Hydraulic Heads

The leachate head on the composite liner is required to calculate the flow (leakage) through the liner. Enter the information below and then press the Continue button.

Leachate Head on Primary Liner: 0.3 m

[Continue]

Primary
Geomembrane

Next enter the geomembrane data, and then press the Continue button.

Thickness: 60 mil
Diffusion Coef: $3\text{E-}05$ m^2/a

[Continue]

Primary
Clay Liner

In the Primary Clay Liner dialog box enter the data below, and then press the Continue button.

Thickness: 0.9 m
Density: 1.9 g/cm^3
Hydraulic Conductivity: $1\text{E-}07$ cm/s
Vertical Diffusion Coef: 0.02 m^2/a
Horizontal Diffusion Coef: 0.02 m^2/a
Distribution Coef: 0.5 mL/g
Porosity: 0.35

[Continue]