Leachate diffusion from two layer soil
compacted clay liner or CCL is at the top, with thickness h_1, natural stratum with thickness h_2 is at the bottom.

Governing equations

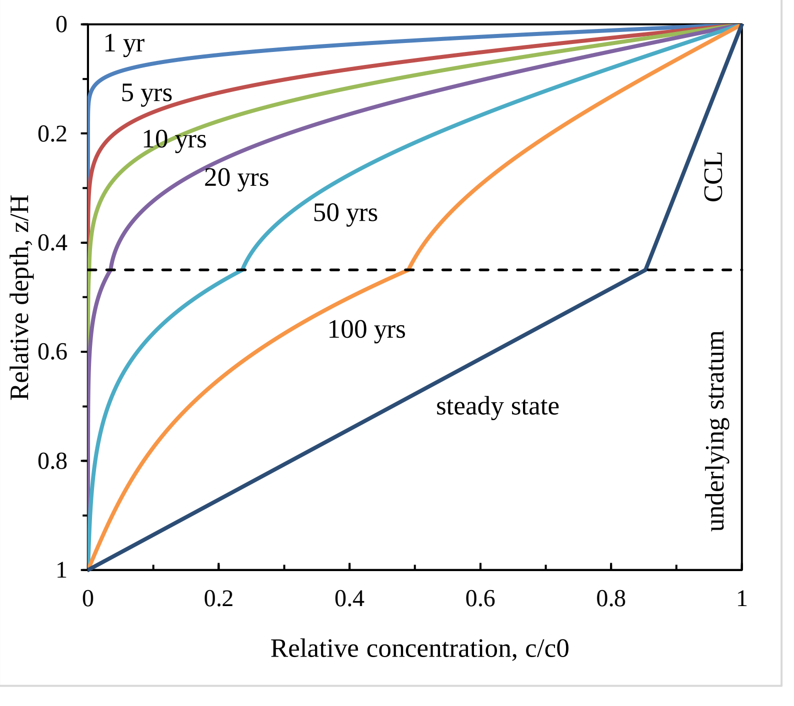
$$R_{d1}\frac{\partial c_1}{\partial t} = D_1^*\frac{\partial^2 c_1}{\partial z^2} \quad 0 \le z \le h_1 \qquad\qquad R_{d2}\frac{\partial c_2}{\partial t} = D_2^*\frac{\partial^2 c_2}{\partial z^2} \quad h_1 \le z \le H$$

Variables
$D^*_1=4\times10^{-10}$ m^2/s, $D^*_2=1\times10^{-10}$ m^2/s (diffusion coefficient)
$R_{d1}=3.3$, $R_{d2}=1.0$ (Retardation factor) $n_1=0.444$, $n_2=0.375$ (porosity)
$h_1=0.9$ m, $h_2=1.1$ m (layer thicknesses)
z = vertical direction, positive downwards (unit = m). z=0 corresponds to top of soil, and z=H corresponds to bottom of the two-layer system t = time (unit = s)
c = leachate concentration $H = h_1+h_2$
The boundary conditions: $c=c_0$ @ z=0 c=0 @ z=H
(there is an aquifer at the bottom that removes any leachate whenever it reaches the bottom of the second layer)
Initial condition: c=0 for 0<z<H
Interface boundary condition

$c_1=c_2$ @ $z=h_1$ $$n_1 D_1^*\frac{\partial c_1}{\partial z} = n_2 D_2^*\frac{\partial c_2}{\partial z} \quad @\ z = h_1$$

(The concentration and mass flux of concentration are continuous at the interface)

Analytical solution using Fourier series:



Reference

Li, Y. C., & Cleall, P. J. (2010). Analytical solutions for contaminant diffusion in double-layered porous media. *Journal of Geotechnical and Geoenvironmental Engineering*, *136*(11), 1542-1554.
https://ascelibrary.org/doi/abs/10.1061/(ASCE)GT.1943-5606.0000365