Simulation of Leachate Plumes in Groundwater from a Landfill Using an Approximate

Kitchakarn Promma*

Department of Natural Resources, Faculty of Agriculture, Naresuan University, Phitsanulok, Thailand

ABSTRACT

Most analytical solutions for contaminant transport in groundwater are difficult to apply in spreadsheets because they require numerical integration. The Domenico solution is approximate without the integral term for a planar source placed at the inflow boundary. In this study, the Domenico solution is extended to a prism source by considering off-domain contaminant transport. The source was lengthened by using the ratio between longitudinal and horizontal transverse hydrodynamic dispersion coefficients. The source thickness was also lengthened by using the ratio between vertical velocity of source loading and longitudinal velocity of contaminant transport. The modified Domenico solution was tested against previous exact solutions and at a landfill in Phitsanulok, Thailand. Results show that the modified Domenico solution simulated higher contaminant concentrations near the source and in the bottom of the domain than the Domenico solution but yielded similar plumes to the exact solutions. The application of the modified Domenico solution at a landfill was successful such that the post-audited model were well matched the predicted model. The modified Domenico solution is convenient for testing the response of plume length and concentrations to measurable input parameters when a three-dimensional representation of the source is important.

Keywords: Groundwater, Simulation, Contaminant Transport

*Corresponding author: kitpromma@yahoo.com