

Evaluating BTEX concentration in soil using a simple one-dimensional vado zone model: application to a new fuel station in Valencia (Spain)

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Specific studies of the impact of fuel spills on the vadose zone are currently required when trying to obtain the environmental permits for new fuel stations. The development of One-Dimensional mathematical models of fate and transport of BTEX on the vadose zone can therefore be used to understand the behavior of the pollutants under different scenarios.

VLEACH - a simple One-Dimensional Finite Different Vadose Zone Leaching Model - uses an numerical approximation of the Millington Equation, a theoretical based model for gaseous diffusion in porous media. This equation has been widely used in the fields of soil physics and hydrology to calculate the gaseous or vapor diffusion in porous media.

The model describes the movement of organic contaminants within and between three different phases: (1) as a solute dissolved in water, (2) as a gas in the vapor phase, and (3) as an absorbed compound in the soil phase. Initially, the equilibrium distribution of contaminant mass between liquid, gas and sorbed phases is calculated. Transport processes are then simulated. Liquid advective transport is calculated based on values defined by the user for infiltration and soil water content. The contaminant in the vapor phase migrates into or out of adjacent cells based on the calculated concentration gradients that exist between adjacent cells. After the mass is exchanged between the cells, the total mass in each cell is recalculated and re-equilibrated between the different phases. At the end of the simulation, (1) an overall area-weighted groundwater impact for the entire modeled area and (2) the concentration profile of BTEX on the vadose zone are calculated.

This work shows the results obtained when applying VLEACH to analyze the contamination scenario caused by a BTEX spill coming from a set of future underground storage tanks located on a new fuel station in Aldaia (Valencia region - Spain).