

Intermediate-scale experimental methods utilized for the investigation of dissolved phase DNAPL plume persistence in field material representing three typical field domains

Derrick Rodriguez and Tissa Illangasekare

Colorado School of Mines, Center for Experimental Study of Subsurface Environmental Processes (CESEP), Golden, CO

Abstract. Current and/or past DNAPL contaminated sites may have plume persistence problems if the flowing groundwater is transporting dissolved phase DNAPL into downstream, low permeability formations. Over time, these low permeability formations may be the source of the back diffusion of dissolving DNAPL into the flowing groundwater and its subsequent transport to a downstream receptor locations. Back diffusion from low permeability formations may explain why at some sites, contaminant concentrations in monitoring wells continue to exceed maximum contaminant levels even after the primary source of contamination has been removed. In order to better understand the fundamental processes that contribute to plume longevity at DNAPL contaminated sites, a series of intermediate-scale experiments were performed in the laboratory using a field soil collected from a contaminated site. Intermediate-scale experiments were used in order to best fill the gap between bench-scale experiments and direct application to a field setting. Three intermediate-scale (4.8 m x 1.2 m x 0.05 m) experiments were conducted based on the predominant subsurface features from an actual contaminated site. The first experiment involved a simple two-layer system; the second system also included a two-layer system, but also involved an embedded mound of field material; and the final experiment involved an inclined plane of field material, overlain by a laboratory sand. The work presented focuses on the challenges faced with the experimental methodology used for performing successful intermediate-scale experiments including: tank design, materials, construction, analytical equipment/methods and various methods unique to experiments of this scale.