



Transverse dispersion: From laboratory experiments to field applications

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Transverse dispersion is relevant for dilution of contaminant plumes in groundwater and in many cases controls the length of steady state plumes during natural attenuation. Also dissolution kinetics of NAPLs in porous media and mass transfer of vapor phase compounds across the capillary fringe (e.g. supply of oxygen) is limited by transverse dispersion. In bench scale laboratory experiments typically very small dispersion coefficients are observed. Transverse dispersivities determined in DNAPL pool dissolution experiments in coarse sands are less than 0.1 mm which agrees with results from lab experiments on dilution of tracers and transfer of oxygen across the capillary fringe. Such low dispersivities lead to long-term persistence of DNAPL pools of many decades to centuries which is confirmed e.g. for chlorinated solvents and coal tars by observations at contaminated sites. However, larger scale investigations, e.g. determination of the length of steady state plumes or reduction of mass fluxes of biodegradable compounds suggest that transverse dispersivities at field scale are up to 3 orders of magnitude higher (1 -10 cm). Reasons for this discrepancy are still unclear, but may be partly explained by processes enhancing transverse mixing such as flow focusing due to aquifer geometries or high permeability inclusions and helical groundwater flow induced by herringbone structures in sediments.