

Water quality impacts of retardation and reaction in low permeability zones in groundwater plumes

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Abstract. Ongoing research at Colorado State University is focusing on contaminant transport via advection and transverse diffusion in heterogeneous media. Analytical solutions for a two-layer system consisting of semi-infinite transmissive and low permeability zones with degradation have been developed. Initial calculations indicated select terms in the solution required series approximations for large domains. Conditionally selecting series approximations has allowed for calculations of contaminant concentrations in domains as large as two kilometers. Results are providing novel insights regarding contaminant transport. First, in the absence of degradation, benefits of complete source removal are limited by ongoing releases from the low permeability zone. Secondly, reactions in low permeability zones, in the absence of low permeability zone retardation, dramatically reduce long term releases from low permeability zones. Thirdly, given large retardation in low permeability zones, the benefits of low permeability zone reaction are reduced. These results support the observation that understanding both reaction and retardation in low permeability zones can be critical to understanding contaminant transport in heterogeneous media.