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Numerical model for the dipole flow and reactive tracer test

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A major concern in groundwater restoration is the effect of imposing lab-scale- determined -or literature-based- parameters upon field-scale transport problems. This results in uncertain predictions of in-situ performance and therefore unnecessarily cautious risk assessment and costly remediation strategies. Hence, cost-effective site investigative tools that have the capability of producing high quality characterization data are required. Research undertaken in this project has the potential to be developed as a major site investigation tool. This tool uses the Dipole Flow and Reactive Tracer Test (DFRTT), as an extension of the recently developed dipole flow test by including reactive tracers, to obtain reactive parameters required for complete site characterization. Upon completion, this tool will provide a method to determine field-scale parameters for use in appropriate reactive transport models and to support remedial technology selection and design. One main element of this tool is the development of a numerical transport model that interprets breakthrough curves (BTCs) obtained from a DFRTT. The model consists of a steady-state ground water flow component and a transient aqueous phase reactive transport component. The first component, which solves the radial saturated symmetric non-homogenous isotopic ground water flow equation, accounts for well skin effect with a user specified thickness, hydraulic conductivity, and porosity; provides options for the location of upper and lower horizontal boundaries; allows for a user specified location of a horizontal feature with a thickness, hydraulic conductivity, and porosity; and accounts for an asymmetric dipole system. The second components accounts for advection-dispersion transport with sorption and first order decay. For model validation, comparisons with analytical solutions for several simple problems are performed and proved model accuracy. Other simulations are

carried out to demonstrate model capabilities.