Managing Large Dilute Plumes Impacted by Matrix Diffusion

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Matrix diffusion, whereby residual constituents, loaded into low permeability zones prior to source control, slowly diffuse back into transmissive zones intercepted by extraction wells, has been demonstrated to contribute to the lack of progress of groundwater cleanup remedies at a number of sites with large, dilute plumes. At these sites, pump and treat and active source control remedies implemented in the 1980s and 90s have been unsuccessful in decreasing the plume footprint to below cleanup targets. This talk will discuss the conditions that are indicative of a site where matrix diffusion is important, methods to assess whether or not matrix diffusion is occurring at a site using existing data, and how conventional methods and/or assumptions are affected when remedy performance is being reviewed or remedy selection is being revisited. These topics will be explored via a case study of a 1.5-mile long chlorinated solvent plume impacted by matrix diffusion in Mountain View, California. Currently, there are over 100 extraction wells removing approximately 2,500 pounds of VOCs per year at the site. The operating duration of the existing pump and treat remedy is expected to be centuries. In hopes of finding an alternative that could expedite the remedy, the US EPA is conducting a focused groundwater feasibility study that considers other technologies such as in situ treatment, permeable reactive barriers, and monitored natural attenuation. The use of traditional solute transport models to evaluate cleanup times by EPA would have led to significant underestimates of both cleanup times and costs associated with the alternatives because these models don't include the significant impacts of mass added through matrix diffusion. Therefore, an approach was developed to estimate realistic cleanup times considering the process of matrix diffusion.