Simulation-Based Optimal Placement of Slow Release Oxidant Cylinders and Comparison of Cost with Injections

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Background/Objectives. When a site contains a large diffuse DNAPL plume, dig-and-haul/pump-and-treat and oxidant injection approaches may be cost prohibitive. If site conditions are favorable, slow release oxidant cylinders may be well indicated. The optimal number, location, installation type (installation wells versus direct push), and replacement times, are sought.

Approach/Activities. Simulation-based optimization is used to find the number, location, installation type (installation wells versus direct push), and replacement times of oxidant cylinders which minimizes the cost of remediation. A comparison is made between remediating a contaminated region using slow release persulfate cylinders versus activated persulfate injections. Mass flux of contaminant at a transect is used as the compliance measure. The Implicit Filtering Enhanced Genetic Algorithm (IFEGA) optimizer calls a FORTRAN simulator, as a Black Box function, to solve the coupled system of Partial Differential Equations (PDEs) representing the fate and transport of the oxidant and contaminant species, as well as natural oxidant demand (NOD). NOD is the natural reactivity of the soil, which is a phenomenon that leads to oxidant lost to non-productive use.

Results/Lessons Learned. From a sensitivity study on the parameters involved, insight is given into the site characteristics which indicated slow release oxidant cylinders are an appropriate remediation strategy. The costs and remediation time associated with using slow release persulfate cylinders and activated persulfate injections will be given for at least one example site.