Optimization of EISB and MNA Confirmation at a Complex Site Using Multiple Evaluation Tools

Leah MacKinnon (lmackinnon@geosyntec.com), Michaye McMaster, Silvia Mancini, and Laura Zimmerman (Geosyntec Consultants, Waterloo, Ontario, Canada)
Charles Elmendorf (SMC LLC, Wilmington, Delaware)
Brian Dean and Alycia McCord (Group Delta, Torrance, California)

Background/Objectives. Enhanced in situ bioremediation (EISB) of 1,2-dichloroethane (1,2-DCA), trichloroethene (TCE) and other chlorinated volatile organic compounds (CVOCs) has been on-going since 2011 in a large-scale application in California. Monitored natural attenuation (MNA) is the primary off-site remedy.

Approach/Activities. The EISB remedy has employed a recirculation approach over a 25-acre site using more than 40 injection and extraction wells to deliver electron donors to promote EISB. The remedy strategy has achieved source and plume treatment despite challenges of complex hydrogeology, difficult geochemical conditions (very high sulfate; 1,1,2-trichloroethane and chloroform presence), access restrictions and a neighboring hydrocarbon plume. This presentation will describe the adaptive management approach used to guide the overall remedy implementation, and the use of multiple tools to guide optimization steps that have ultimately demonstrated remedy success. These tools have included numerical flow modeling, mass balance evaluations, and molecular, geochemical and isotope analysis. These same tools have been essential for confirming the effectiveness of MNA for the off-site plume, allowing active remediation to be limited to the on-site area. As the active remedy achieves the remedial goals through various areas of the site, EISB is being transitioned to a passive approach via injection of a long-term electron donor to limit the potential for post-treatment rebound from lower permeability intervals.

Results/Lessons Learned. To date, the remedy has substantially reduced CVOC concentrations in three target hydrogeologic units such that more than 85% of the pre-EISB mass has been treated. The success achieved has allowed shutdown of active remediation for one third of the remedy. Shutdown of the remainder of the remedy is anticipated within the next few years.