Shut-Down Test after 22 Years of Groundwater Treatment Reveals Optimal Strategy

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Background/Objectives. The Site is an undisclosed facility located in the mid-Atlantic that was previously used for the manufacture of printed circuit boards including electrolysis/electroplating, etching and coating processes. In 1986, chlorinated volatile organic compounds (CVOCs), primarily consisting of 1,1,1-trichloroethane (TCA) and methylene chloride (MEC), were identified in soil at the solvent tank farm and solvent recovery area associated with the manufacturing facility. In 1991, the U.S. Environmental Protection Agency (EPA) required the installation and operation of a groundwater treatment system (GWTS) with specified cleanup goals for MEC, TCA, 1,1-dichloroethene (DCE), and 1,1-dichloroethane (DCA) similar to maximum contamination levels (MCLs). Manufacturing operations ceased in June 2001, and the Site was developed into a shopping mall in 2006. The GWTS operated from 1995 until December 2016 and includes 18 extraction wells and four dual-phase extraction (DPE) wells. The objective of our work was to assess the fate and transport of CVOCs under non-pumping conditions including an evaluation of source area control, abiotic and in situ biogeochemical processes, and remedial alternatives to produce an optimized combined remedy.

Approach/Activities. To assess the effectiveness of the current remediation system through: 1) a temporary "shutdown" of the GWTS in January 2016 to evaluate plume stability and CVOC fate and transport under non-pumping and new optimized limited pumping, 2) aggressive soil sampling with real-time screening for total VOCs using the Color-Tec Method, 3) site-wide statistical analysis to understand plume stability and attenuation processes, 4) aggressive and strategic monitoring to evaluate biotic/abiotic attenuation pathways including qPCR DNA analysis, and 5) long-term risk analysis of receptors including water-supply wells, wetlands, and indoor air for the shopping mall in consideration of a potential optimized combined remedy.

Results. Results from the temporary shutdown and subsequent aggressive monitoring indicate 1) CVOCs can be managed by injections of sodium persulfate, 2) large portions of the plume remain stable and within contingency values with specific locations that require additional evaluation allowing for optimization, 3) abiotic/biotic activity is generally occurring, but more rapid near sanitary sewer locations near buildings, and 4) a consistent layer of clay is present in the subsurface along with construction grade vapor barriers that appear to limit the movement of vapor from the groundwater to building foundations. Results from this work will be summarized and presented in addition to projected cost savings.

Lessons Learned. Sewer utilities can serve as preferential pathways for groundwater flow, but can also serve to release carbon to aid in the degradation of TCA to vinyl chloride. Obtaining information on behalf of the responsible party from a developer can be time consuming and difficult, but worthwhile, and consistent communication with stakeholders during a Shut-down Test with aggressive groundwater monitoring is vital so that the appropriate strategy or combined strategy can be developed considering all stakeholders.