Lessons Learned in Optimizing Air Sparge/Soil Vapor Extraction at a Former Dry Cleaner Site

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Background/Objectives. Tetrachloroethene (PCE) was discovered in residences, irrigation wells, and surface water downgradient of a former dry cleaner site in the northeastern United States beginning in the 1990s. Air sparging (AS) and soil vapor extraction (SVE) were selected to address PCE in the sandy soil and shallow groundwater at the source area, with the objectives of achieving asymptotic mass removal rates and reducing soil concentrations to less than 1 milligram per kilogram, a decrease of up to three orders of magnitude.

Approach/Activities. The well field for the AS/SVE system installed in 2016 consists of 15 AS points, four SVE points for vapor removal from the vadose zone, and six vapor monitoring points (VMPs). The VMPs and SVE wells were installed to a depth of approximately 12 feet, and the AS wells were installed to a depth of approximately 40 feet. The total flow of the AS system is up to approximately 50 cubic feet per minute, with SVE airflow of up to approximately 300 cubic feet per minute. Volatile organic compounds (VOCs) are recovered from the SVE wells and treated using granular activated carbon.

Performance monitoring includes semiannual groundwater monitoring for comparison to baseline sampling conducted prior to AS/SVE system construction. Correlation curves were also created for process monitoring (using field and laboratory analyses) for various contaminants of concern to support more accurate estimates of mass removal.

Results/Lessons Learned. From the design phase through performance of initial operations activities, various aspects of the system were optimized to maximize system efficiency, increase mass removal, and decrease the overall cleanup timeframe. These included utilization of an alternative site cover (which sped up installation while providing an improved surface seal); periodic adjustments of the system blowers to increase overall airflow, area of influence, and mass recovery; increasing airflows at select SVE wells to focus on areas exhibiting higher vapor concentrations; and adjusting AS airflows at select locations to address areas with higher groundwater concentrations and expedite the overall groundwater cleanup effort.
Although system flow rates were restricted to meet air permit requirements with respect to maximum influent concentrations, a rapid decrease in both extracted vapor concentrations and groundwater concentrations was observed. Over the first year of operation, the system removed and treated an estimated 2,000 pounds of chlorinated VOCs; during this time period, VOC mass removal decreased from an initial rate of more than 850 pounds per month to less than 20 pounds per month. Concentrations of PCE and trichloroethene (TCE) in shallow groundwater also decreased by 99.9% by the end of the first year of operation.

To further optimize the remedial system and increase VOC extraction rates going forward, pulsing of the air sparge system was initiated on a 2-week cycle, after 1 year of full-time system operation. This pulsing strategy has achieved an increase in VOC mass removal rates. Lessons learned during the process of system optimization will be presented in detail.