

Monitoring of a Large Trichloroethene Soil Gas Plume: Prior to, during, and Post Soil Vapor Extraction Pilot Testing

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Background/Objectives. The objective of this presentation is to describe the monitoring program and observed effects of soil vapor extraction (SVE) pilot studies on a large trichloroethene (TCE) soil gas plume at the Cold Regions Research and Engineering Laboratory in Hanover, New Hampshire. TCE was released to shallow silt and clay soils by a leaking underground storage tank containing TCE, by experiments related to a former Ice Well, and by an aboveground storage tank explosion containing TCE in 1970. TCE adsorbed to shallow and intermediate soils resulted in the development of a highly-contaminated soil gas plume underlying the facility and surrounding properties. Unsaturated zone thickness range from 130 to 135 feet. TCE concentrations in soil gas exceeding $100 \mu\text{g}/\text{m}^3$ encompass an area of approximately 60 acres with a plume volume in excess of 4,000,000 cubic yards. Concentrations in the source area range between 2M to 10M $\mu\text{g}/\text{m}^3$. As there have been no known inputs of TCE mass to the system since 1987 the soil gas plume is assumed to be at equilibrium in a semi-confined, deep vadose zone geologic setting.

Approach/Activities. The soil gas monitoring network was installed in a phased approach using direct push methods. Eighty-seven implant locations were established with multi-level sampling intervals ranging from 5 to 125 feet deep. Up to 270 soil gas samples are collected each synoptic sampling round. A total of four synoptic soil gas sampling rounds have been completed in addition to periodic, task-specific sampling. Air samples are analyzed on-site by HAPSITE® ER GC/MS. Soil vapor extraction (SVE) pilot tests have been conducted in source areas. Over 500 gallons of TCE has been removed from the vapor phase over a 15-month period of SVE pilot test operation. Synoptic soil gas sampling was conducted to bracket these pilot tests. Soil gas results are incorporated into the three-dimensional conceptual site model and volumetric representations are created using interpolative methods.

Results/Lessons Learned. Synoptic soil gas sampling shows that the footprint of TCE impacted soil gas remained relatively unchanged over a six-year period prior to the SVE pilot test. The SVE pilot tests removed over 500 gallons of the vapor phase TCE. During the pilot test the concentrations in the cores of the soil gas plume decreased by over an order of magnitude from 10M $\mu\text{g}/\text{m}^3$ to less than 1M $\mu\text{g}/\text{m}^3$. At locations peripheral to the source area, concentrations in soil gas have been reduced up to 90%. Concentrations at the perimeter of the vapor plume, several hundred feet from the SVE wells, also decreased, showing the effect of cutting off diffusive transport from source areas and natural attenuation in the outlying areas. SVE has been very effective in mass reduction of TCE in the deep vadose environment.