Soil Vapor Extraction Pilot Test Effects on Sub-Slab Depressurization Influent TCE Concentrations

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Background/Objectives. The Main Laboratory building at the Cold Regions Research and Engineering Laboratory (CRREL) has a comprehensive sub-slab Vapor Intrusion Mitigation System (VIMS) that has reduced infiltration of trichloroethylene (TCE) into the building.

The facility is located on a lacustrine deposit with a 130-foot-thick unsaturated zone. Historic use of TCE at the facility has resulted in a TCE soil gas plume originating in two primary source areas (AOC-2 and AOC-9). The highest TCE concentrations are in the upper 50 feet of unsaturated soil, which is comprised of silt and clay. These low permeability soils are underlain by sandier, much more transmissive soil. Implementation of VIMS to address vapor intrusion issues was performed in 2013 and 2014. Due to building use logistics, sub-slab conditions, and the magnitude of the building foot-print, four separate VIMS blower and sub-slab vapor extraction networks were installed beneath the Main Laboratory basement and sub-basement floor slabs, which both include sections that daylight at grade.

Soil vapor extraction (SVE) pilot study activities were initiated in June 2015, and have included both long-term constant rate testing and rebound periods. The objective of this presentation is to describe the observed effects of SVE pilot study activities on the concentration of TCE in the influent to the VIMS.

Approach/Activities. Influent soil gas samples for each of the VIMS were collected on average every two weeks as part of VIMS performance monitoring activities. Operating data, including influent TCE concentrations, applied vacuum, and flow were recorded for the SVE pilot systems. SVE pilot study activities at both AOC-2 and AOC-9 have involved operation of several types of vapor extraction equipment, extraction from shallow and deep zones, both individually and in combination, and rebound studies consisting of extended system shutdowns.

The data collected for both the SVE pilot study and VIMS operations have been compared, including examination of VIMS behavior during various SVE operating conditions. Graphical comparisons were performed to explore the impact of the external SVE on the VIMS influent concentrations.

Results/Lessons Learned. In general, implementation of SVE pilot study activities has resulted in both decreased variability and magnitude of VIMS influent TCE concentrations. Influent concentrations for three of the VIMS have decreased by approximately 90% during the pilot testing. Furthermore, there is an apparent lag between changes in SVE pilot system operational changes and the impacts to VIMS influent concentrations.

The presentation will identify potential design criteria including: when VIMS can be decommissioned at sites with an SVE remedy planned or in place; identification of the potential presence of soil gas to indoor air pathways outside the footprint of VIMS influence; and VIMS and SVE system layout options to optimize vapor intrusion mitigation.