

Soil Vapor Extraction Using Horizontal Remediation Wells and Condensation Treatment to Recover Chlorinated and Petroleum NAPLs

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Background/Objectives. In 2016, NAPL impacts including TCE, DCE and jet fuels were delineated across a 500,000 square foot area at a former military installation. Most NAPL impacts were identified in the capillary fringe zone, atop the water table and were supported by the buoyancy of the petroleum hydrocarbon fuel mass. Remedial options were considered, with the preferred remedy identified as NAPL extraction supplemented by soil vapor extraction in the deep vadose zone and capillary fringe.

Approach/Activities. The installation of horizontal remediation wells was selected due to the discrete vertical interval of NAPLs encountered throughout the large affected area. Three horizontal remediation wells of ~1,000 ft length each were installed at the project site: two horizontal NAPL collection wells and one horizontal soil vapor extraction well. The high concentrations of chlorinated and petroleum hydrocarbon off-gasses were addressed by the installation on a condensation-based vapor extraction and treatment system of 250 scfm capacity. The condensation treatment system utilizes a regenerative, closed-loop cooling system to recover off-gas VOCs as NAPL that is disposed of offsite along with NAPL from the collection wells.

Results/Lessons Learned. The installation of horizontal remediation wells reduced the installed length of wells by over 90% compared to vertical wells. The design of the two different extraction well types will be discussed in detail, along with suggestions for future implementations. The SVE system has recovered as much as 100 pounds of VOCs per day, while maintaining > 99.9% reduction of VOC vapor concentrations, and > 95% runtime efficiency. This system has already removed >100,000 pounds of NAPL impacts, and is expected to be upgraded to a larger volumetric capacity in the coming months. A discussion of design and operational lessons learned for NAPL and vapor extraction will focus on the specific considerations of utilizing horizontal extraction wells. Further recommendations based on the project results will be made regarding the proper selection and operation of condensation-based vapor treatment systems for high concentrations of mixed chlorinated and petroleum VOCs.