

Soil Vapor Extraction Using a Horizontal Remediation Well to Remediate Biogenic Methane and VOCs at a Hydrocarbon Contamination Site

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Background/Objectives. At a site undergoing environmental investigation and remediation for petroleum-hydrocarbon impacts, the effectiveness of a horizontal remediation well (HRW) was evaluated to remove biogenic methane and petroleum hydrocarbon VOCs from the vadose zone. The first phase of remediation (Phase I) consisting of a traditionally configured soil vapor extraction (SVE) system with 15 vertical wells and a thermal oxidizer had removed approximately 370,000 pounds of methane and VOCs since October 2014. The conceptual approach for the second phase of remediation (Phase II) originally consisted of approximately 32 additional vertical SVE wells. This approach was modified to evaluate an optimized configuration consisting of HRWs that would limit near surface infrastructure and potential conflicts related to future site redevelopment.

Approach/Activities. A pilot test for evaluating the HRW was installed using entry/exit well directional horizontal drilling along sandy layers at a depth of 30 to 35 feet. The HRW well was constructed with 3-inch HDPE pipe with 260 feet of screen. During the 12-week pilot test of the HRW, the Phase I wells were temporarily shut down, and testing employed existing in-place Phase I treatment system equipment.

Testing performed during the HRW pilot test included:

- three-dimensional field vacuum response and parametric data collection followed by pore velocity modeling to estimate influence at three depth intervals;
- evaluation of methane and VOC response during pilot testing and estimation of the full-scale methane and VOC removal rate; and
- air infiltration testing with a sulfur hexafluoride tracer to evaluate gas transport in the subsurface and the feasibility of bioventing using a HRW.

This presentation will discuss the installation and operation of the pilot HRW, the results of the pilot HRW operation and comparisons to the Phase I vertical well operations. The presentation will also discuss the design and operation of the full-scale system which consists of 21, HRWs with 100-foot screen intervals connected to a larger Phase II SVE treatment system.

Results/Lessons Learned. Based on the pilot test results, it was determined that a HRW could effectively remove methane and VOCs while limiting near surface infrastructure that could inhibit future redevelopment of the site. Additionally, initial air respiration testing and the air infiltration testing performed during the pilot study indicates that it may be feasible to convert the HRWs to air injection wells for enhanced aerobic bioremediation following completion of SVE to optimize long-term remediation cost.