Horizontal Vapor Extraction Wells: Investigating the Zone of Influence and Optimizing Well Spacing

Brian Younkin, Ph.D. (brian@horizontaldrill.com) and Dan Ombalski, P.G. P.E. (dan@horizontaldrill.com) (Directed Technologies Drilling Inc., Bellefonte, PA)

Background/Objectives. Soil vapor extraction (SVE) wells have been demonstrated as a reliable remediation approach to mitigate vapor intrusion, and horizontal directionally drilled (HDD) wells have long been used for this practice. In many cases horizontal wells allow for the placement of wells under occupied spaces that are inaccessible with vertical drill rigs. Horizontal wells can also provide much longer screen section within/above a contamination plume than can be achieved in a vertical well orientation.

HDD and horizontal wells are being improved with advanced drilling techniques, navigation systems and installation methods. However, well layout and screen design often falls to a more seat-of-the-pants approach. Historically, “rules-of-thumb” established with vertical wells often carry over to horizontal well design. With different well orientations and unique screen designs perhaps horizontal wells need to be designed based on new parameters. The objective of this study is to gather field monitoring results from recently installed horizontal wells and present a guideline for SVE well spacing.

Approach/Activities. Directed Technologies Drilling (DTD) has installed numerous horizontal vapor mitigation wells. Data are collected from multiple projects to determine the effectiveness of the horizontal wells. Available data includes vacuum pressures and vapor concentration levels recorded in monitoring wells in proximity to horizontal SVE wells.

The authors compile monitoring well data to discover key design parameters for vapor mitigation systems. The relationship of soil types (implied pneumatic conductivity) to a well’s zone of influence are investigated. Other notable parameters include depth of well, depth to ground water and soil moisture.

Results/Lessons Learned. Horizontal SVE wells have shown a larger zone of influence than previously thought. Monitoring wells around horizontal SVE wells are detecting vacuum pressures 50 to 60 feet out from the well. Several factors that affect the extent of this zone of influence are formation pneumatic conductivity, depth of well, and soil moisture content.

Detailed field monitoring increases our understanding of effective horizontal well systems. Proper horizontal well spacing optimizes an economic approach to effective interception of soil vapors.