Environmental Fracturing in Low-K Conditions to Enhance Soil Vapor Extraction

Steven Pitts (steven.pitts@equipoisecorp.com)
(Equipoise Corporation, San Clemente, CA, USA)
Rick Blackmer, P.E. (Equipoise Corporation, San Clemente, CA, USA)
Klaus Rohwer, P.G. (Equipoise Corporation, Murrieta, CA, USA)

Background/Objectives. The soil and soil gas at a former industrial facility in California (the Facility) are impacted with volatile organic compounds (VOCs) including trichloroethene (TCE). Soil vapor extraction (SVE) and two-phase extraction (TPE) systems have operated for several years at the Facility; however, VOC recovery rates with the current SVE/TPE well system have reached asymptotic conditions. This is a function of extended remediation operations at each SVE/TPE well and low effective porosity conditions comprised of friable to moderately-indurated sandstone with varying degrees of cementation. Environmental fracturing (EF) technology was implemented at the Facility to increase air flow within the unsaturated zone and enhance the performance of the existing SVE/TPE systems.

Approach/Activities. The approach consisted of installing high pressure air injection infrastructure to target depth discrete intervals. Following air injection, the TPE/SVE systems were operated to extract newly available VOCs from the subsurface. The physical process of EF requires the injection of clean air into the subsurface at a pressure and flow rate that exceeds the soil matrices in-situ stresses and natural permeability, respectively. Air injection occurs within designated EF wells within the unsaturated zone. As the fracturing event takes place, pressurized air opens new apertures and expands existing channels. These channels accelerate the rate at which pore gases flow through the subsurface, inherently increasing the effectiveness of the existing SVE/TPE network.

Results/Lessons Learned. The results of the pilot test identified EF as a viable technology to enhance removal of VOCs from the unsaturated zone using SVE/TPE systems operating at the Facility. Pilot test results indicated improvements in subsurface connectivity based on measured changes in pressure, flow rate, and photoionization detector (PID) readings. Lessons learned include: injection point design, pressure demand, and radius of influence from the injection point. Performance monitoring of the pilot test is scheduled to complete in October of 2017.