

AEHS 2018 Conference Paper Abstract

Quantifying the Thermal Desorption Effect During ISCO Injections

Gary Cronk (JAG Consulting Group, Inc.)
Greg Sounhein (SounPacific Environmental Services)

Paper Presented at the AEHS 2018 Conference

Thermal desorption is a widely recognized environmental remediation technology that utilizes heat to increase the volatility of VOC contaminants so they can be removed (desorbed) from the soil matrix. However, in contrast to most thermal technologies, the heat given off during the Fenton's ISCO reaction has seldom been quantified or recognized as a significant contributor in VOC destruction. This probably is due to the generation of high strength hydroxyl radicals that provide excellent VOC destruction without even considering the thermal desorption effect. Due to the large number of ISCO sites that experience VOC rebound from matrix diffusion, there is a significant need to quantify the effectiveness of thermal desorption occurring during the Fenton's ISCO reaction.

Hydrogen peroxide possesses tremendous exothermic potential. In the field, groundwater temperatures generated by the Fenton's reaction have often been measured in the range of 120 to 140 degrees F (based on 10% and 12% peroxide injections). However, this temperature increase cannot be duplicated in the lab environment, due to the small size of the testing vessels typically used (one liter or smaller). The Fenton's reaction is most evident and measurable in a field injection, where the heterogeneous soils create semi-confining conditions which trap the heat released by the Fenton's reaction while simultaneously increasing subsurface pressures due rapid release of oxygen gas.

JAG designed several Bench Scale Treatability Tests which simulated the thermal effect from the Fenton's reaction. JAG tested separate peroxide reactor vessels in laboratory tests by heating vessels to 110 degrees and 130 degrees Fahrenheit, respectively. Using a mass balance approach, these tests confirmed that 30% more thermal desorption from the soil occurs at 110 degrees F and 55% more at 130 degrees F (in relation to a control vessel). Peroxide oxidation is a two-step process that involves desorption of VOCs and subsequent destruction of dissolved VOCs.