Controlled Vadose Zone Saturation and Remediation (CVSR) Using Chemical Oxidation

Gary Cronk, Stephen Koenigsberg, Barbara Coughlin, Mark Travers and Dave Schlott

Controlled Vadose Saturation and Remediation (CVSR) is essentially a long overdue advancement of standard in-situ treatment methods that have been traditionally been used in the saturated zone with appreciable success. Unsaturated zone treatments are not new, but they revolve around mechanical operations such as SVE. When compounds with limited volatility are involved, or there are other infrastructure limitations at the site, there is an opportunity for CVSR to be applied. To our knowledge this is the second published report on this approach using in-situ chemical oxidation (ISCO).

Alkaline activated sodium persulfate using sodium hydroxide was used to treat the shallow soils (to 15 ft depth) beneath an active industrial site in Illinois. The shallow soil was contaminated with a variety of VOC constituents including PCE, TCE, methylene chloride, toluene, and xylenes. Prior to the field injections, a soil buffering test was performed in the laboratory in order to determine the amount of sodium hydroxide need to raise the pH of the soil to above 10.5 and maintain it for two weeks.

To saturate the vadose zone, a combination of injection wells and an infiltration gallery were constructed to first percolate water to achieve saturation and then to oxidize. A total of 12 injection wells where installed in two treatment areas along with the infiltration galleries. Due to the low permeability silts and clays, each injection well had an estimated radius of influence of 10 feet. Approximately 4,700 gallons of sodium hydroxide (25%) and 11,500 pounds of sodium persulfate were injected into the wells over a 20 day period. The compounds of concern as listed were reduced from 88% to 99% by 180 days after treatment. The ISCO injections attained the site-specific soil cleanup criteria established by the State of Illinois EPA for this site and a “No Further Remediation” letter will be requested for Area #2. A second injection of activated persulfate is currently planned for Area #1.