Treatability Testing as a Tool for Identifying Appropriate Site-specific Remediation Technologies

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Laboratory testing was conducted on two soil types and groundwater from a site in Southern California to aid in the selection of a suitable oxidant for remediation of contaminants of concern (COCs). Testing assessed COC destruction as well as the potential effect of each oxidant on secondary water quality since adverse secondary effects such as the formation of hexavalent chromium, Cr(VI), can render a technology in appropriate for a site. Specific COCs were gasoline range organics (GRO), BTEX compounds (benzene, toluene, ethylbenzene, and xylenes), methyl t-butyl ether (MTBE) and t-butyl alcohol (TBA). The oxidants tested were modified Fenton's reagent using hydrogen peroxide (H_2O_2) and either iron-EDTA or VTX™ as the catalyst, and activated persulfate using PermeOx Plus™ as the activator.

The soil from two borings was grouped into sandier soil and clay soil. Soil #1 (sandier soil) contained 190 mg/kg TPH-g, and 2400 µg/kg total xylenes, while Soil #2 (clay soil) contained 21µg/kg of ethylbenzene, and 140 µg/kg total xylenes. Groundwater contained 19 mg/L TPH-g, 10,000 µg/L TBA, 1000 µg/L MTBE, and over 13,000 µg/L total BTEX. While these compounds are generally susceptible to aerobic biodegradation, high concentrations have persisted in some areas at the site, thereby necessitating the need for more aggressive treatment.

Laboratory testing clearly demonstrated that all of the oxidants evaluated could destroy COCs. However, modified Fenton's catalyzed with FeEDTA was clearly superior in its effect on TBA. A dose of 1% H_2O_2 and 250 mg/L Fe (added as FeEDTA) destroyed 94-97% of TBA, depending upon the soil type. All other treatments destroyed between 18-77% of the TBA. Modified Fenton's using FeEDTA was also noticeably better for destruction of TPH-g, but removal of all other COCs was similar regardless of reagent or soil type. Removal of COCs was due primarily to destruction rather than volatilization. For modified Fenton's reagent using either catalyst, < 10% of each COC could be accounted for in off-gases or post-treatment soil. For all of the activated persulfate tests, < 5% of each COC could be accounted for in off-gases or soil.

All treatments generated Cr(VI) concentrations in the part per billion range, but the amount was substantially less for modified Fenton's reagent. All oxidants mobilized some metals, though the specific metal varied and the changes were generally minor. Treatment with activated persulfate also increased pH to > 11 due to the alkaline nature of the persulfate activator, though the pH should decrease as the persulfate decomposes.

Based on the results of the treatability testing and other factors, Fenton's reagent using FeEDTA was selected as the remedy for this site.