MTBE Treatment Using Modified Fenton's Reagent

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Modified Fenton's reagent was applied for *in situ* treatment of an aquifer in Jacksonville, Florida where the primary contaminant is methyl-tert-butyl ether (MTBE). MTBE was measured in groundwater up to 250 µg/L. The contamination occurred in a shallow aquifer (between 10 and 30 feet below ground surface) that consists of a silty, clayey sand. The contaminant plume is under a fueling center parking lot and adjacent building that are still extensively used by the facility. The goal of the remedial action is to attain site closure within three years while minimizing disturbances to facility operations.

CH2M HILL selected in situ chemical oxidation (ISCO) as the most appropriate treatment technology for the site due to the short period of performance and the infeasibility of closing the parking lot for an extended duration. Of the oxidants commonly used for ISCO, hydrogen peroxide (modified Fenton's Reagent) and sodium persulfate were the only feasible alternatives to treat the MTBE, benzene, ethyl benzene, and xylenes. Ozone was not selected because it is difficult to distribute in the subsurface and permanganate is ineffective in the oxidation of MTBE. During project planning, the State of Florida was imposing stringent secondary drinking standards for both sulfate and iron. Because sulfate is a by-product of the degradation of persulfate, this treatment method was eliminated as an alternative. Also, the secondary standard for iron precluded the addition of iron to stimulate Fenton's chemistry. However, previous groundwater analytical results indicated high iron content in the aquifer, implying that a modified Fenton's application could work using the naturally occurring iron.

Prior to the ISCO application, CH2M HILL completed a bench scale test to assess the longevity of 12% H_2O_2 solution in slurries comprised of site soil and distilled water. The pH of the test slurries was maintained near 7 throughout the test. The results of the bench scale test indicated a peroxide half-life of about 48 hours. The field injection design calls for 12% solution injected in 3 foot intervals over the vertical span of the aquifer.

The initial two-week ISCO injection was completed in September 2005. During the field activities, difficulties were encountered during chemical injection due to the high iron content in groundwater and the H_2O_2 injection concentration, resulting in rapid degradation of H_2O_2 (producing oxygen and hydrogen gas) and development of significant backpressure in the subsurface. However, 20,000 pounds H_2O_2 were introduced to the subsurface and groundwater monitoring 30 days after the injection showed a 96% decrease in the MTBE concentration at the most contaminated well. Some rebound in the MTBE concentration has been observed at this well, however approximately three months after the ISCO injection, the MTBE concentration (27.6 µg/L) was still only 11% of the baseline concentration (250 µg/L). This concentration is only slightly above the treatment standard for site closure (20 µg/L). A second ISCO injection is scheduled for April 2006.