CASE STUDIES IN APPLICATION OF IN-SITU CHEMICAL OXIDATION TO TREAT EXPLOSIVES-CONTAMINATED GROUNDWATER

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The past production and handling of conventional munitions has resulted in explosives contamination of the soils and groundwater at various military facilities. While soil cleanup is underway at the largest sites, the final solution for explosives-contaminated groundwater remains one of the Army's major environmental challenges. With Army sites pumping and treating over 4 million gal/day of explosives-contaminated groundwater, alternative treatment technologies are needed to remediate the higher concentrations of explosives in aquifers, rather than simply containing plumes.

The U.S. Army Environmental Center first conducted trials in 1985 to evaluate the effectiveness of Fenton's reagent treatment on ammunition plant soils contaminated with TNT and RDX. Fenton's reagent combines hydrogen peroxide with ferrous sulfate as a catalyst to create hydroxyl radicals that are powerful non-specific oxidizing agents. Bench scale test results found that relatively low molar ratios of Fenton's reagent removed up to 100% of TNT and RDX in slurried sediments. Microtox tests showed that toxicity of the slurry was also reduced significantly.

While Fenton's chemistry has been employed successfully against chlorinated solvents and other organic contaminants, it was not until 1998 that it was investigated for treating groundwater contaminated with nitro aromatics at Milan Army Ammunition Plant, TN. The Milan test site was located above a shallow groundwater plume resulting from historical wastewater discharge from an explosives production line. Baseline explosives concentrations were 240 µg/L for RDX and 196 µg/L for TNT, as summed by wells in the test area. Milan and the Army Corps of Engineers performed a pilot test at three injection points. Sampling was conducted at 11 monitoring wells placed at various distances in order to determine the effectiveness of the process and its radius of influence. Post-treatment samples showed an initial 82% decrease in RDX groundwater concentrations, and a 92% reduction in TNT.

Following the success of the Milan demonstration, Pueblo Chemical Depot, CO, conducted its own field tests of in-situ chemical oxidation to treat an explosives plume from a former washout lagoon. Although it's confined aquifer and low contaminant concentrations (60 µg/L TNT and 19 µg/L RDX) favored the success of in situ treatment, subsurface conditions made it difficult to maintain an optimal pH for Fenton's oxidation.

This presentation will review results of these case studies, and examine factors that affect the attractiveness of in-situ chemical oxidation as a remedial option.