Accelerated BTEX/MtBE Destruction Achieved through Chemical Oxidation

The Town of Harrison, NY, and private industry recently collaborated in efforts to expedite ground-water cleanup at a municipal site adjacent to property scheduled for residential development. Investigations at this West Chester, NY, site, which formerly housed a public works garage, discovered BTEX and MtBE concentrations in ground water reaching 4,869 µg/L and 451 µg/L, respectively. Cleanup was challenged further by the site's steep grades and underlying bedrock.

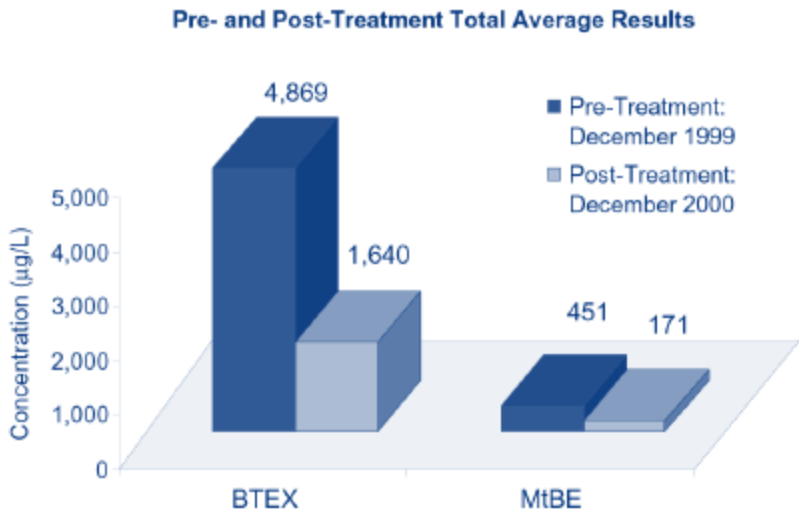
Petroleum leaks from an underground storage tank operating on the 100-acre property created a 2,400-sq-ft BTEX plume in the source area and a 17,600-sq-ft downgradient MtBE plume. The subsurface consists of very fine to coarse sand and gravel with occasional cobbles and an estimated ground-water flow rate of 0.23 ft3/day/ft2. The sand and gravel is underlain by highly weathered and fractured bedrock at 11-17.5 ft below ground surface (bgs). The depth to the water table ranges from 3 to 10 ft bgs.

Following site-specific laboratory studies that achieved non-detect concentrations of BTEX and MtBE, the ISOTECSM modified Fenton's reagent in-situ chemical oxidation (ISCO) process was selected as the remedial alternative for the site. The process involves the injection of hydrogen peroxide and chelated iron catalysts directly into the subsurface. Together, the chelated iron catalysts and stabilized hydrogen peroxide promote generation of reactive hydroxyl radicals under neutral pH conditions. The aqueous radicals react with organic materials to produce non-toxic by-products such as carbon dioxide and water.

Unlike remediation technologies based on the conventional Fenton's reaction, the ISOTEC process does not employ acidic additives, which hinder the natural attenuation process. Once equilibrium is achieved, contaminant concentrations typically decrease further due to natural attenuation and other physical processes occurring within the aquifer. The ISOTEC process also enhances subsurface mobility of injected reagents, which is needed for greater radial coverage of treated areas.

Injections at the West Chester site were performed in two 10-day phases conducted in June and November 2000. Reagents were injected into both bedrock plumes, within a 20,000-sq-ft treatment area on hilly terrain. The first phase involved injection of 1,700 gal of hydrogen peroxide and 760 gal of catalyst into 23 injection wells, at a rate of 1.64 gal/min. In the second phase, 2,500 gal of hydrogen peroxide and 1,200 gal of catalyst were injected into 21 wells. In addition, 76 direct-push points positioned in a 10-ft grid pattern were used to treat the contaminated interval, located 11-20 ft bgs. A total of 2,400 gal of hydrogen peroxide and 1,300 gal of catalyst was injected at an average rate of 0.89 gal/min at these points.

Field monitoring activities were conducted at 12 sampling locations one month after each of the two injection events. Project results indicated a 66% decrease in the total average BTEX concentration and a 62% decrease in the total average MtBE concentration (Figure 3). Treatment costs for this project totaled $150,000, or approximately $20.24/yd3 of contaminated ground water. Costs were significantly lower than the $1.5-2 million required for implementation of an alternative (5- to 7-year) pump and treat system.



Through the use of ISCO with modified Fenton's reagent, ground-water contaminants dropped within 13 months. The New York State Department of Environmental Conservation subsequently determined that the site required no further remedial action, and the adjacent property development will proceed as planned. This accelerated cleanup project received the New York Association of Consulting Engineers' Diamond Award and the American Council of Engineering Companies' National Recognition Award.

Other applications have shown the ISOTEC process effective in addressing significantly higher concentrations of MtBE. [For more information, view EPA/TIO's MtBE Treatment Profiles at www.clu-in.org/products/mtbe]. Additional studies are underway to evaluate this technology's effectiveness in removing other recalcitrant volatile and semivolatile organic compounds, as well as organic pesticides.

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