

Combining Aerobic Bioremediation with Chemical Oxidation for the In Situ Remediation of a MTBE Plume

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The use of in-situ techniques to address soil and groundwater impacts has increased significantly over the last decade with in-situ techniques being used at approximately one-third of all sites. In situ treatment using aerobic biodegradation or chemical oxidation has been shown to be effective on a large number of impacted sites. Typically aerobic biodegradation is accomplished by adding electron acceptors such as oxygen to the subsurface with the objective of stimulating naturally occurring micro-organisms that degrade the petroleum hydrocarbons. Chemical oxidation using a variety of oxidants such as percarbonate, persulphate, hydrogen peroxide, ozone and Fenton's Reagent has also been shown to be effective if applied correctly. Groundwater and soil impacted by petroleum hydrocarbon additives such as MTBE have a shorter and less studied remedial history when addressed by aerobic bioremediation and chemical oxidation. The number of studies that combine both aerobic bioremediation and chemical oxidation are limited.

At a site in southern Alberta, aerobic bioremediation and chemical oxidation was combined to address a petroleum hydrocarbon plume containing MTBE. Using the chemical oxidant, percarbonate, and combining it with the oxygen-releasing material, calcium peroxide, the groundwater plume was addressed over an 18-month period. The oxidant/calcium peroxide was delivered to the subsurface using direct push technology over a series of injections events. Monitoring of the plume indicated a continual reduction in mass and extent with each series of injections. Pre-treatment concentrations of MTBE were greater than 1,000 ug/L with post treatment concentrations being less than 5 ug/L. Long-term monitoring of the aquifer indicated that rebound was not an issue.

Subsequent numerical modeling of the injection process indicated that one of the key design components is the persistence of the oxidant and oxygen-releasing material within the subsurface.