Facilitating Property Transfer Using In Situ Bioremediation within Glacial Till Environments: Three Case Studies

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Background/Objectives. At many remediation sites the primary treatment objective is not to attain a reduction in contaminant concentrations to specific criteria but to facilitate property transfer between two parties. In these scenarios, remediation is often best suited by a longer-term risk mitigation strategy. Specific remedial goals may include reducing contaminant mass within source zones and minimizing risk for on-site exposure and/or off-site migration. In areas with complex geologies, such as glacial tills, using slower but longer lasting bioremediation strategies is preferred over purely abiotic treatments in order to increase treatment longevity and combat contaminant rebound. The presentation will focus on three properties in glacial till environments within the Greater Toronto Area (GTA) where bioremediation was successfully applied as a complete remedial strategy or as part of a remedial treatment to achieve goals for property transfer.

Approach/Activities. At Site 1, enhanced reductive dechlorination (ERD) was employed to remove trichloroethylene (TCE) by injecting a combination of dechlorinating bacteria (KB-1) and emulsified vegetable oil (EVO) mixed with zero valent iron (ZVI). Following a successful pilot test that reduced TCE by 99% four months after injection, full-scale remediation was carried out, targeting areas of high risk. The results of the pilot- and full-scale remediation resulted in sale of the property.

At Site 2, sale of the property was carried out prior to remediation, and the terms of sale dictated environmental due diligence be carried out by the seller following the sale. Due diligence required a remedial intervention, which was carried out as an in situ injection of KB-1, EVO, and iron sulfate (to trigger biologically induced reductive dechlorination [i.e., BIRD]). Due to the high permeability of the soil overburden and bedrock, injections were carried out by gravity feed through a single injection well within the soil overburden. A fluid head from the injection volume pushed the amendments deep into the bedrock and throughout the surrounding overburden, achieving remedial influence that encompassed the targeted area.

At Site 3, it was determined that remedial work would be necessary to reduce the source zone of a chlorinated solvent groundwater plume. Combined remedial technologies of bioremediation using EVO and KB-1 and abiotic degradation via ZVI were successfully used to reduce contaminant source zone mass by ≥99% and the downgradient plume by ~95%.

Results/Lessons Learned. Complex geologies are often found in the GTA as the majority of soils are heterogeneous glacial till deposits with widely varying permeabilities, often with shallow bedrock or layers of clay and silt which enhance back diffusion. Combining bioremediation with abiotic treatment is often optimal at these sites for reducing remedial cost and risk of rebound, as the biotic component of the treatment regime is longer lasting and can mobilize itself along concentration gradients to treat contamination that a purely abiotic approach might miss. For the three sites discussed, remediation of chlorinated solvents was achieved under a variety of glacial till environments, including a shallow bedrock site, under different physical conditions and financial scenarios to facilitate and expedite property transfer.