



CASE STUDY

BTEX, PHC F1, F2, F3 IN TORONTO, ON

Background

CLIENT: National Retailer

DURATION: 1.5 years

LOCATION: Toronto, Ontario, Canada

PROJECT VALUE: \$243,000 CDN

During the decommissioning of a retail gas bar in a highly populated Toronto area, petroleum hydrocarbon impacts, in the form of gasoline, were discovered in the soil and groundwater. Another contractor attempted to remediate the source area using dig and dump methodology coupled with dewatering. However, due to the high hydraulic conductivity of the aquifer, this approach failed and further spread the impacts vertically. The backfilling also mixed highly permeable materials into the native soil, causing highly heterogenetic conditions. Combined with the presence of NAPL, this complicated geologic and hydrogeologic setting created significant remedial challenges.

Approach

The landowner, a large national retailer, contracted an international environmental consulting firm to characterize the site and complete initial sampling. The consultant managed the tendering of the project for bid to four companies.

As part of their bid, IRSL conducted a Remedial Option Review of various technologies, including: physical removal, pump & treat, air sparging, biosparging, soil vapour extraction, multi-phase extraction, chemical oxidation and aerobic bioremediation. They earned the contract based on their cost-effective, innovative approach:

- 1 Surfactant Flushing
- 2 Chemical Oxidation
- 3 Aerobic Bioremediation

To mitigate the BTEX (Benzene, Toluene, Ethylbenzene, and Xylenes), along with the PHC (Petroleum Hydrocarbons) F1, F2 and F3 fraction compounds in the soil and groundwater of this highly heterogenetic aquifer, IRSL developed and executed a progressive in-situ remediation approach using three technologies sequentially.

**For more information,
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APPLIED TECHNOLOGIES

IRSL used Surfactant-Enhanced Chemical Oxidation (SECO) followed by Aerobic Bioremediation to mitigate the BTEX, PHC F1, F2 and F3 impacts to the soil and groundwater.

1 Surfactant Flushing

To reduce the sorbed hydrocarbons and PHCs existing as ganglia in the soil, the impacted aquifer was flushed with a non-ionic biodegradable surfactant specifically designed to address light PHCs, which was then captured using hydraulic methods. To better estimate the quantity of surfactant captured, an inert tracer was added to the solution and monitored during pumping.

2 Chemical Oxidation

Next, a combination of oxidants, including persulphate activated by hydrogen peroxide, were delivered into the aquifer using both injection wells and direct push technology, to chemically oxidize the dissolved petroleum hydrocarbons (existing as NAPL, sorbed, and dissolved) and destroy any remaining surfactant.

3 Aerobic Bioremediation

Finally, oxygen was added to the aquifer using two methods: chemically, using oxygen-releasing materials; and, directly, using Waterloo Emitters™. The oxygen delivery created a diffusion gradient from the high hydraulic conductivity zones into the lower hydraulic conductivity zones. The native micro-organisms within the aquifer used the oxygen to biodegrade the remaining contaminants into harmless byproducts.

GEOLOGY: Silty sand, Highly heterogenetic aquifer

PLUME SIZE: Approx. 170 m²

Challenges

- The client required an expedited remedial timeline to accommodate the property transaction.
- The client chose to set the treatment standards at the more stringent residential levels, even though the site was classified for commercial/industrial land use.
- The location of the contaminated groundwater, in a highly heterogenetic aquifer, made delivering the reagents challenging.

Results

- Dissolved oxygen concentrations within the Emitter wells are greater than 12 mg/L with dissolved oxygen levels in down-gradient wells increasing by up to 500% over the original concentrations.
- PHC mass within the soil decreased with observed NAPL being extracted during the surfactant flushing activities.
- Soil and groundwater concentrations continue to decrease in alignment with the objective of meeting the Ministry of Environment's Table 3 Standards for BTEX, PHC F1, F2 and F3 parameters within 1.25 years.



InSitu Remediation Services Ltd (IRSL) is one of Canada's most experienced remediation companies. Our team has designed, implemented, and maintained soil and groundwater remediation programs in diverse geological environments in North, Central, and South America, Europe and the Middle East.

We confidently implement innovative solutions, based on sound knowledge, using seasoned field staff. Our pragmatic, flexible approach reduces effort, cost to our clients, and environmental risk.

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