



## CASE STUDY

# BTEX, PHC F1 & F2 IN STOUFFVILLE, ON

## Background

**CLIENT:** National Retailer

**DURATION:** Ongoing

**LOCATION:** Stouffville, Ontario, Canada

**PROJECT VALUE:** < \$25,000 CDN per year

As part of a commercial redevelopment project in Stouffville, Ontario, a property located down-gradient of an active retail gas bar required the installation of a remediation system to mitigate potential environmental and legal risks associated with the dissolved phase plume migrating onto the property. The groundwater plume consisted of BTEX (Benzene, Toluene, Ethylbenzene, and Xylenes) and PHC (Petroleum Hydrocarbons) F1 and F2 compounds.

The impacted groundwater was located in a heterogeneous aquifer with the unconfined aquifer's hydraulic conductivity contrasting greater than 4 orders of magnitude. The contamination, resulting from historical releases of gasoline from leaking underground storage tanks and associated piping up-gradient of the site, was flowing within the shallow groundwater towards, and possibly onto, the client's site. The nature of the aquifer, municipal infrastructure, and presence of a long-term source, limited the available remedial options.

## Approach

The landowner, a large national retailer, contracted an Ontario-based environmental consulting firm to characterize the site and complete initial sampling. The consultant managed the tendering of the project for bid to three contractors, who each submitted recommendations for remediation. IRSL earned the contract with the retailer based on their innovative approach, which cost significantly less than the other methods proposed.

As part of their bid, IRSL conducted a Remedial Option Review of over 25 technologies, including: pump & treat, air sparging, biosparging, soil vapour extraction, multi-phase extraction, chemical oxidation, and aerobic bioremediation. Based on the option review, IRSL worked with the general contractor and environmental consultant to develop a remedial approach that enabled the client to address the migrating plume.

### ENHANCED AEROBIC BIOREMEDIATION

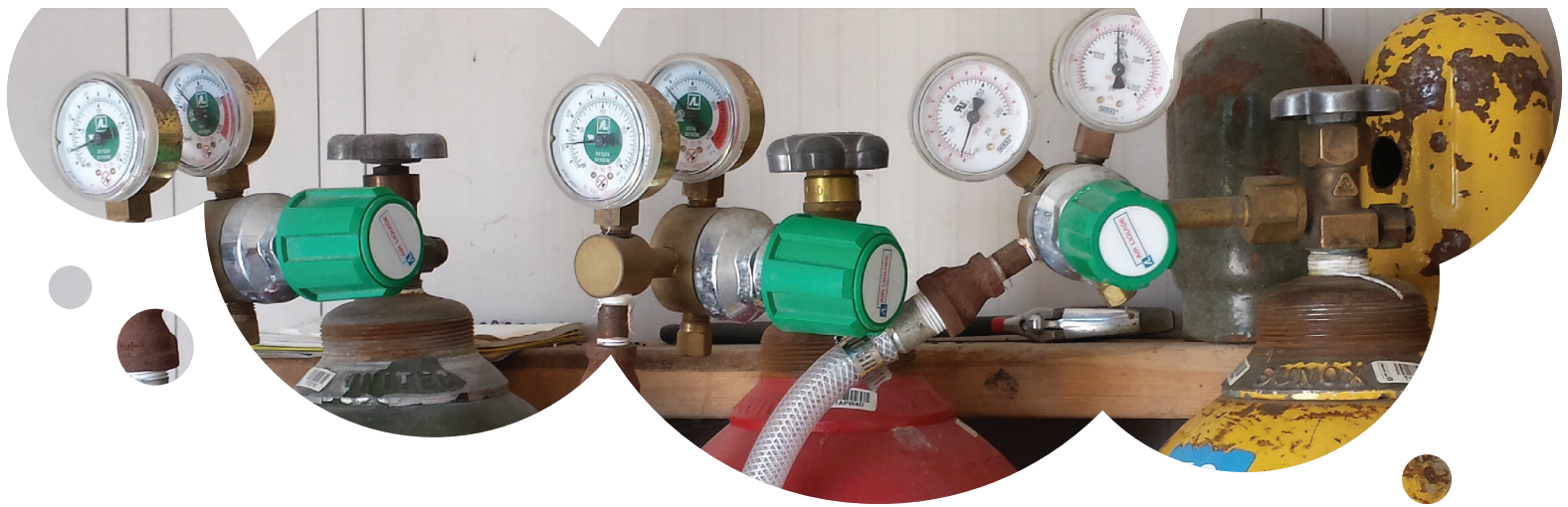
To mitigate the BTEX, PHC F1 and F2 within the groundwater while minimizing disruption to the site, IRSL developed and executed a progressive in-situ aerobic bioremediation plan. The surface footprint required was less than 4 m<sup>2</sup>, thus ensuring a very small ecological footprint.

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**GEOLOGY:** Silty sand, Heterogenetic aquifer with sand seams

**PLUME SIZE:** Approx. 30 m wide

### APPLIED TECHNOLOGIES

IRSL used Aerobic Bioremediation to mitigate the BTEX (Benzene, Toluene, Ethylbenzene, and Xylenes), along with the PHC (Petroleum Hydrocarbons) F1 and F2 fraction plume flowing onto their client's site.

A total of 17 4"-wells were installed perpendicular to the groundwater flow, on a one-metre spacing, to create a semi-passive reactive barrier designed to intercept the plume and treat the compounds of concern using Waterloo Emitters™.

Waterloo Emitters consistently release oxygen into the groundwater without destabilizing the hydrocarbons. Designed to run continuously for extended periods of time, the emitters are low maintenance, require no energy, and leave a very small ecological footprint.

In this aerobic bioremediation technique, the native micro-organisms within the aquifer use the oxygen to biodegrade the BTEX and PHC F1 and F2 fractions into harmless byproducts.

## Challenges

- Due to the presence of an up-gradient hydrocarbon source, the project required a long-term remediation system with low operating and maintenance costs, which could operate continuously, 365-days-a-year.
- The location of the contaminated groundwater in a highly heterogenetic aquifer with sand seams, with hydraulic conductivity contrasts of greater than 4 orders of magnitude, made designing a biobarrier challenging due to the reaction times required.
- The petroleum hydrocarbons entering the biobarrier at concentrations greater than 400 µg/L required an approach that was both aggressive, in order to mitigate on-site risks, as well as discrete, in order to minimize impacts on the site itself.

## Results

- Dissolved oxygen concentrations within the Emitter wells are greater than 12 mg/L.
- Independent sampling of down-gradient wells indicate that all contaminants have been reduced to below the Ministry of Environment's Table 3 Standards for commercial sites for BTEX, PHC F1 and F2 parameters within 3 metres of the permeable barrier.
- Operating and maintenance costs have decreased relative to inflation with time.



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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