

## CASE STUDY

# TCE, DCE AND VINYL CHLORIDE REMEDIATION IN WEATHERED SHALE



## Background

**CLIENT:** Industrial

**DURATION:** 2 Weeks

**LOCATION:** Toronto, Ontario

**PROJECT VALUE:** \$115,000 CDN

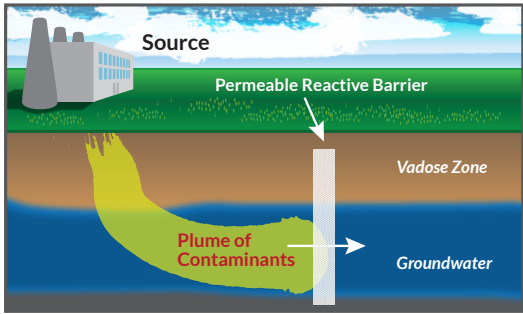
At a manufacturing plant in Toronto's Islington district, chlorinated ethene groundwater impacts, in the form of TCE, DCE and vinyl chloride, were discovered through environmental testing performed in preparation for selling the property. The contamination, originating from manufacturing processes, was potentially flowing down-gradient onto the adjacent property at a groundwater flow velocity of approximately 8 metres per year. The site owner required an expedient remediation solution in order to minimize environmental damage and complete the property sale. The building itself, as well as an electrical transformer compound, restricted site access, making traditional installation methods impractical and remediation challenging.

## Approach

The industrial landowner hired an environmental consulting firm to characterize the site. At the conclusion of the investigation, the consultant recommended a Permeable Reactive Barrier. They tendered the project for competitive bid to three companies. IRSL earned the project based on their extensive experience with Permeable Reactive Barriers, which coupled practical experience with an innovative design.

### PERMEABLE REACTIVE BARRIER USING INJECTION WELLS AND DIRECT PUSH TECHNOLOGY

To treat the chlorinated ethene (TCE, DCE and vinyl chloride) groundwater impacts flowing from the source on site, IRSL designed and installed a 100 m long Permeable Reactive Barrier (PRB) using Injection Wells and Direct Push Technology (DPT) to administer a Zero-Valent Iron and Emulsified Oil mixture.



**GEOLOGY:** Silty Sand and Weathered Shale

**PLUME SIZE:** Approx. 100 m

## ANALYSIS

To develop an optimal Permeable Reactive Barrier design, IRSL used their proprietary analytical model, which incorporated observed contaminant concentrations, groundwater flow rates, reaction rates, temperature and inorganic parameters, within the shale, soil and groundwater. Through this process, they discovered variations in gradient and flow direction, which had been previously overlooked, and significantly impacted the design.

## CONSTRUCTION

Based on their analysis, IRSL created and implemented the design. They successfully constructed a Permeable Reactive Barrier, using both injection wells and direct push technology, in two weeks without impacting the operating facility.

**Injection Wells:** To remediate the contamination in the weathered shale, IRSL installed a series of injection wells in a 100 m barrier perpendicular to the groundwater flow.

**Direct Push Technology:** To remediate the contamination in the overlying silty sand, they used Direct Push Technology at various depths and intervals to create a barrier.

## TREATMENT

Into the shale and overburden, IRSL injected a mixture of **Zero-Valent Iron (ZVI)** and **Emulsified Vegetable Oil (EVO)**. Through the process of **Chemical Reduction**, the ZVI donated electrons to the chlorinated ethenes, transforming them into harmless compounds. The EVO stimulated **Anaerobic Biodegradation**. Together, the two simultaneous processes degraded the TCE, DCE and vinyl chloride to below the applicable regulatory standards.

## Challenges

- The restrictive location of the PRB complicated the installation. IRSL leveraged its extensive installation experience to realize significant cost savings for the client.
- The weathered shale made delivering the ZVI-EVO mixture into the chlorinated ethene plume a challenge, which required the development of an innovative delivery method.
- Unknowns associated with the geology and hydrogeology required a robust remedial design.

## Results

- The chlorinated ethene plume was treated to below the applicable regulatory standards.
- The Permeable Reactive Barrier incurred no Operations & Maintenance costs.



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