



# Site Closure via In Situ Aerobic Bioremediation of Petroleum Hydrocarbons in British Columbia, Canada

## Summary

A former fueling facility in Port Coquitlam, BC contained four USTs and accompanying dispensers. The USTs were removed in 1990 after volatile petroleum hydrocarbon (VPH) concentrations were found above regulatory limits. Well BH206 had significant VPH and naphthalene concentrations reaching 13,000 µg/L and 240 µg/L, respectively. In addition, wells BH 303 and BH 205A had concentrations of VPH as high as 5,600 µg/L.

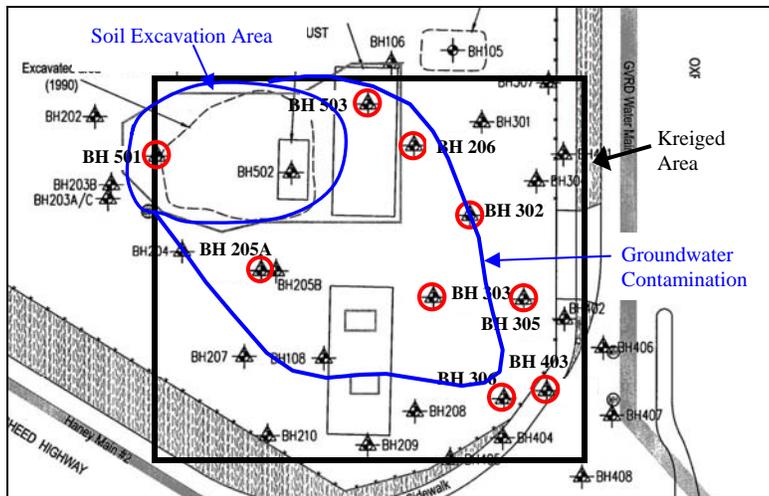


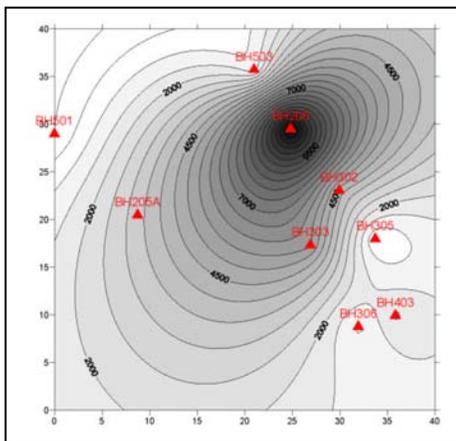
Figure 1. Site map with plume outline and monitoring well locations

Contaminant	BH206 Concentrations	Cleanup Goal
VPH	13,000	1,500
LEPH	2,600	500
Naphthalene	240	10

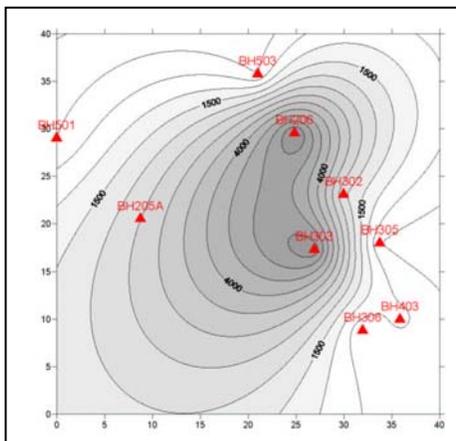
## In-Situ Application Details

- **Remediation Objective:** Reduce concentrations of VPH, LEPH, and Naphthalene to cleanup goals. See Table 1.
- **Application Type:** Grid
- **Soil Type:** Sand
- **Quantity Applied:** ORC<sup>®</sup> – 1,350 lbs  
ORC Advanced<sup>®</sup> – 500 lbs
- **Total Product Cost:** \$23,955 CAN; \$17,957 US

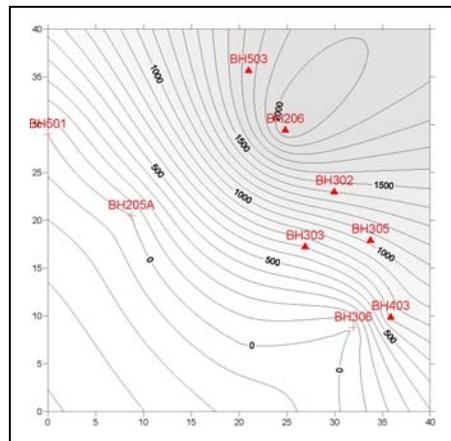
## VPH Time Lapse Shots



VPH Plume Day 0



VPH Plume Day 300



VPH Plume Day 930

## Remediation Approach

Excavation activities removed approximately 1,300 m<sup>3</sup> of contaminated soil which were later disposed of at a permitted facility. Following the excavation, a groundwater remediation program was implemented using 1,350 lbs of Oxygen Release Compound (ORC®). An ORC slurry was added to the backfill and injected into the groundwater plume to further reduce VPH concentrations as well as light extractable petroleum hydrocarbons (LEPH). A second application using 500 lbs of ORC Advanced® was applied one year after the ORC application to continue reducing trends of petroleum hydrocarbons.

## Results

Naphthalene	Baseline	Day 510
BH 108	86	24
BH 206	240	120
BH 302	140	42
BH 303	160	110
BH 305	12	ND
BH 306	35	2
BH 403	49	83
BH 503	69	ND

As shown in the VPH time lapse shots on the front, VPH reduction occurred across the plume. Approximately, one year after injection VPH declined from 13,000 µg/L to 4,300 µg/L in well BH206 and well BH303 showed a decrease of 80%. Downgradient of the source area VPH was reduced below cleanup goals. Prior to injection, a total of 7 wells had LEPH concentrations above the standard (500 µg/L). By day 510, four wells reached concentrations below cleanup goals. Reduction of naphthalene was also seen across the contaminated area (Table 2). Most notable are the 3 wells that reached the cleanup standard 510 days after injection.

Within 3 years of the initial application, all contaminants of concern were reduced to below the cleanup goals. Concentrations of VPH and LEPH were reduced by 1 to 2 orders of magnitude and naphthalene declined from a high of 280 µg/L to 7.9 µg/L. The site achieved closure approximately 5 years after commencing remedial treatment.

