

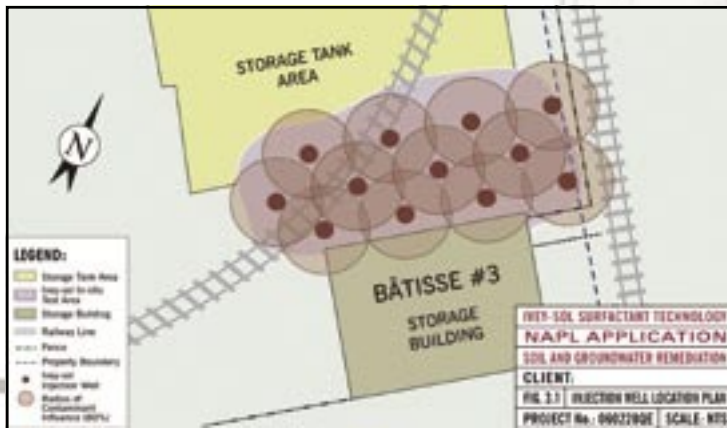
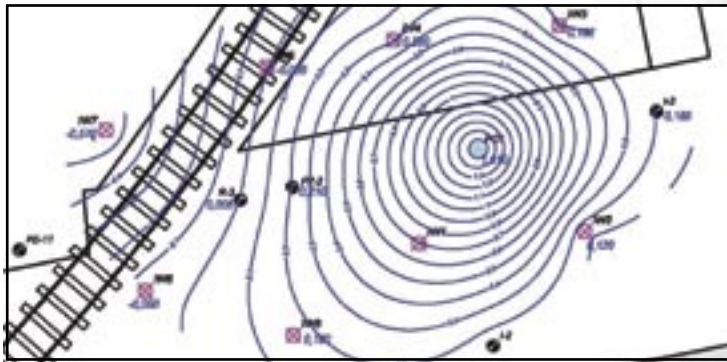


Case Study: In-situ Surfactant Enhanced DNAPL Recovery Pilot Project - Refinery Site Montreal Canada

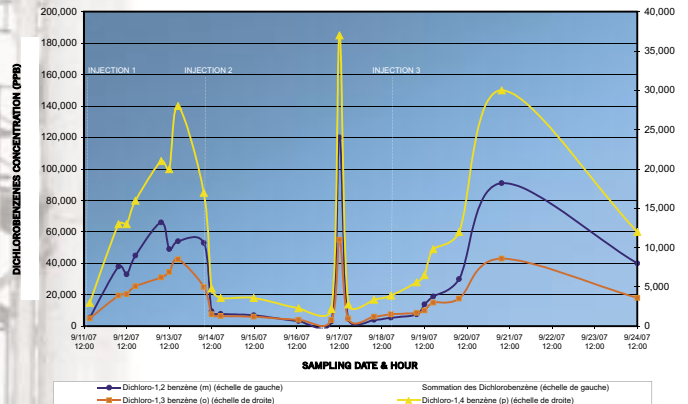
PROJECT FACTS:

- Active chemical refinery (20 acre site)
- Several DNAPL (chlorobenzene and dichlorobenzenes) and BTEX stored on-site
- Multiple DNAPL and BTEX spill events reported over a site history extending back to the 1950's.
- DNAPL and BTEX impacts to both the local soil and groundwater covering an 8 acre (+) area
- Risk: potential risk for impacting the near-by municipal groundwater aquifer
- Soil comprised of glacial till

- Property owner tried several different in-situ remediation technologies over the past 3 years without success, at a considerable cost.
- Ivey-sol 106 pilot scale injection program between September 11 - 24, 2007
- Pump and treatment system installed and operating with 3 inch Hg vacuum
- Pilot scale results demonstrated significant ability to improve contaminant recovery and potential to clean up the site in a rapid and cost effective manner.



DICHLORBENZENES CONCENTRATION AT RECOVERY WELL
Variation de la concentration des dichlorobenzènes en fonction du temps au puits PO-1



RESULTS:

$$\text{Mass Recovery (mg/day)} = \text{Flow Rate (L/min)} \times \text{Concentration (mg/L)} \times \text{Time (T) min/day}$$

Over the course of the Pilot Scale Application the increase in DNAPL Mass Recovery was 549%, and BTEX Mass Recovery was 303%, based on a real time calculation.

Increases of >800% to > 1200% in individual DNAPL and BTEX contaminant parameters were observed.

"The in-situ application of the Ivey-sol surfactant technology significantly increased the DNAPL and BTEX mass recovery from the impacted soil and groundwater on-site. We were very pleased by these results leading to our recommending a full scale site application as a rapid and cost effective method to achieve site clean up"

- Martin Beaudoin, Project Engineer with Sanexen Environmental Services Inc.

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