In situ treatment of BTEX and cVOC under a large car manufacturing industrial plant

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SESSION 6 - LNAPL and Chlorinated compounds remediation
Remtech 2020
Site description

Remediation with PlumeStop® at Volvo Car Gent, Belgium

Plant realized in 1965
First European plant outside Sweden
6000 workers
Site description

Production 250,000 vehicles/year
Welding, painting and final assembly
Site description

Use of lubricating oils and cleaning solvents
Geological and hydrogeological features

• Fine (running) sands
• Foundations and underground services
• Shallow unconfined aquifer
• Groundwater level approx 2.5 m BGL
• Groundwater velocity: 10-20 mt/year
Contamination

- Several small sources
- Two plumes detected:

**Area 1:** Paint mix and painting area (gasoline tank)
- BTEXS (average 1000 μg/l; max. 9-18,000 μg/l)
- TPH (up to 1,600 μg/l)
- No soil contamination

**Area 2:** Downgradient area (no specific plants)
- BTEXS (5-20,000 μg/l)
- Chlorinated ethanes (7-20,000 μg/l)
Contaminated areas localization

- **Plume 1 (TPH-BTEX)**
- **Plume 2 (BTEX-CHC)**

Groundwater direction

Downgradient site boundary
Remediation Strategy – Plume 1

- Aerobic biodegradation enhanced by in situ sorption
- Injection barrier configuration
- Total length 60 meters, divided in 3 portions
- 22 total injection points
  - 6 injection wells (pilot)
  - 16 direct push (full scale)
- Injection layer: 2.5 to 4.5 m BGL
- 1 single application
Technology description

- Colloidal remediation agent
  - 1-2 micron activated carbon colloid
  - polymer/dispersive agent
  - Non-toxic, black “ink”
- Distributes widely in subsurface
- Turns aquifer into activated carbon purifying filter
- Sorbs contaminants rapidly
- Regenerates sorption sites
  - Biological degradation of sorbed contaminants
  - Co-applied with electron donors or acceptors
Treatment process
Pilot test – Area 1 (2016)

- Injection in 6 new injection wells
- Distance 2.5 meters
- Site works 3 days
- Total use of:
  - 9000 liters PlumeStop solution
  - 800 liters ORC Advanced slurry
- Monitoring wells within and downgradient of barrier
In situ application
Results – Pilot Area 1
Total BTEX Concentration Over 6 Months Following Application

- Injection
- 95% Reduction
- >99% Reduction
Full Scale – Area 1 (2018)

- 16 direct push locations
- No re-injection in pilot area
- PlumeStop: 1200 liters/point
- ORC Advanced: 40-60 liters/point
Results – Full Scale Area 1
Total BTEX Concentration – Pilot area downgradient wells

![Graph showing the concentration of BTEX over time.](image-url)
Results – Full Scale Area 1
Total BTEX Concentration – Full Scale downgradient wells
Remediation Strategy – Area 2

- Located below wastewater treatment plant
- Difficult access
- Excessive mass for direct application of PlumeStop
- Grid application

Phase 1: 3 direct push ISCO campaigns
- RegenOx: non-corrosive

Phase 2: PlumeStop on residual contamination
- Co-applied with HRC (biostimulation) + BDI+ (bioaugmentation)
Full Scale – Area 2 (2018)

• Total area 600 m²
• ISCO only in a limited portion
• 45 total direct-push injection points
• Grid 3x3 meters
• Treatment layer 4 mt (2.5 to 6.5 mt BGL)

• PlumeStop: 2000 liters/point
• HRC + HRC-X: 20 liters/point
• BDI+: 1 liter/point
Results – Full Scale Area 2
Total BTEX and cVOC Concentration – Average values
Conclusions

• Pilot and additional SI allowed to:
  • optimize injection approach
  • revise full scale design (ISCO added)
  • accurate and cost effective design

• Manufacturing plant has continued to proceed without interruption:
  • Short programme of injection
  • No ongoing maintenance
  • Minimized disruption

• PlumeStop has allowed for single injection – self regeneration

• Client had rapid removal of off-site liability and maintaining over long term
Thank you!

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