



REGENESIS[®]

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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



Site description



First European plant outside Sweden

Site description



Site description



Site description



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:

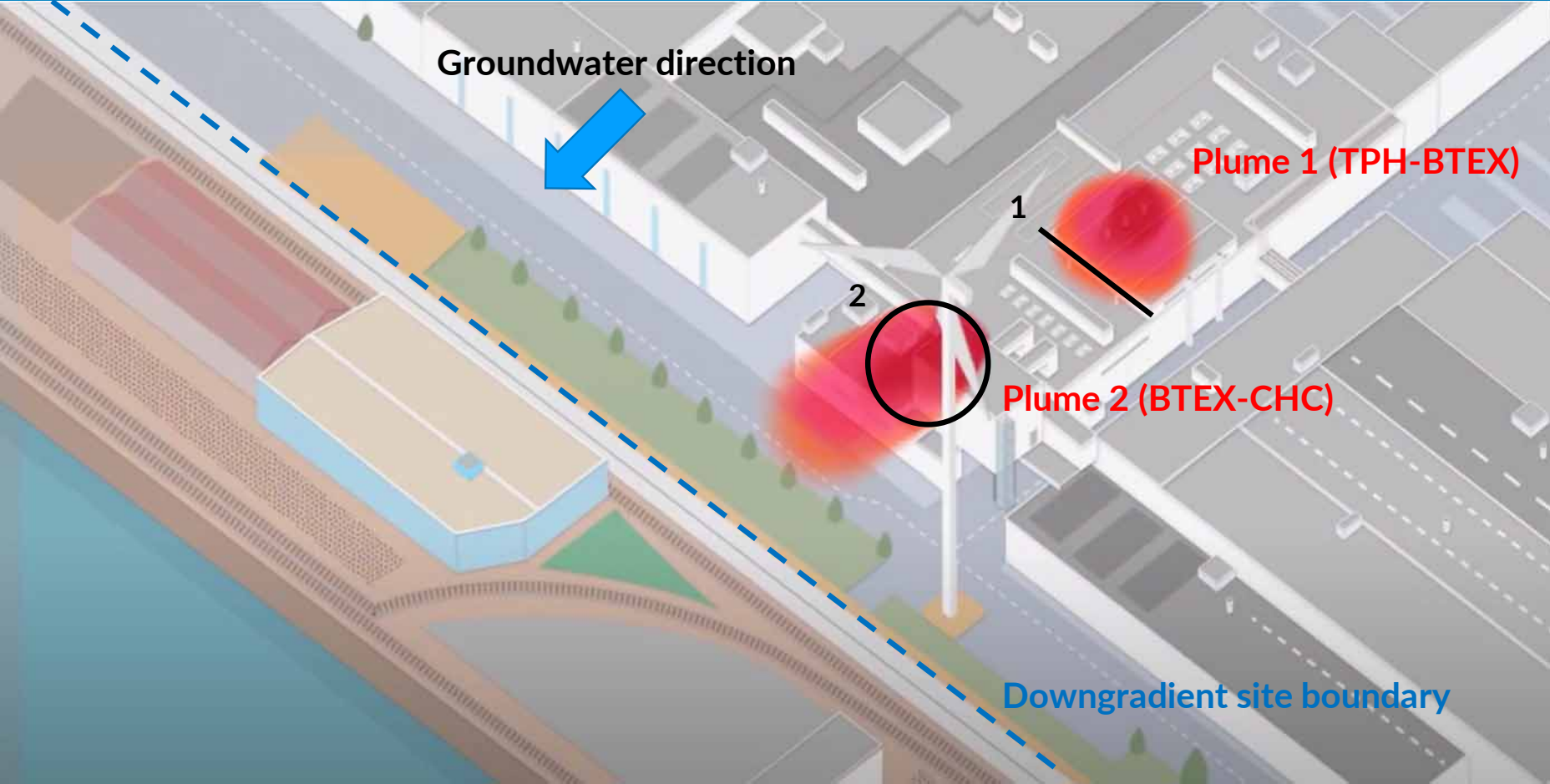
Area 1: Paint mix and painting area (gasoline tank)

- BTEXS (average 1000 $\mu\text{g/l}$; max. 9-18,000 $\mu\text{g/l}$)
- TPH (up to 1,600 $\mu\text{g/l}$)
- No soil contamination

Area 2: Downgradient area (no specific plants)

- BTEXS (5-20,000 $\mu\text{g/l}$)
- Chlorinated ethanes (7-20,000 $\mu\text{g/l}$)

Contaminated areas localization



Remediation Strategy – Plume 1

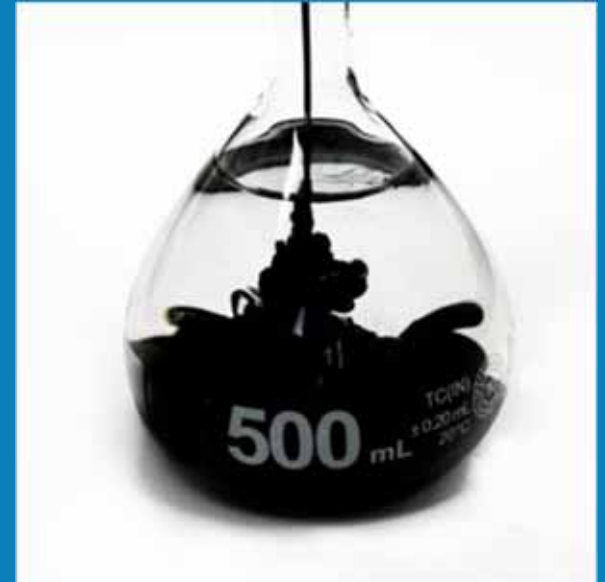
- Aerobic biodegradation enhanced by in situ sorption
- Injection barrier configuration
- Total length **60 meters**, divided in 3 portions
- 22 total injection points
 - 6 injection wells (pilot)
 - 16 direct push (full scale)
- Injection layer: 2.5 to 4.5 m BGL
- 1 single application

PLUME STOP
Liquid Activated Carbon



ORC.
ADVANCED
**OXYGEN
RELEASE
COMPOUND**

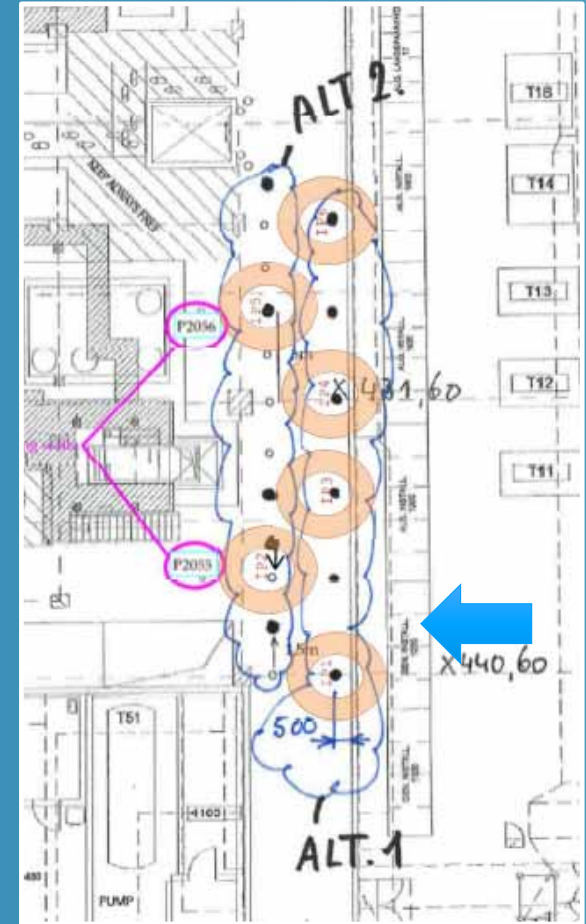
- Colloidal remediation agent
 - 1-2 micron activated carbon colloid
 - polymer/dispersive agent
 - Non-toxic, black “ink”
- Distributes widely in subsurface
- Turns aquifer into activated carbon purifying filter
- Sorbs contaminants rapidly
- Regenerates sorption sites
 - Biological degradation of sorbed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





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



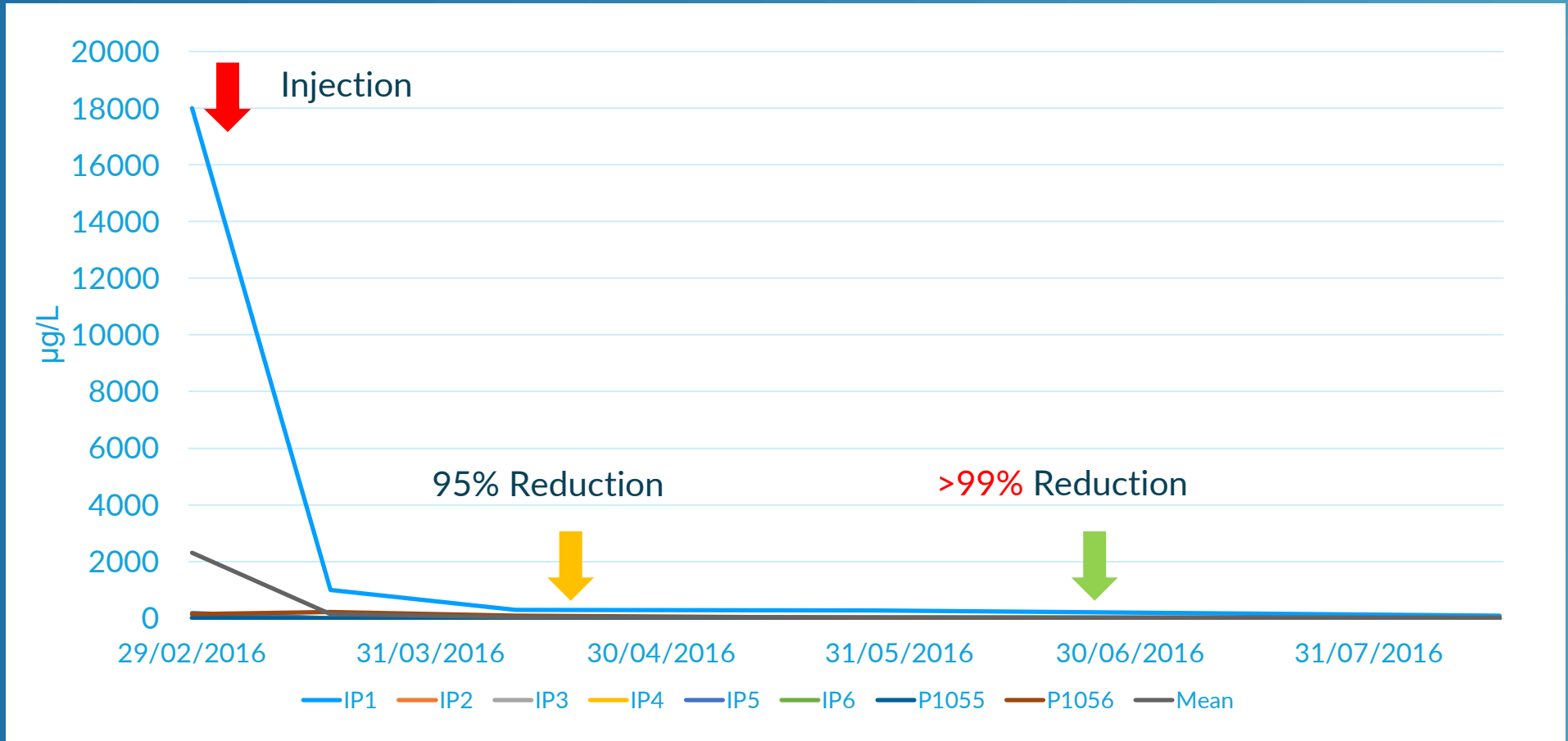
10m

In situ application



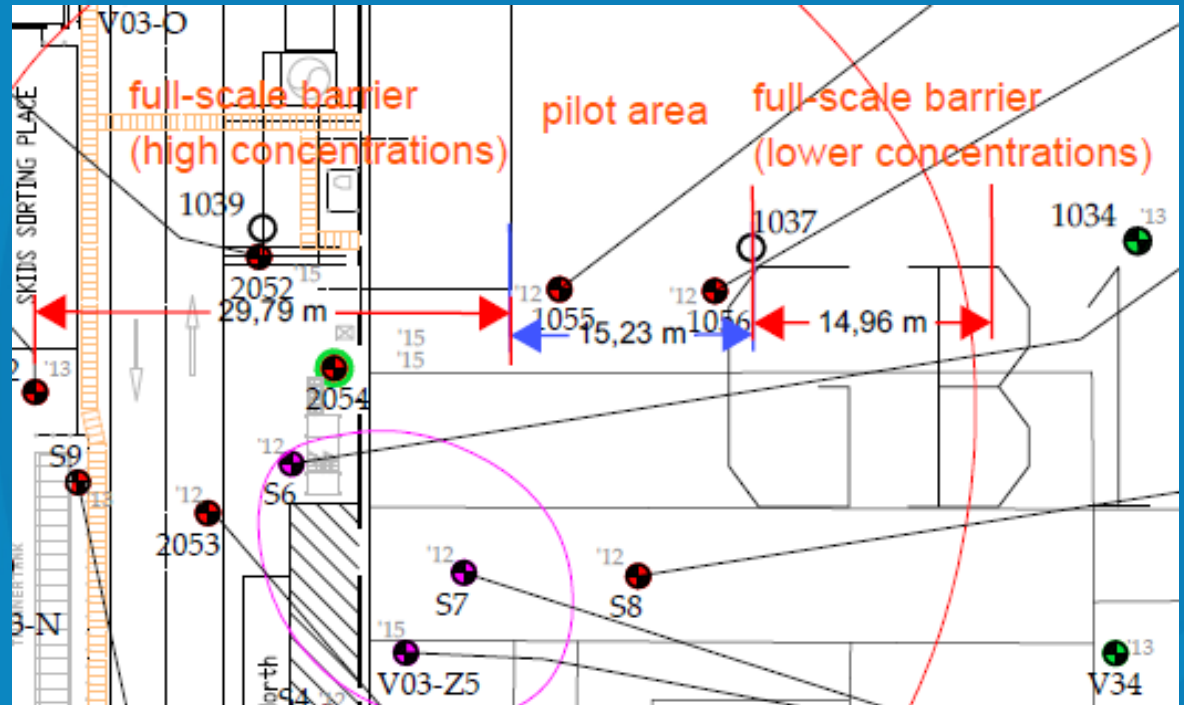
Results – Pilot Area 1

Total BTEX Concentration Over 6 Months Following Application



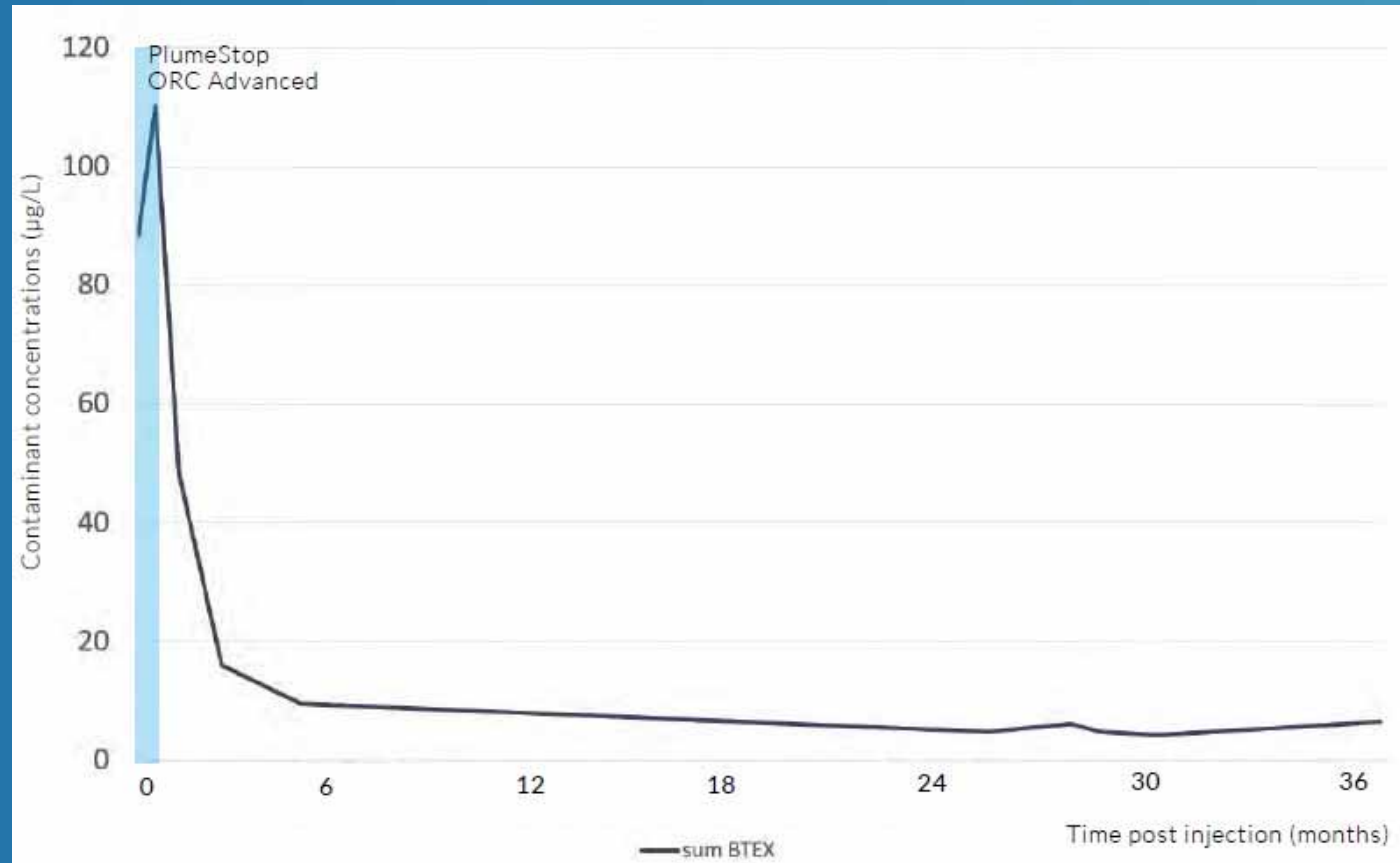
Full Scale – Area 1 (2018)

- 16 direct push locations
- No re-injection in pilot area
- PlumeStop: 1200 liters/point
- ORC Advanced: 40-60 liters/point



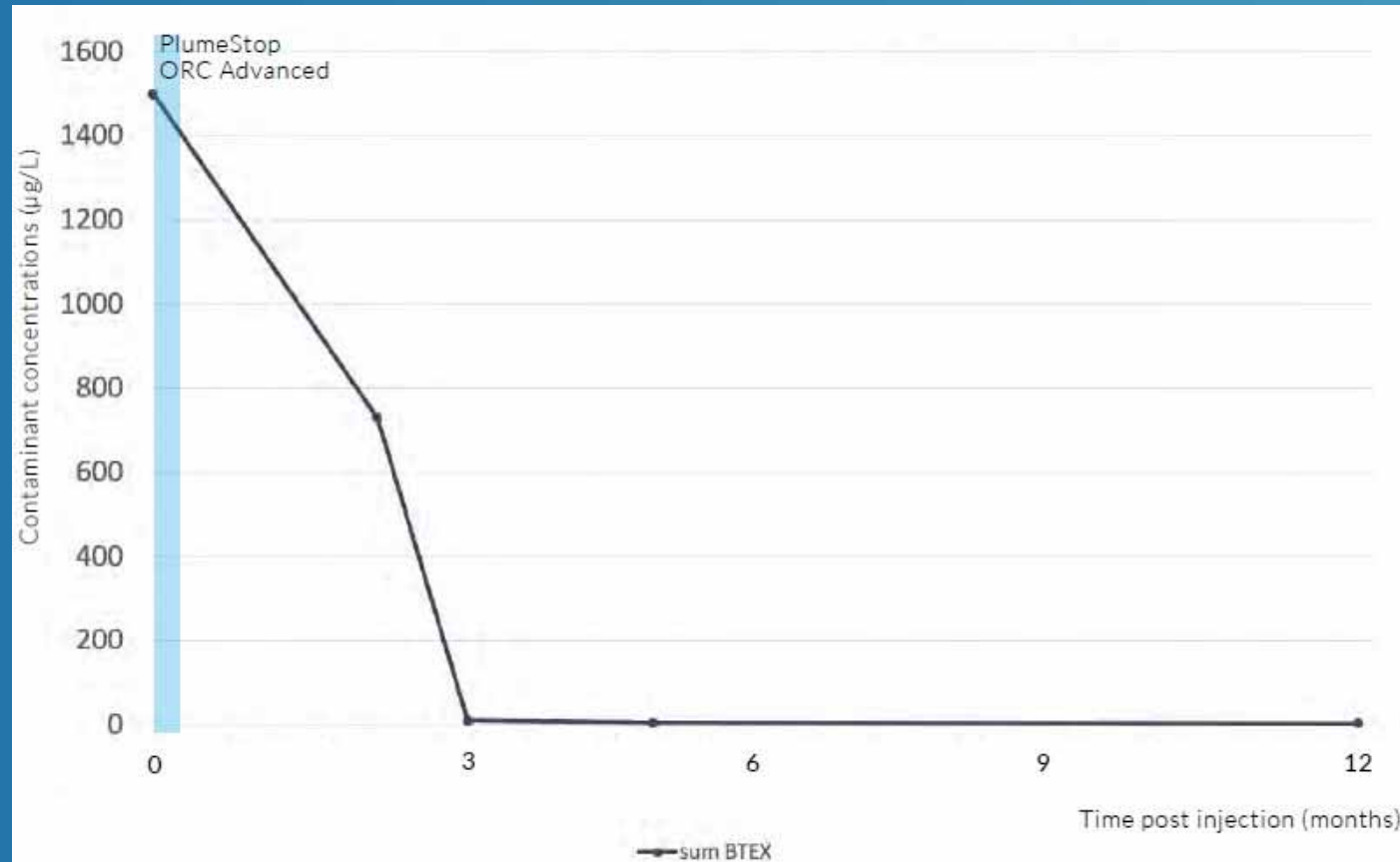
Results – Full Scale Area 1

Total BTEX Concentration – Pilot area downgradient wells



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

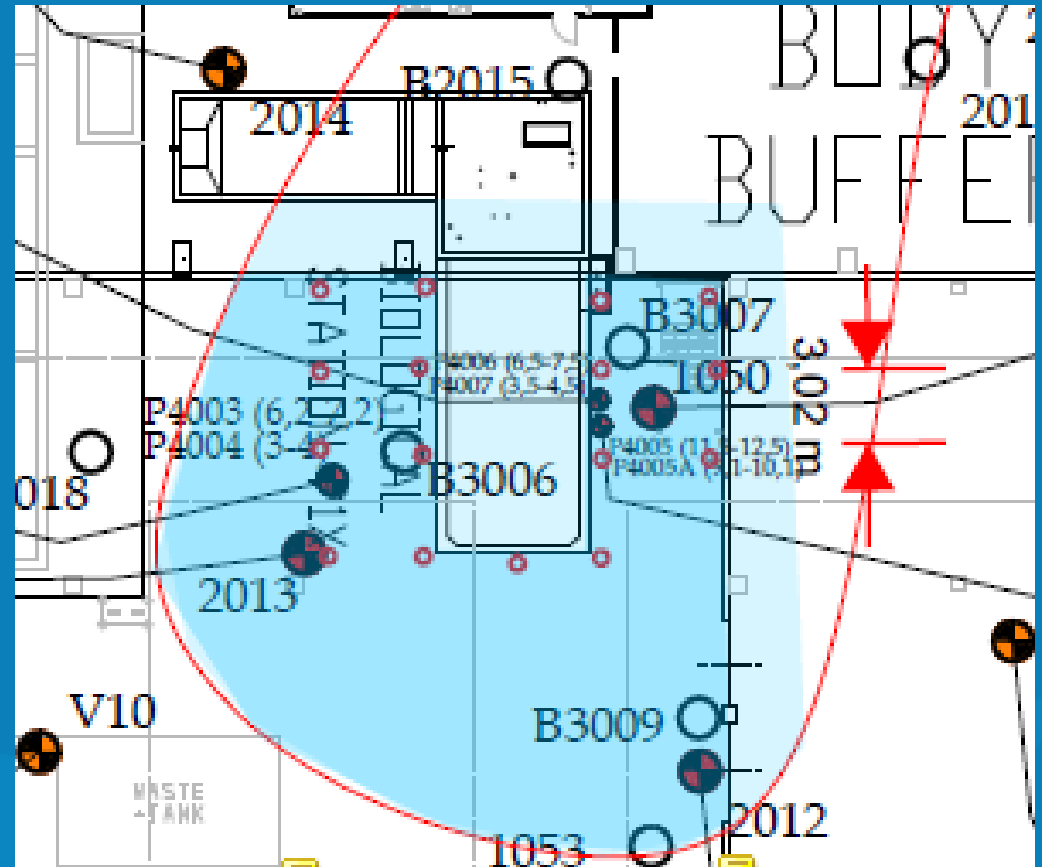
Phase 2: PlumeStop on residual contamination

- 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

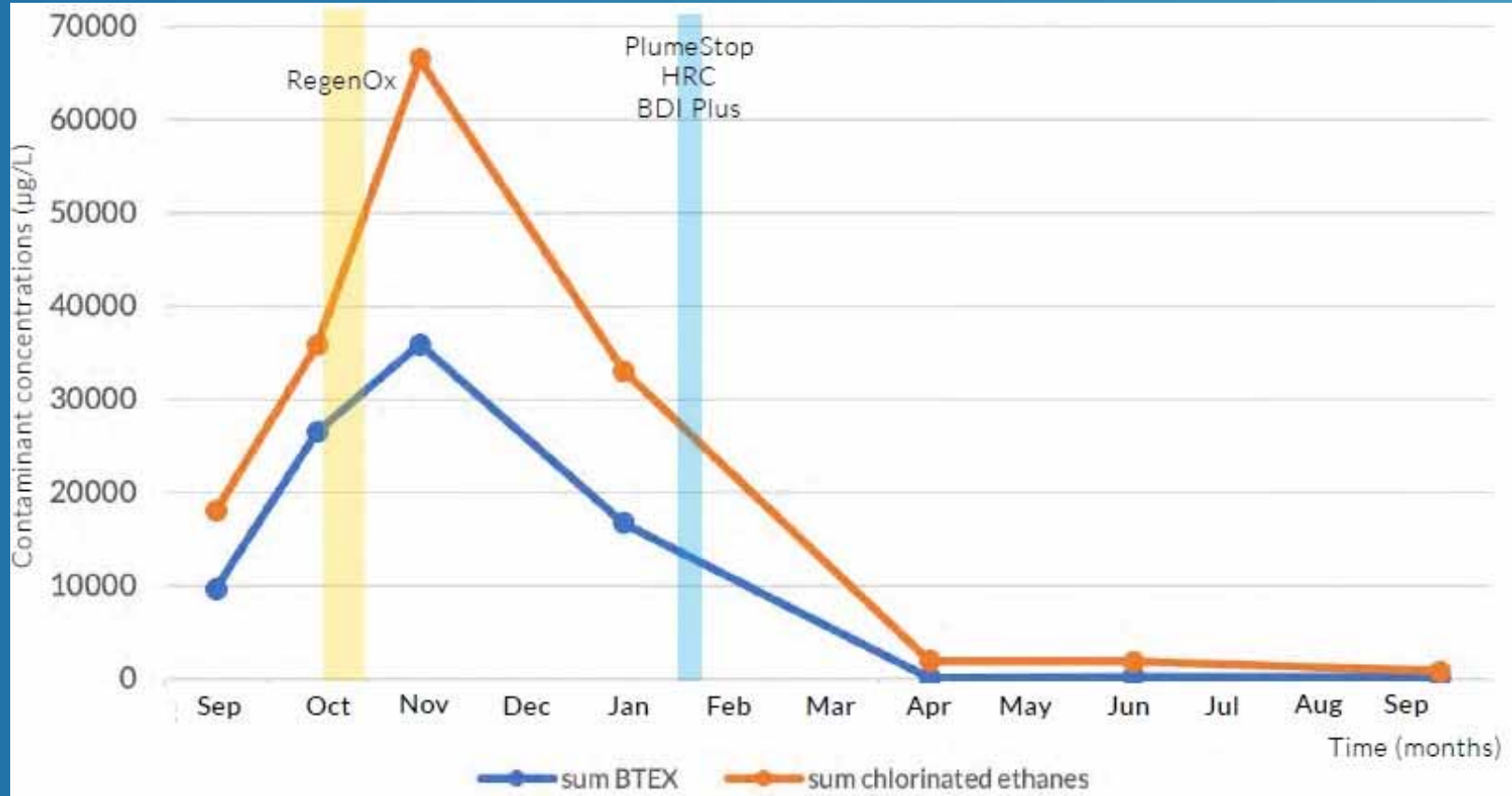


Injections in Area 2



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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