

Remediation of BTEX and CHCs at Volvo Car Gent

CASE STUDY

Long-term monitoring shows success of in situ groundwater
treatment at an active car manufacturer in Belgium

BACKGROUND

Volvo Car Gent is a car manufacturing facility in the port district of Ghent, in the west of Belgium. Around 5,000 people work at the facility, producing more than 250,000 cars per year. Manufacturing activity at this plant includes welding, painting and final assembly; all processes which typically involve the use of lubricating oils and cleaning solvents. The handling and storage of these chemicals has led to the occasional spill or leakage in the past. This has resulted in soils and groundwater below the plant becoming contaminated with Petroleum Hydrocarbons (including BTEX) and Chlorinated Solvents.



Fig. 1 Google earth view of Volvo Car Gent

Site investigation by **Artemis Milieu** revealed two contaminated areas relating to these historic spillages. The groundwater contaminant concentrations are persistent and in the low thousands of $\mu\text{g/L}$ range in one area, and several tens of thousands of $\mu\text{g/L}$ in the other. Due to the direction of the groundwater flow, there is a risk that the contamination could migrate across the plant's site boundary. Site access is limited due to existing building structures and underground services.

REGENESIS was asked to provide a solution to treat the plumes and prevent off-site migration, whilst keeping any disruptions to Volvo Car Gent operations to an absolute minimum. Artemis Milieu and REGENESIS worked closely together with client Volvo Car Gent, to deliver the most appropriate and effective remediation solution for the site.



SITE TYPE

Active car manufacturer



GEOLOGY

Made ground
and fine (running) sand



CONTAMINANTS

Area 1: ΣBTEX up to 18,000 $\mu\text{g/L}$
Area 2: ΣBTEX up to 20,000 $\mu\text{g/L}$
 ΣcVOC up to 20,000 $\mu\text{g/L}$



PROJECT DRIVER

Prevent off-site
contaminant migration



TREATMENT

In Situ Chemical Oxidation (ISCO)
In Situ Sorption and Biodegradation



TECHNOLOGIES

PlumeStop®, ORC Advanced®,
HRC®, BDI Plus®, RegenOx®

DESIGN AND APPLICATION

REGENESIS designed and implemented two different approaches to treat the plumes:

Treatment Area 1 - Barrier Injection

Located adjacent to the plant's paint mix area, this area has a plume comprising dissolved BTEX associated with the location of a former fuel storage tank. Here, a PlumeStop barrier was installed across a total length of 60 meters (initially 15 meters for a pilot test and the remaining 45 meters was completed as part of the full-scale application two years later). PlumeStop Colloidal Activated Carbon (CAC) was co-applied with ORC Advanced to provide a long-term supply of dissolved oxygen, stimulating and maintaining the aerobic biodegradation of the sorbed BTEX and consequential regeneration of the activated carbon barrier.

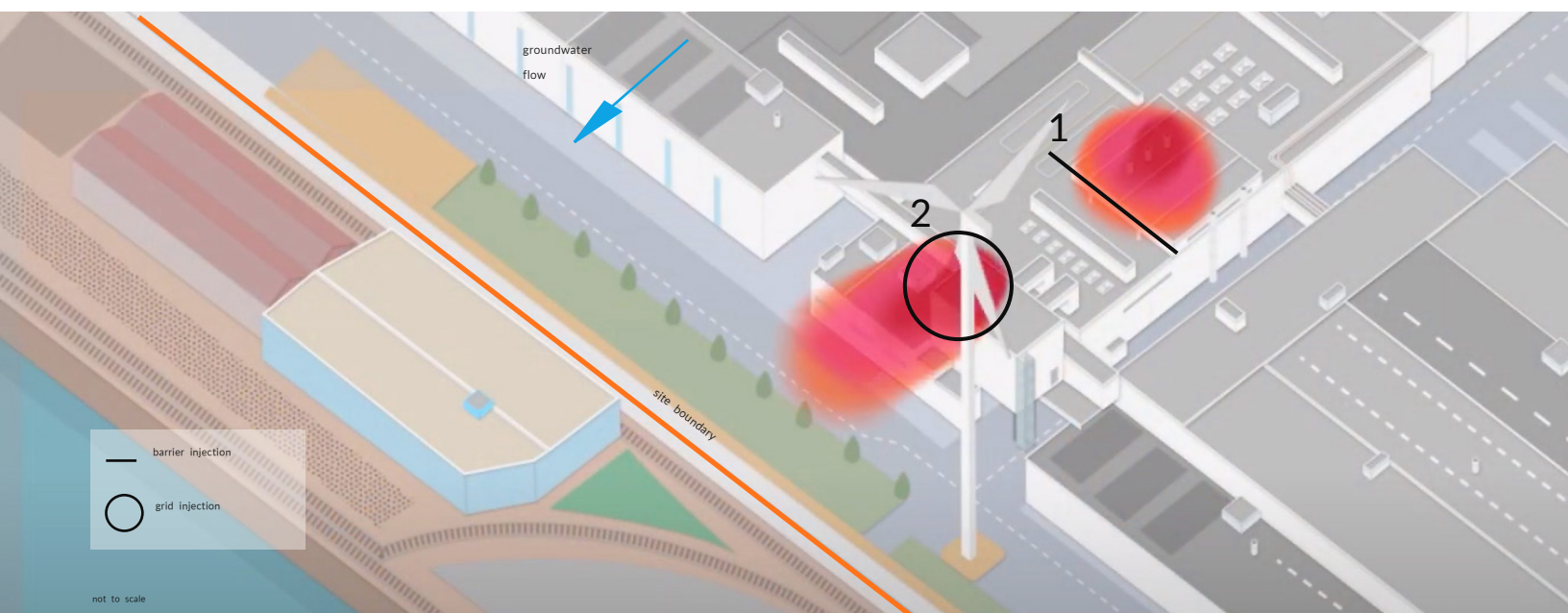


Fig. 2 Treatment area locations

Treatment Area 2 - Grid Injection

This area contains a secondary source of residual BTEX and chlorinated ethanes resulting from the historic manufacturing activities. The contamination is located below the wastewater treatment plant with difficult access. Excessive mass was precisely targeted using three In Situ Chemical Oxidation (ISCO) campaigns using our non-corrosive oxidizer RegenOx, after which PlumeStop was applied across a larger area to manage residual dissolved contamination; PlumeStop was co-applied with HRC and BDI+ to provide biostimulation and bioaugmentation for the chlorinated solvents.

The treatments act to contain the plumes and prevent any off-site migration. The use of in situ barrier for Area 1 application removed any requirement to physically access the entire plume underneath existing buildings. Application was completed using a small, portable injection rig meaning that there was no interference with manufacturing during the site works. Once injected, the treatments require no maintenance or power, resulting in no disruption to the factory while remediation is occurring.

RESULTS - AREA 1

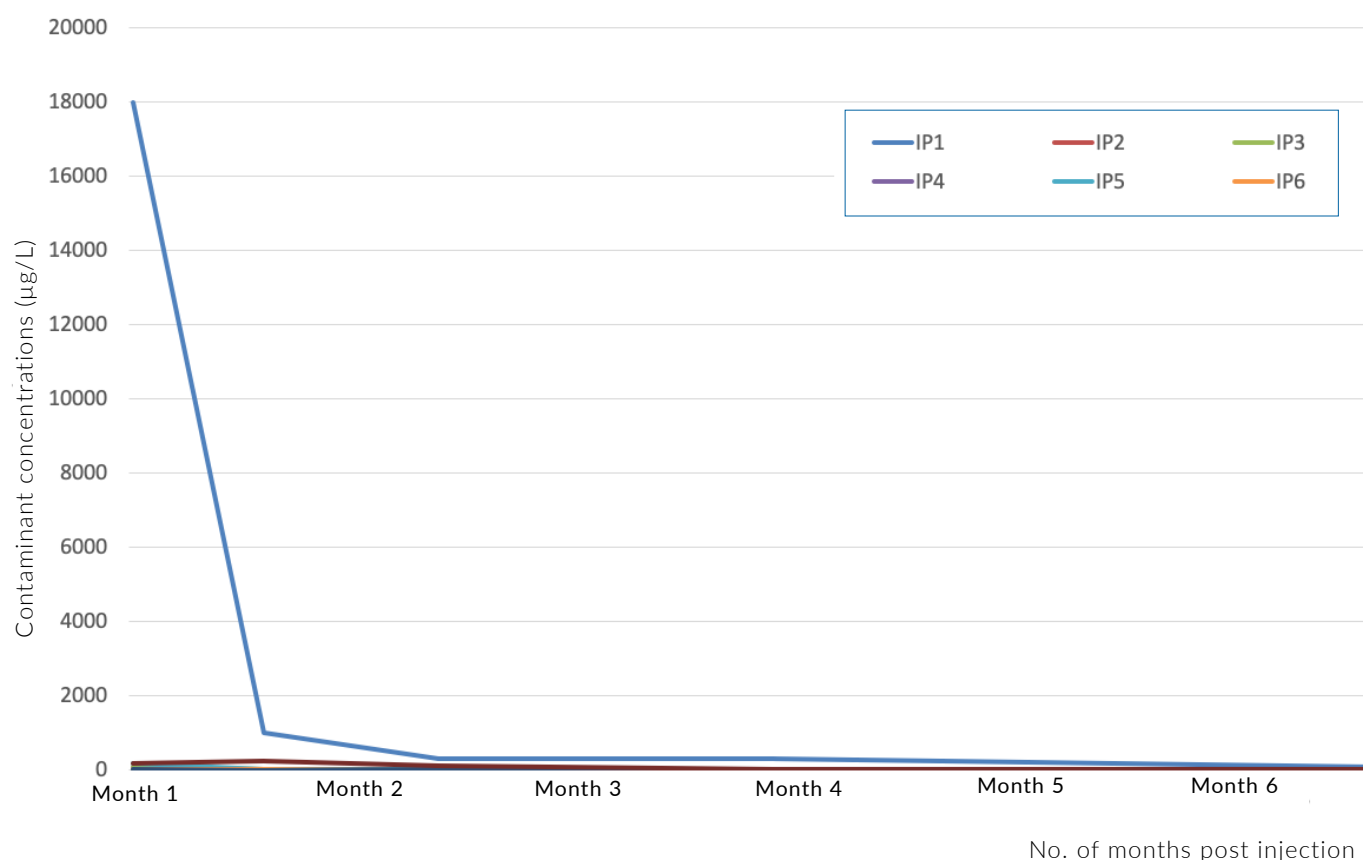
Pilot Test

REGENESIS first completed a pilot test in Area 1, located inside the factory buildings. This 15m long permeable reactive barrier was created to confirm field conditions and inform the full-scale remedial design. Monitoring was completed for 6 months following injection both inside and downgradient of the barrier. The graph below shows the total BTEX concentrations were reduced by 99% within 6 months post application.



Fig. 3 Pilot test location in treatment area 1

Fig. 4 Area 1 - BTEX Concentrations over 6 months following pilot test



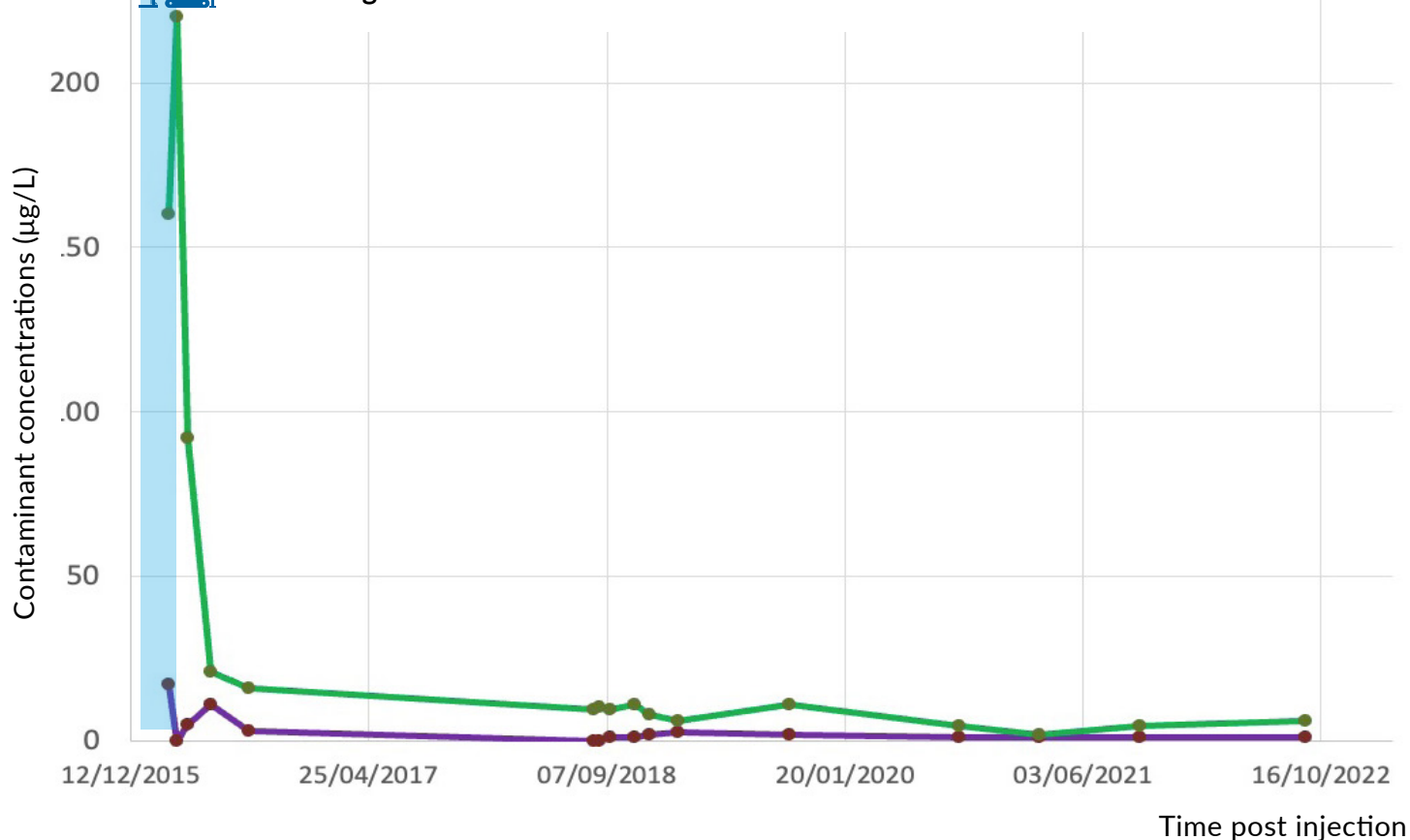
Full-Scale

Following the successful pilot, the full-scale barrier installation was designed and injected onsite two years later. There was no need to re-apply within the pilot area, due to biological degradation on the colloidal activated carbon, regenerating the sorption sites on the PlumeStop, so that the barrier constantly removes and degrades contaminant influx.

Monitoring wells downgradient of pilot area show a rapid and significant reduction in contaminant concentrations in the months following injection. The concentrations have then been maintained or reduced further over >3 years of validation monitoring.

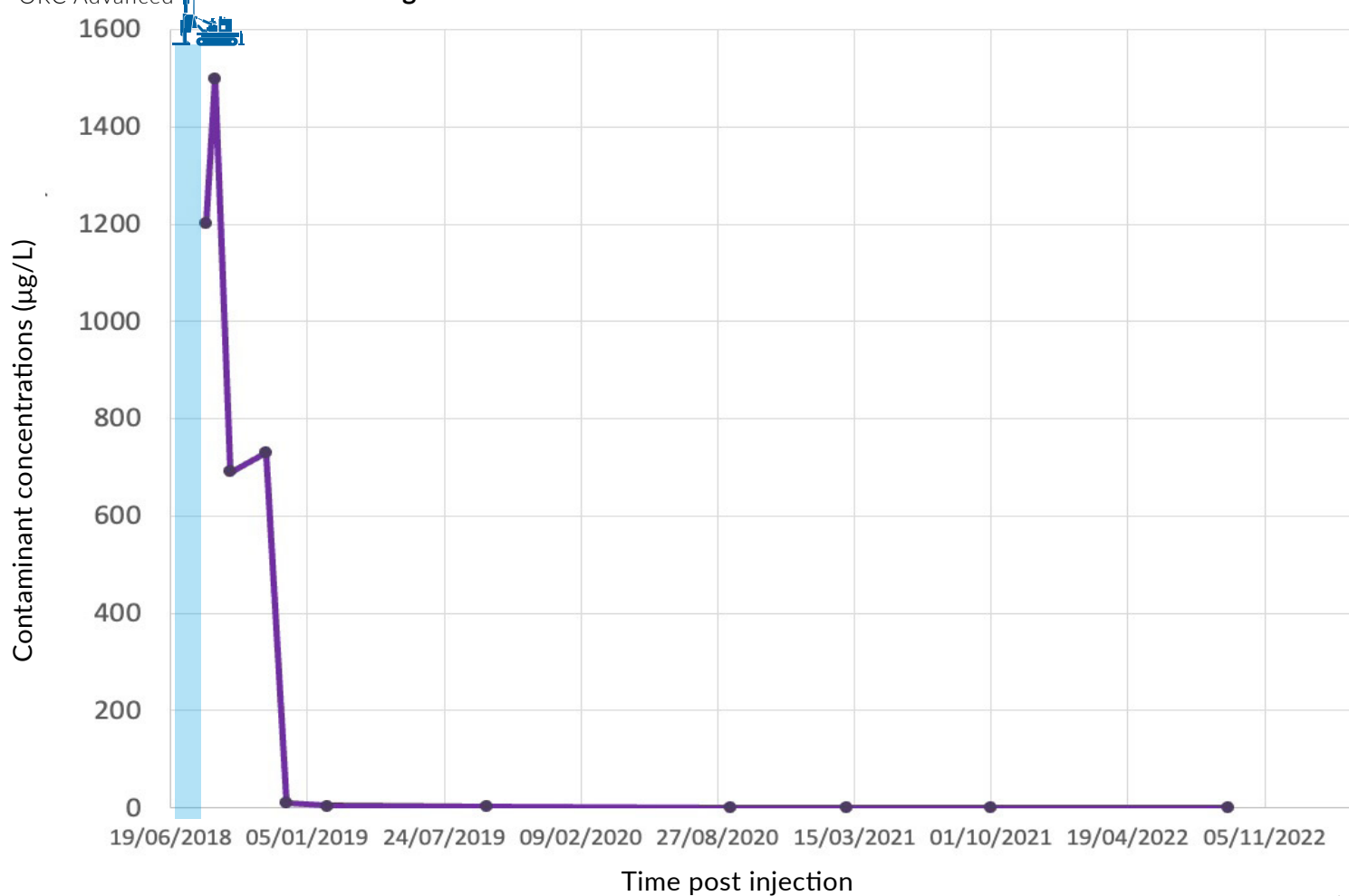
PlumeStop
ORC Advanced

Fig. 5 Area 1 - BTEX Concentrations over time - Centre of Barrier



PlumeStop
ORC Advanced

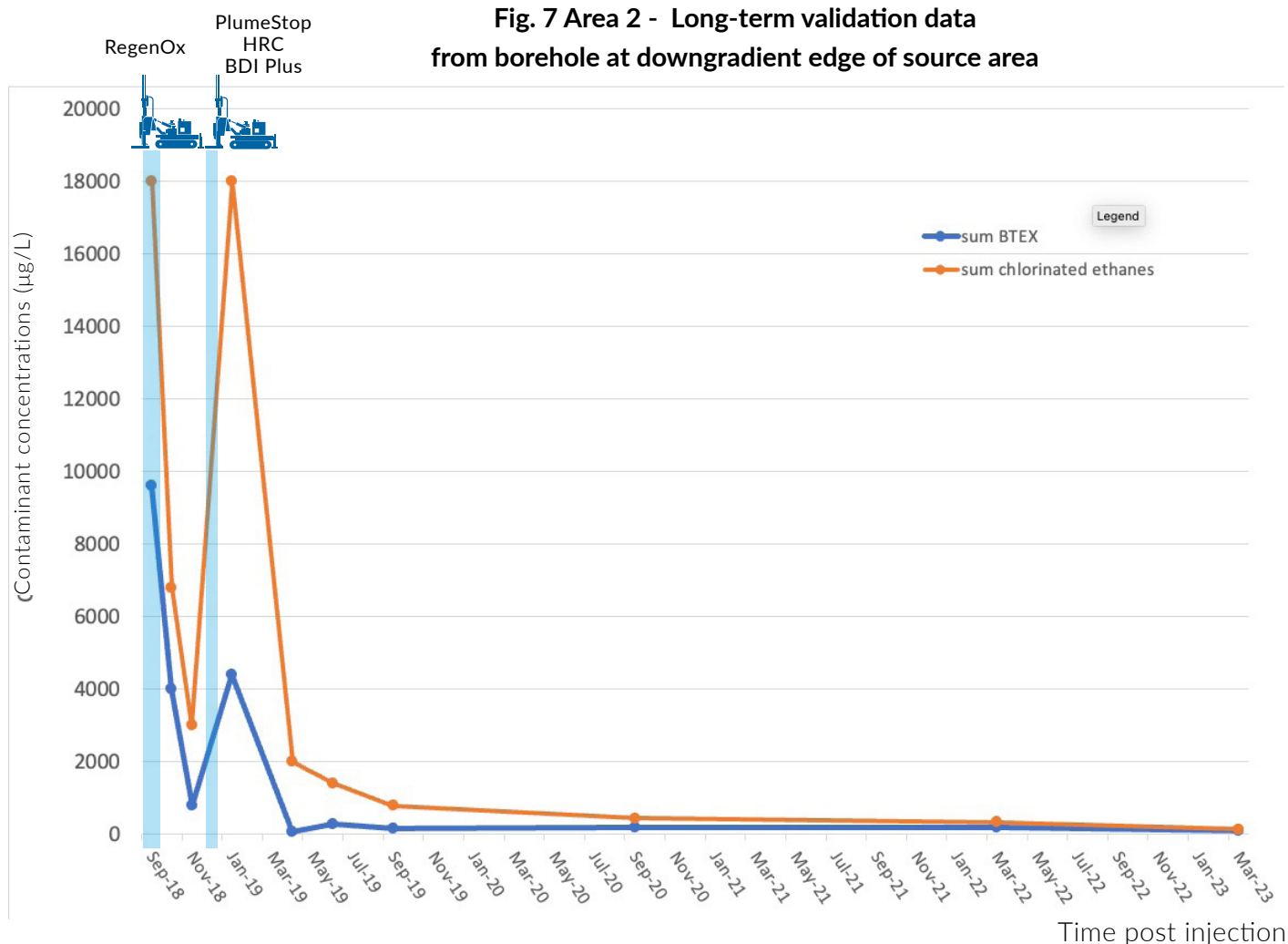
Fig. 6 Area 1 - BTEX Concentrations over time - Extension of Barrier



RESULTS - AREA 2

The RegenOx applications resulted in rapidly destroying a large amount of contaminant mass, allowing the PlumeStop application to efficiently target the residual contamination. Challenging concentrations for the PlumeStop treatment remained elevated for both BTEX and cVOC. However the technology demonstrated the ability to reduce the concentration from up to several tens of mg/L, to <1 mg/L, with an ongoing decreasing trend over time.

Fig. 7 Area 2 - Long-term validation data from borehole at downgradient edge of source area



TREATMENT AREA

Area 1: 60m Barrier

Area 2: 600m²

COST

Area 1: €75k

Area 2: €260k

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An excellent result has been achieved due to the client's belief in the innovative remedial approach and optimum teamwork between all parties involved. Any disruption to commercial activities has been kept to a minimum and the remediation results surpassed the expectation.

”

Vincent Lepère
Bestuurder, Artemis Milieu



Fig. 9 | In situ remediation in area 2

CONCLUSION

- Long-term monitoring data shows ongoing successful treatment at the site.
- By carrying out a pilot test, the injection approach was optimized, and the results used to make the full-scale remedial design accurate and cost effective.
- With the short programme of injection, the lack of a need for ongoing operation and all of the treatment occurring in situ, Volvo Car Gent manufacturing has continued to proceed without interruption throughout.
- PlumeStop has allowed the management of ongoing plumes without the necessity for re-injections over time, thanks to the self-regenerating capability of the carbon through biodegradation
- The process has minimized disruption and remediation costs, while the client has been able to rapidly remove offsite liability and maintain this over the long term.

CONSULTANT REFERENCE

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TECHNOLOGIES APPLIED

PlumeStop® – Liquid form of Colloidal Activated Carbon to provide proven, fast and cost-effective achievement of stringent targets for widespread contaminant plumes.

ORC Advanced® – Accelerated aerobic biodegradation of hydrocarbons for upto a year from a single application

HRC® – Low-volume, controlled-release electron donor for anaerobic biological degradation in low-permeability settings.

BDI Plus® – Robust and proven enriched microbial consortium for anaerobic bioaugmentation.

RegenOx® – Powerful and safe ISCO, compatible with underground structures and services.

For more information, please get in touch or visit our website.

PLUME STOP
Liquid Activated Carbon



**OXYGEN
RELEASE
COMPOUND**



**HYDROGEN
RELEASE
COMPOUND**



**BIO-DECHLOR
INOCULUM**

REGEN Ox



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