REGENESIS®

Cost-effective In Situ Remediation of Chlorinated Solvents in Svenljunga, Sweden

CASE STUDY

SUMMARY

In situ remediation of groundwater impacted with Trichloroethylene (TCE) was completed at a former fur factory in Svenljunga, Sweden, as it had been determined that excavation or thermal treatment would have been too expensive.

A targeted application of 3-D Microemulsion® was performed using direct push technology (DPT) to complete the injections. Validation sampling showed that the concentrations in the groundwater and soils had been reduced by approx. 95%, to well below the remedial targets.

SITE TYPE

Fur processing and manufacturing facilty

CONTAMINANTS

TCE: Typical= 21-170µg/L (max 4300µg/L)
DCE: Typical= 64-1400 µg/L(max 25 000µg/L)
VC: Typical= 5.4-120µg/L (max 2800µg/L)

GEOLOGY

Sand, fine sand and clayey silt

PROJECT DRIVER

Site redevelopment, regulatory requirement

TREATMENT

Enhanced reductive dechlorination

TECHNOLOGIES

3-D Microemulsion® (3DME)

TREATMENT AREA

330m²

TREATMENT THICKNESS

5.5m

REMEDIATION COST

€35K

INTRODUCTION

From the 1930s to the 1960s, a fur factory operated on a site in Svenljunga, Sweden, in which TCE was used as part of the process. Historic spillages and leaks resulted in contaminated soils and groundwater beneath the site. Following the closure of the business, the Svenljunga municipality took on the responsibility for remediation of the site.

The area to be remediated consisted of sands and silts, with some natural organics (peat), with a groundwater level at 1.5-2 mBGL. Slow, naturally occurring biological degradation was evidenced on the site by the presence of daughter compounds cis-1,2 Dichloroethylene (DCE) and Vinyl Chloride (VC) present. Observations of low concentrations of ethylene provided evidence that full degradation was occurring. However, a large build-up of DCE shows that the natural process was very slow and 'stalling' at DCE, as the system was 'carbon-limited'.

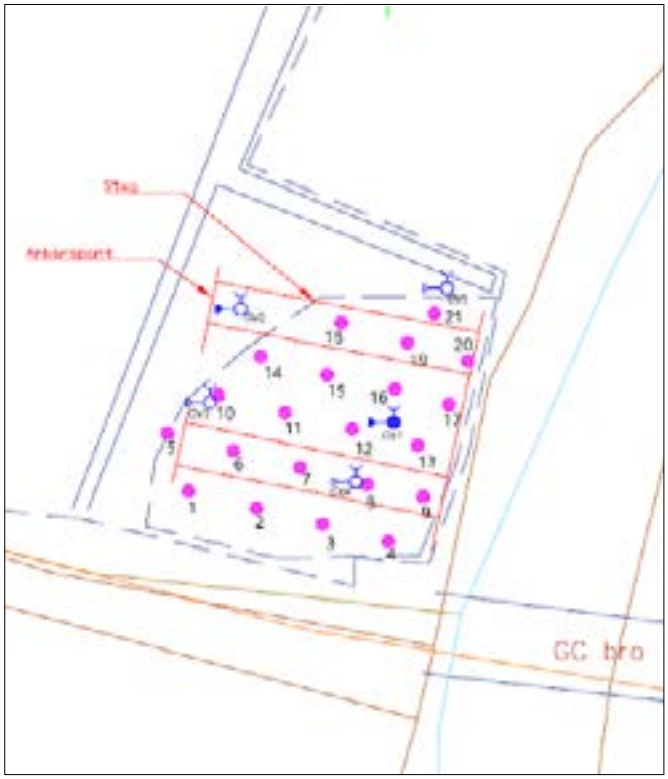
Site location overview (Courtesy of Svenljunga Municipality)

It was determined that remediation to 'moderate residual levels' was acceptable to the regulatory authorities and that this should be achieved within four years. This, combined with the fact that it was considered costly to carry out excavation, or thermal remediation, in comparison to the risks posed by the contamination, led to the choice of enhanced reductive dechlorination as the remediation method. It was estimated that excavation would cost approx. €65–€92/tonne, thermal remediation would cost approx. €276/tonne, whereas the in situ 3-D Microemulsion approach cost €21/tonne on this site.

APPLICATION

Although natural anaerobic biological degradation was occurring, the process was slow and 'carbon limited' i.e. the necessary respiration/redox reactions were hindered by a lack of bioavailable electron donor. Therefore, a simple injection of 3-D Microemulsion was designed to enhance the reductive dechlorination process already underway at the site.

The 3-D Microemulsion was applied through 21 direct push points, injecting 12,000L per point between 2.5-8.0mBGL. The works were completed in 2 weeks onsite, after which only validation monitoring was required.



Left: Injection plan, Right: Injection locations marked onsite (Courtesy of Sortera)

RESULTS

Validation sampling of the groundwater was carried out by the Consultant for 4 years following application. Sequential reductive dechlorination can be seen in the data, with firstly TCE being reduced, followed by DCE and VC, and ethene showing full reductive dechlorination is occurring.

On average, groundwater decreased by 96% for TCE, 94% for DCE and 68% for VC, with the VC expected to continue to decline due to the destruction of the parent compounds. Validation of the soil samples at the 4 year mark showed a reduction of 96% TCE (to 0.27mg/kg), 94% DCE (to 0.46mg/kg), 100% VC (non-detect).

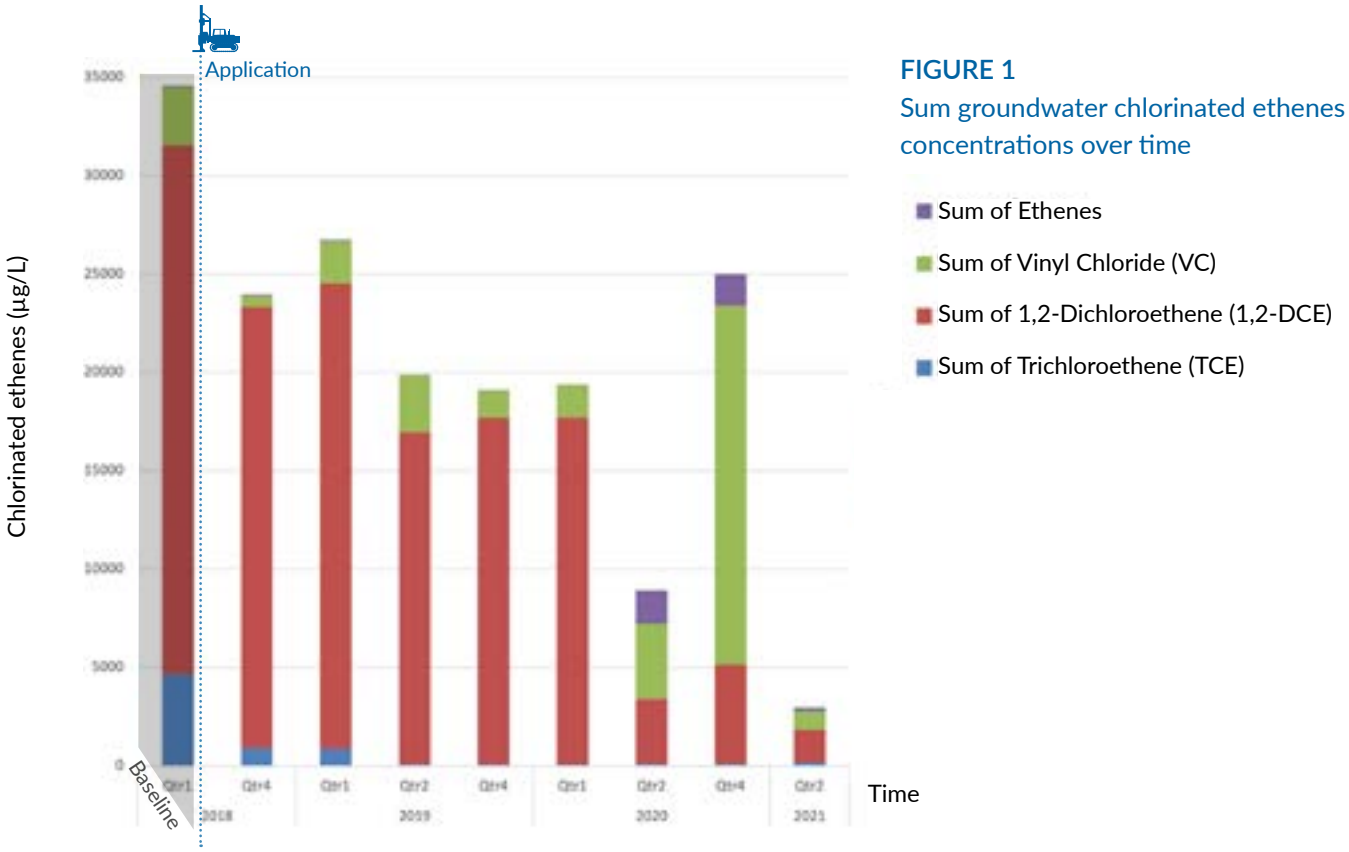


FIGURE 1
Sum groundwater chlorinated ethenes concentrations over time

CONCLUSIONS

Enhanced reductive dechlorination of the chlorinated ethylene contamination in the soils and groundwater was successfully remediated to low concentrations using a single 3-D Microemulsion application.

The project was completed in a short period of time with little disturbance to the site or development programme. 94-100% reductions in the contaminants to very low concentrations were achieved.

The remediation was completed at a small fraction of the cost of the alternative methods considered.

Click here to watch the webinar recording on this project (in Swedish).

PROJECT REFERENCES

Magnus Af Petersens
Head of Projects
Sortera
magnus.petersens@sortera.se

Helena Nord
Remediation Expert
Sheeba Environmental Engineering
helena@sheeba.eu

REGENESIS®

CONTACT

europe@regenesis.com
+44 (0)1225 61 81 61

WWW.REGENESIS.COM