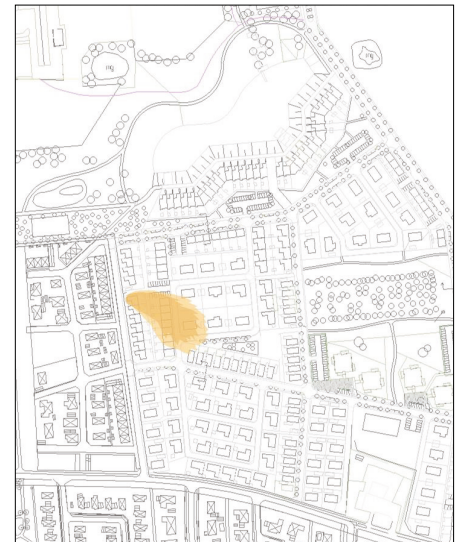


# Groundwater in Soils and Bedrock Treated at an Industrial Site, Sweden

## A single application provides enhanced reductive dechlorination in both aquifers

with Arkil A/S Miljøteknik and WSP

Geology	Gravel and Shalestone
Contaminant Of Concern	TCE
COC Range	500 µg/L TCE
Treatment Area & Thickness	19,000m <sup>3</sup> total, based on 4,050m <sup>2</sup> at 3-8 m BGL
Former Site Use	Manufacturing Facility
Project Driver	Redevelopment
Product Design details	3-D Microemulsion®



Plume spread and location

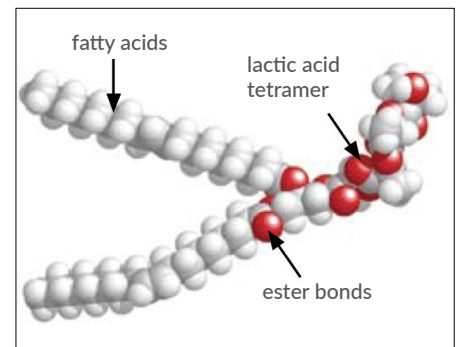
### Introduction

Extensive chlorinated solvent contamination was discovered during the redevelopment of a former manufacturing facility into residential properties. Low but persistent concentrations of TCE were present within the soil and groundwater and the contamination had infiltrated the underlying fractured mudstone bedrock.

A remedial solution was required that would address the groundwater contamination in the bedrock and sorbed contamination in the soils.

### Treatment

**3-D Microemulsion (3DMe)**, an advanced self-distributing and long-lasting electron-donor technology developed by REGENESIS, was selected to enhance the natural process of anaerobic bioremediation. 3DMe stimulates and maintains enhanced reductive dechlorination (ERD) for an extended period from a single injection.



3DMe's molecular structure



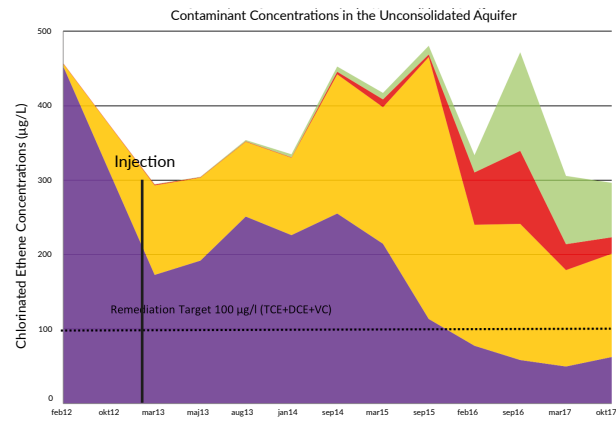
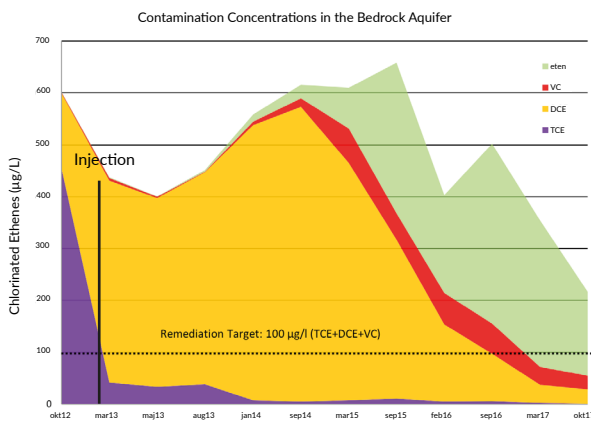
photo: Arkil

The 3DMe application was completed across the 4,050 m<sup>2</sup> area using 51 direct push injection points to target the shallow soils. 32 injection wells were also used, allowing application into the bedrock and unconsolidated soils above. In total 143,000 L of 3DMe was injected over 43 days. Remediation then continued in situ with no further onsite works required.

As the injections were carried out in November, the ambient temperature was -10°C and the ground was frozen. Therefore, the solution was warmed to 40°C prior to injection.



The heating of 3DMe to 40° prior to injection (photo: Arkil)

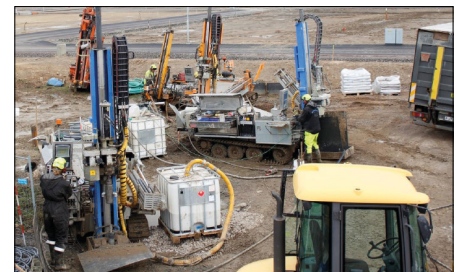


Chlorinated solvent concentrations over time (Results Graphs: WSP)

## Results

The ideal conditions for ERD were quickly established by the application, resulting in the rapid reduction in TCE within the groundwater of the bedrock aquifer, from 500ug/L to the limits of detection. The daughter products have also been reduced to very low levels showing that full reductive dechlorination has occurred.

In the unconsolidated soils aquifer, the reduction in TCE took longer due to there being more sorbed mass in the subsurface than had been expected. However, the TCE has now been reduced to approx 50ug/L. Full reductive dechlorination is occurring, with the daughter products decreasing as the secondary source mass is reduced.



Drill rigs performing direct injection (photo: Arkil)

## Conclusion

- A single application of 3DMe provided ERD treatment for over 4 years and is still ongoing.
- Successful application and treatment was made in two aquifers at the same time; in unconsolidated soils and underlying bedrock.
- The freezing conditions on site did not impede the injection works, nor the in situ remediation of the contamination.

For more information or to discuss your project, please contact:

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