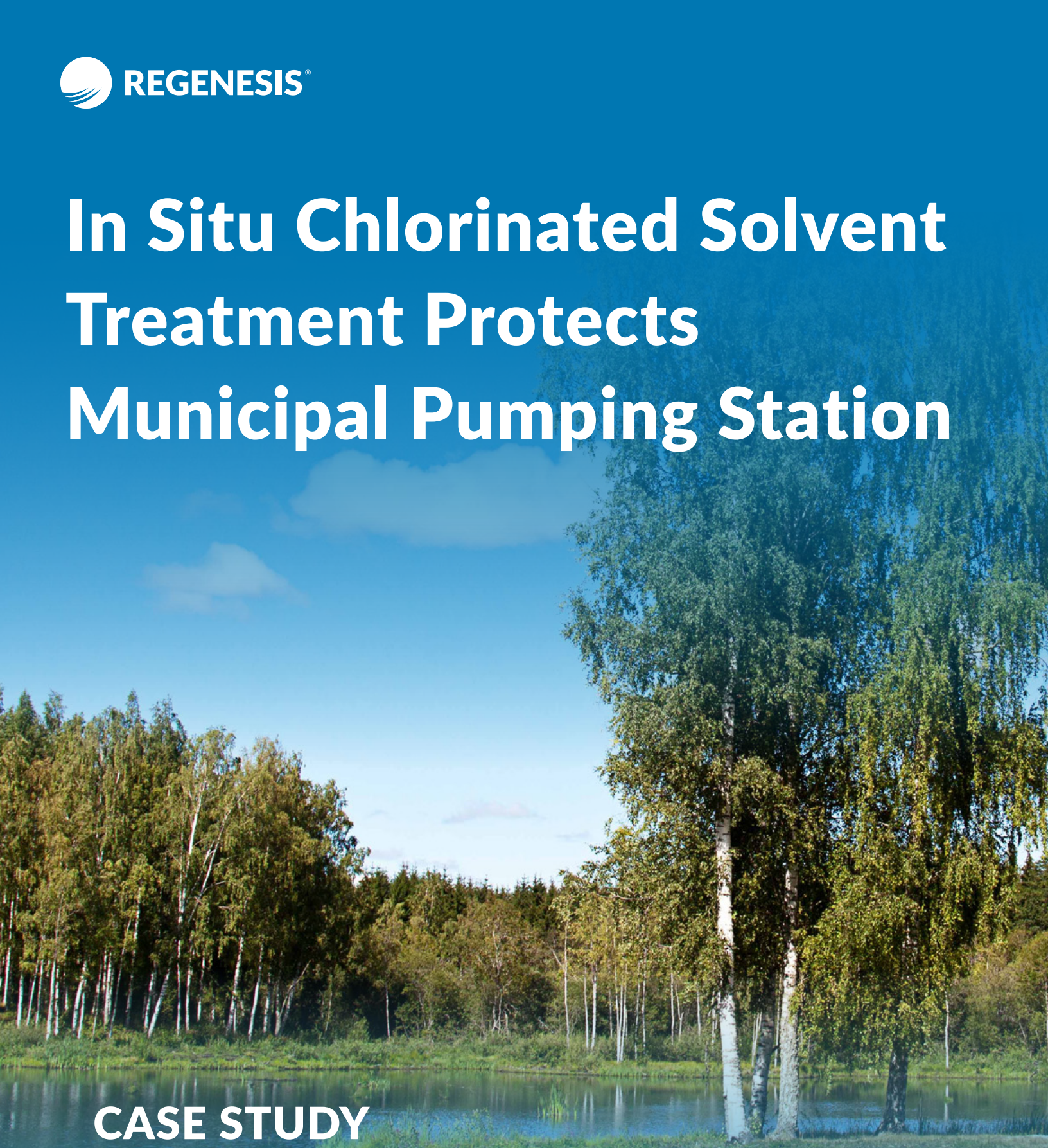
REGENESIS®

In Situ Chlorinated Solvent Treatment Protects Municipal Pumping Station



CASE STUDY

Remediation of a former dry cleaner site in Värnamo, Sweden

BACKGROUND

Between 1938 and 1989 industrial drycleaning activities were carried out at the Värnamotvätten site. Due to spillages and leaks during this time, between 0.7-2.5 tonnes of tetrachloroethylene (PCE) were released into the underlying soils and groundwater.

Soil remediation was carried out by RGS Nordic using multiphase extraction between 0-8mBGL in the source area, however a considerable groundwater plume had been generated by the movement of contamination through the vadose zone. Concentrations in the source area reached 6,000 µg/L of PCE and towards the river bank 100,000 µg/L. The contaminant plume had been shown to flow under the river Lagan, impacting the water abstraction wells at the Ljusseveka waterworks, a municipal drinking water pumping station, located 500m to the southeast. A temporary 'pump and treat' groundwater recirculation system had been installed at the site to prevent further contaminant egress, however this proved to be expensive and so a permanent solution was sought for the contaminant plume.

RGS Nordic worked with REGENESIS to design an in situ remediation solution for the chlorinated solvent plume.

Fig. 1 Site plan

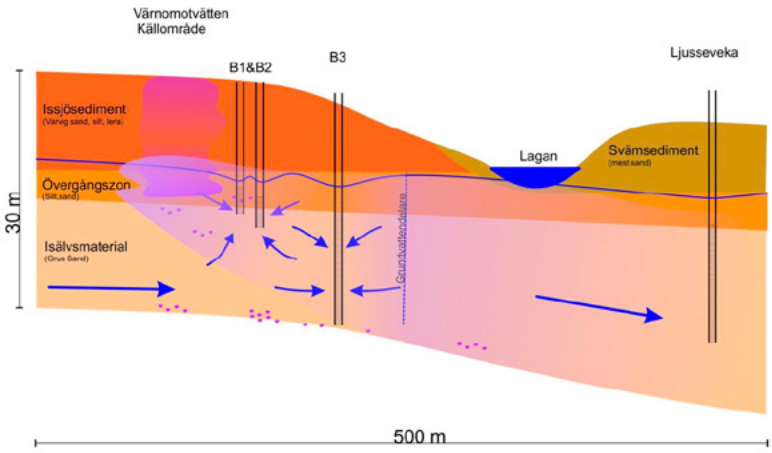


Fig. 2 Cross Section showing the source and plume area and temporary recirculation wells - Daniel Glatz, Structor

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REMEDIAL DESIGN

In situ remediation using Enhanced Reductive Dechlorination (ERD) was chosen to provide the most cost-effective solution for the groundwater plume. The aquifer consists of gravel and coarse sands at the bottom fining upwards to silt and clay. The vadose zone was located in a transition zone ('övergångszon' in the cross section, see fig. 2) that consisted of a complex set of low permeability clays/silts and more permeable lenses of sands and silts that acted as contaminant flux zones.

The electron donor substrate type and dose was chosen to match the permeability of the soils and the contaminant concentration across the site. HRC® was injected into the flux zones to provide a controlled release of electron donors in order to drive ERD for over five years from the single application.

APPLICATION

The application design comprised 80 injection points in a grid pattern across the source area, targeting contamination from 8-12mBGL.

The majority of the application was completed using vertical injections completed by Direct Push Technology (DPT) rigs.

In order to target the contamination under the river bluff, directional drilling rigs were used, creating horizontal lines of injection, located in parallel at different depths to target the entire contaminated zone.

Fig. 3 and 4 Remediation works on site, including directional injection ©RGS Nordic

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RESULTS

Prior to application the contaminant plume primarily consisted of PCE with a small amount of daughter products. Following injection the PCE was rapidly degraded by 99.98%. All daughter products were degraded sequentially and the presence of ethene showed that full reductive dechlorination was occurring.

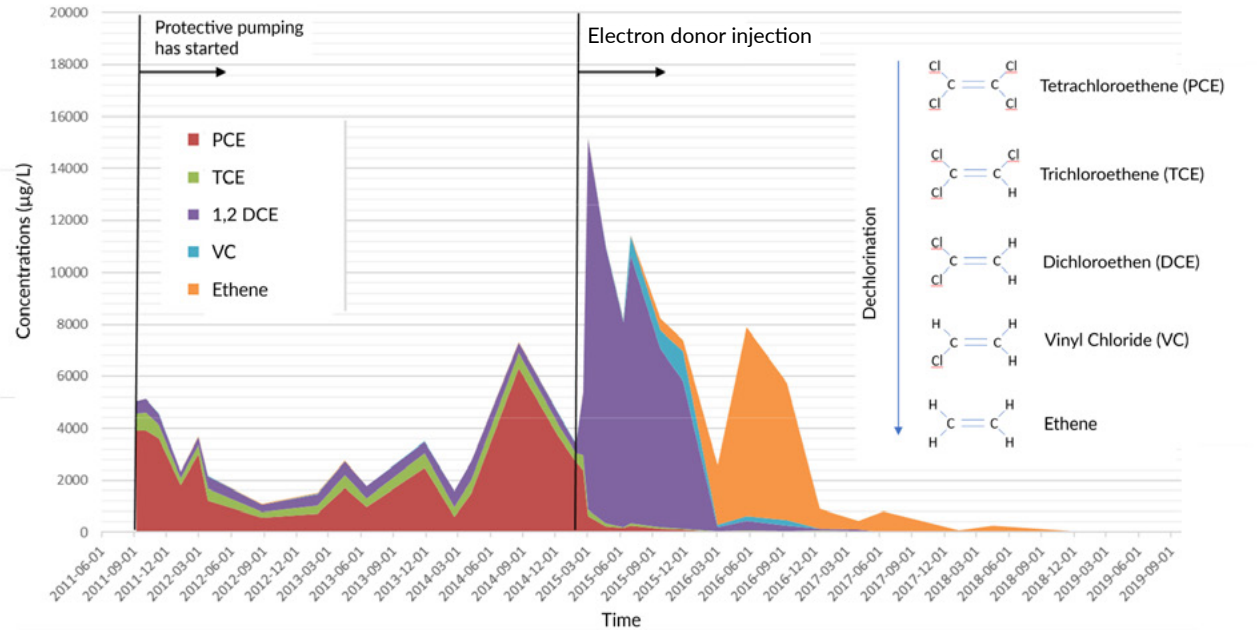

Fig. 5 Contaminant concentrations over time (pre and post in situ remediation) - Daniel Glatz, Structor

Long term monitoring shows that no rebound in parent or daughter contaminant concentrations has occurred, with an overall reduction in total chlorinated solvents of 99.6%.

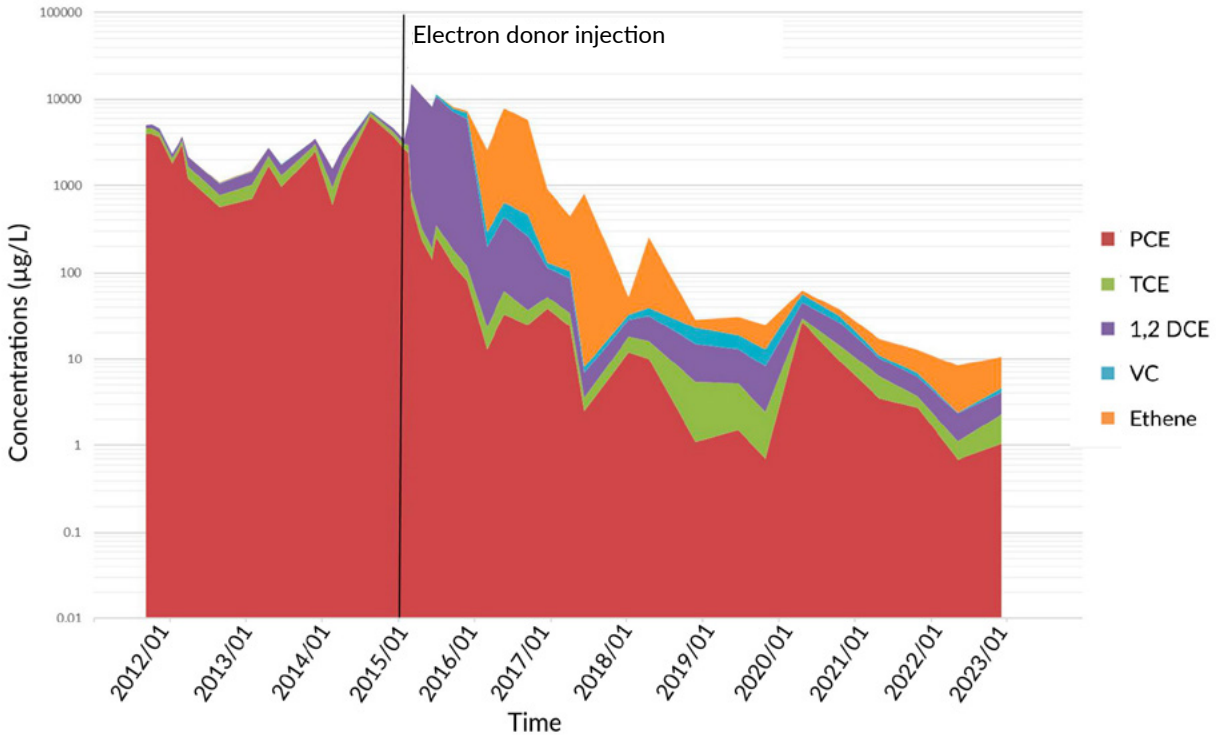

Fig. 6 Longterm monitoring data: Cumulative contaminant concentrations (**logarithmic scale**) over time - Daniel Glatz, Structor

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CONCLUSION

The single injection of controlled release electron donors resulted in the degradation of the contaminant plume and protection of the downgradient drinking water pumping station.

This sustainable solution was completed in 2 months, and required no further operational costs, energy use and produced no waste for disposal, ultimately allowing the protective pumping system to be switched off.

This in situ remedial approach was able to be applied in tight soils, in difficult terrain and successfully remediated high levels of contamination.

Fig. 7 Direct push injections in the source zone ©RGS Nordic

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PROJECT REFERENCES

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