

ISCO treatment of chlorinated solvents beneath industrial infrastructure



A private client approached INJECTIS to design and execute a remediation strategy for groundwater contamination with chlorinated solvents underneath an industrial building.

Site situation

The contamination originated from former industrial activities and consisted primarily of:

- Trichloroethylene (TCE)
- cis-1,2-Dichloroethylene (cis-1,2-DCE)
- Vinyl chloride (VC)

During redevelopment works, the former buildings were demolished and the source zone was excavated and treated ex situ. Despite source removal, groundwater concentrations remained above the 1% solubility threshold. According to Flemish soil legislation, additional remediation was therefore required. The affected zone covered approximately 400 m², with contamination located between 3 and 6 m-bgl. Maximum concentrations before the start of the in-situ works:

- 63,800 µg/L TCE
- 3,518 µg/L cis-1,2-DCE
- 59 µg/L VC

Residual dissolved-phase contamination was clearly still present in the saturated zone.

Remedial strategy

In collaboration with the soil remediation consultant, different treatment options were evaluated. Considering the concentration levels, the contaminant type and the subsurface conditions, an in situ chemical oxidation (ISCO) approach was selected. NaOH-activated sodium persulphate was retained as the most appropriate oxidant for this site.

Laboratory optimisation

Before any field injection, laboratory testing was carried out in-house at INJECTIS. The objectives were straightforward:

- determine the optimal activation pH and hence NaOH dosage,
- quantify the oxidant demand,
- define the minimum effective dosage required to reach the remediation objective in a single injection phase.

A NaOH titration series was performed to establish the required pH for persulphate activation. Subsequently, several concentration series were tested to evaluate degradation efficiency under site-specific geochemical conditions. This optimisation phase allowed us to move to the field with a realistic and technically justified dosage – avoiding both underdosing and excessive product use.

Subsurface conditions

The subsurface consisted of fine loamy sand grading into less permeable loam at greater depth. These soil types are typically challenging for conventional direct-push injection methods. Limited hydraulic conductivity and sensitivity to compaction often lead to:

- uneven distribution,
- limited radius of influence,
- and risk of preferential flow paths.

To ensure homogeneous oxidant distribution, the SPIN[®] Injection Technology was selected. The controlled low-pressure injection combined with mechanical rotation allows reagent placement without fracturing or compacting the soil. In this case, it enabled effective delivery of the activated persulphate across the entire contaminated interval, including the finer fractions.

Execution

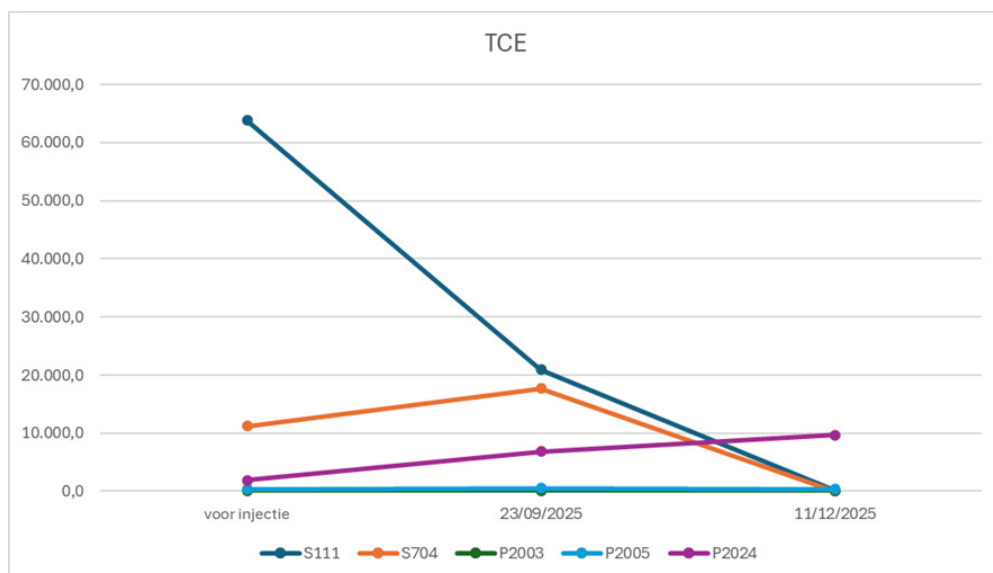
The field works were carried out in July 2025. A total of 32 injections were conducted. The activated persulphate was injected throughout the full 3–6 m interval. Injection proceeded under stable conditions, with consistent flow rates and full delivery of the planned dosage of 250 litres per vertical metre. No abnormal pressure build-up or short-circuiting was observed during execution.

Monitoring results

Groundwater monitoring four months after injection showed a strong reduction in dissolved concentrations:

- TCE: 150 µg/L
- cis-1,2-DCE: 12 µg/L
- Vinyl chloride: < 0.4 µg/L

The results confirm that a well-prepared and properly executed ISCO treatment can significantly reduce residual chlorinated solvent contamination – even in relatively low-permeability formations.



Technical reflection

This project once again highlights three critical aspects:

1. Laboratory-based optimisation before field execution
2. Realistic dosage calculation under site-specific geochemical conditions
3. High-quality injection adapted to the actual soil characteristics

Residual groundwater contamination after source removal is a common scenario. With a tailored injection strategy and proper activation chemistry, it can be addressed efficiently in a single treatment phase.

If you are facing a comparable solvent case, we are happy to evaluate the technical options together.

Location:	Flanders, Belgium
Geology:	Loamy fine sand and loam
Pollutant(s):	VOCl sum max. 67.000 µg/L
Reaction:	Chemical oxidation (ISCO)
Reagent(s):	NaOH activated Sodium Persulfate
Application type:	Grid application
Surface/length:	400 m ²
Number of points:	32
Depth interval:	3,0 – 6,0 m-bgl
Dosage:	250 l/m

Injectis, your specialist partner for in situ soil remediation

Innovative techniques for cleaning and restoring contaminated soil in its original location.

