Environmental Solutions

EHC® Reagent
Case Study

In Situ Treatment of Chlorinated Solvents in Groundwater at a Former Metalworking Facility in Southern Germany

Project

Site:	Former Metalworking Facility – Southern Germany
Lead Consultant:	Günter Dernai, HPC AG, Heidenheim
Injection Contractors:	Fugro Consult GmbH

Background

Figure 1. Direct injection application of EHC® Reagent

Groundwater at a former metalworking facility in Southern Germany was heavily impacted with chlorinated volatile organic compounds (CVOCs) such as tetrachloroethylene (PCE) and its daughter products. PCE was used in the process of galvanizing metals. Five years of groundwater monitoring in two aquifers tracked the contaminant plume and its progression along with natural biodegradation pathways. EHC®, an *In Situ* Chemical Reduction (ISCR) Reagent, was used to accelerate the abiotic and biotic degradation of chlorinated solvents in the two impacted aquifers under the site.

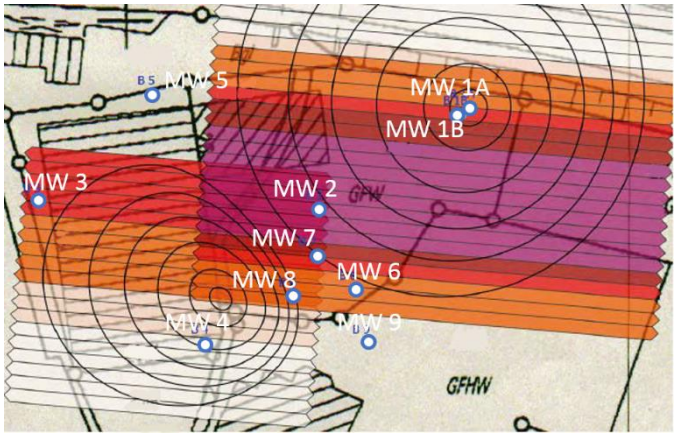

Figure 2. Contaminant plumes 2 years before injection

Challenges

Concentration of total CVOCs were as high as 11,700 micrograms/litre (µg/l) at groundwater monitoring point MW B-8. MW B-8 was screened within two separate groundwater aquifers beneath the site (1.7 to 8.0 meters (m) and 9.6 to 16.9 m below ground surface (bgs)). Modifications to the site development plans resulted in the need to apply more stringent clean-up requirements. Financial limitations, desired construction timelines, and the depth and volume of contamination ruled out other remediation methods.

Solution

EHC reagent is delivered as a dry powder which is mixed with water to create a slurry prior to injection into the targeted area. EHC reagent is composed of controlled-released food grade organic carbon and zero valent iron (ZVI). The subsequent chemical and biological reactions produced by EHC create a highly reductive environment in groundwater; thereby, accelerating the rate of both abiotic and biotic degradation of CVOCs. EHC was selected as the remedy for the site because its ability to meet the challenges faced at the site cost effectively.

Method	Total Estimated Cost, Euros
Excavation and Disposal	665,000
Hydraulic Containment	630,000
Microbiological Treatment (EHC injection)	155,000

Table 1. Estimated cost of remediation methods assuming 25-year runtime.

Approach

A 20 m x 20 m injection field was planned around three groundwater monitoring points (MW B-6, MW B-7, and MW B-8) representing the highest contaminant concentrations in and around the source zone. 15 tonnes of EHC reagent was injected via direct push technology (mixed into a 25% wt solids slurry) at 15 locations into the upper (3 m bgs) and lower (12 m bgs) groundwater aquifers.

The longevity of EHC reagent can range from 5 to 10 years, during which regular groundwater monitoring tracks the rate and degree of dechlorination within the impacted aquifers. Site construction activities were allowed to proceed as planned, while paying special attention to keep monitoring points accessible.

Results

One year after the injection campaign, concentrations of target compounds in MW B-6 and MW B-7 (upper groundwater aquifer) had decreased significantly. Total CVOCs (TVOC) in MW B-6 fell from 1,692 µg/l to 161 µg/l and concentrations in MW B-7 decreased from 63 µg/l to below the limit of detection. Total CVOCs in MW B-8 increased from 11,709 µg/l at the time of the EHC injection to 21,510 µg/l after one year, which could be credited to an increase in cis-1,2-dichlorethene (CDCE) and vinyl chloride (VC) concentrations. An increase of daughter products was expected in this stage of the process as the rate of biodegradation rapidly accelerated after the EHC injection.

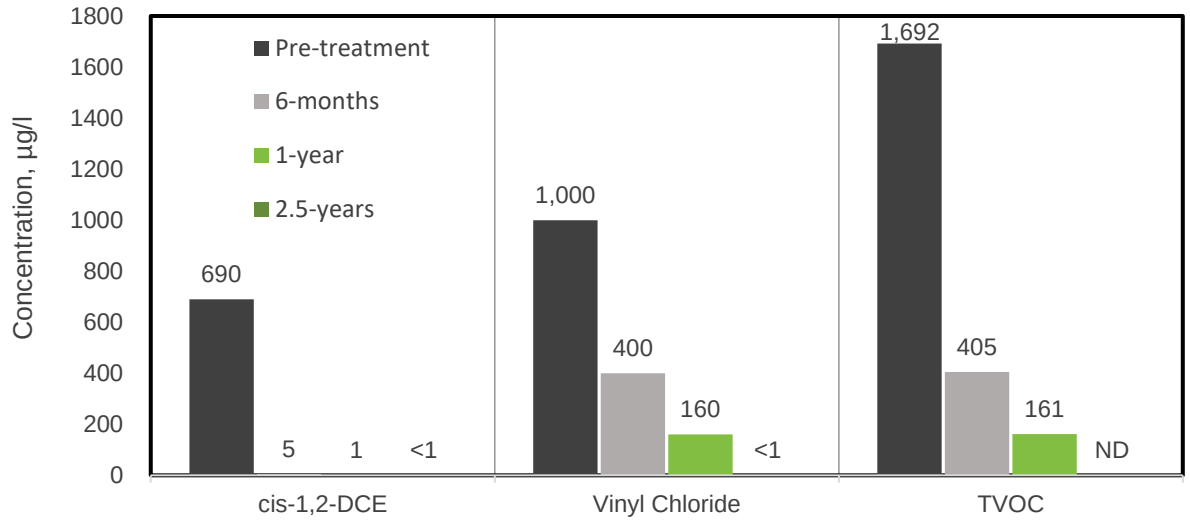

Figure 3. The effect of EHC treatment on target contaminants at MW B-6.

After 2.5 years in MW B-6 and 3 years in MW B-7, total CVOCs concentrations were below the limit of detection. After 3 years, total CVOC concentrations in MW B-8 measured 1,548 µg/l, with the daughter product VC alone accounting for 1,500 µg/l. Total CVOCs in B-8 shows a strong, downward trend, and is expected to continue to decrease as the site enters its final years of dechlorination. The dechlorination process is expected to be completed within 5 years, and pending approval by environmental authorities, the site will be cleared of further active remediation requirements and will enter a passive groundwater monitoring phase.