



## 3-D Microemulsion® Bio-Barrier Rapidly Treats Cis-DCE and Vinyl Chloride Contamination and Maintains Reductive Dechlorination Over a 1,200-Day Period

### CASE SUMMARY

#### Commercial Facility, Des Plaines, IL

Cis-1,2-dichloroethene (cis-DCE) and vinyl chloride (VC) were migrating off-site at this commercial facility. A pilot test of enhanced anaerobic bioremediation was performed to determine if a bio-barrier using 3-D Microemulsion, a form of HRC Advanced®, could effectively reduce the cis-DCE and VC contamination before it moved off-site. The remediation design included the subsurface injection of 3-D Microemulsion upgradient of contaminated well MW-9.

### TECHNOLOGY DESCRIPTION

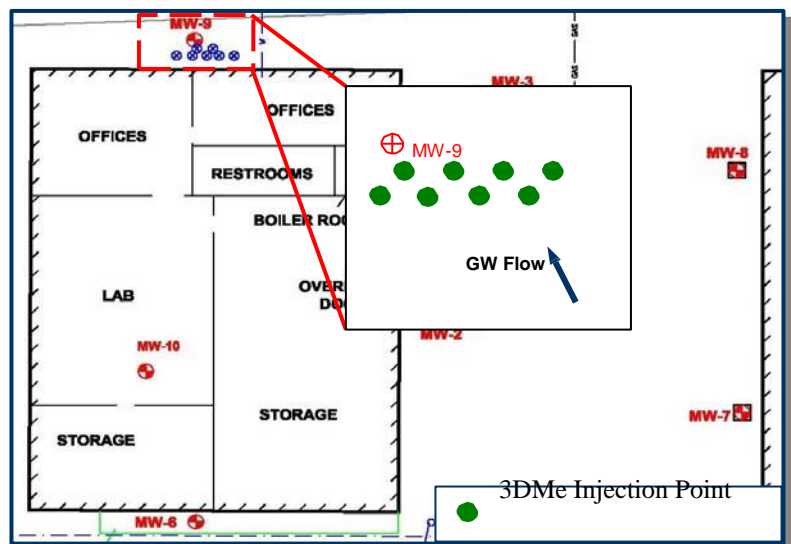
Reductive dechlorination is a process used to degrade certain contaminants in groundwater (e.g., cis-DCE and VC) to ethene. 3-D Microemulsion is a highly effective agent to facilitate this process. 3-D Microemulsion is composed of free lactic acid, controlled-release lactic acid (polylactate), and certain fatty acid components esterified to a carbon backbone molecule of glycerin. When injected into contaminated soil and groundwater, 3DMe produces a sequential, staged release of its electron donor components. The immediately available free lactic acid is fermented rapidly while the controlled-release lactic acid is metabolized at a more gradual rate. The fatty acids are converted to hydrogen over a mid- to long-range timeline giving 3DMe an exceptionally long electron donor release profile. This staged fermentation provides an immediate, mid-term, and very long-term controlled release supply of hydrogen (electron donor) to fuel the reductive dechlorination process.

### REMEDIATION APPROACH

The objective at the site was to demonstrate the ability of 3-D Microemulsion to prevent the off-site migration of cis-DCE and VC by contaminant reduction. The reduction was to be achieved by the introduction of 3DMe into the subsurface through 8 injection points spaced 5 feet apart (Figure 1).

**Contaminants of Concern:**  
*f* cis-DCE: 4,300 ug/L  
*f* Vinyl Chloride: 7,300 ug/L

Figure 1. Site Map with 3-D Microemulsion Injection Points





f <b>Treatment Area:</b> ~500 ft	f <b>Quantity Applied:</b> 480 lbs
f <b>Soil Type:</b> Silty Sand	f <b>Application Rate:</b> 7.5 lbs/ft
f <b>Application Type:</b> Pilot Test	f <b>Injection Spacing:</b> 5.0 ft
f <b>Product:</b> 3-D Microemulsion®	

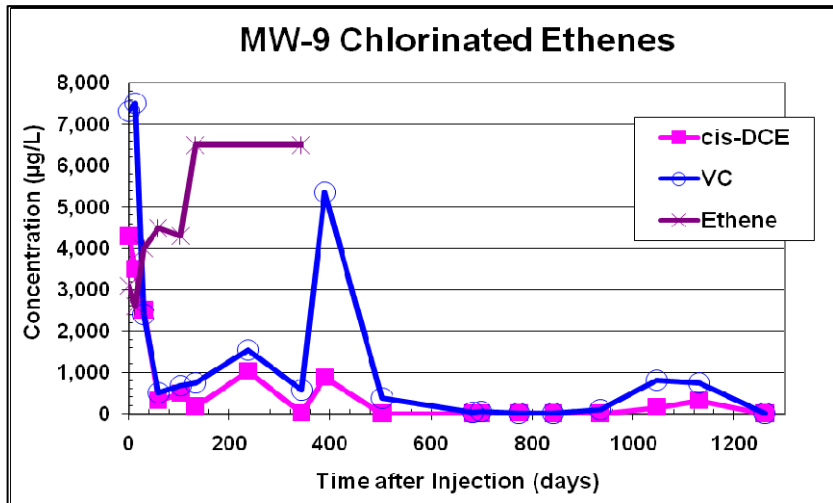
**RESULTS**

Within 60 days of the application of 3-D Microemulsion, concentrations of the target contaminants were significantly reduced (Table 1 and Figure 2). Over the 1,200-day monitoring period, cis-DCE was reduced by a magnitude of 3 from 4,300 to 3 micrograms per liter (µg/L). VC was reduced by 2 orders of magnitude from 7,300 to 24 µg/L, interrupted briefly by an anomalous spike likely to be laboratory error. As a result of this process, ethene concentrations increased by 102 percent, from 3,100 to 6,500 µg/L, after 130 days (a clear indication of complete dechlorination). Elevated levels of ethene were maintained for more than 300 days until ethene monitoring ended at Day 350 (Figure 2).

**Table 1. Concentrations over Time in Well MW-9**

Contaminant	Initial Concentrations (µg/L)	Day 60 Concentrations (µg/L)	Day 350 Concentrations (µg/L)	Day 700 Concentrations (µg/L)	Day 1050 Concentrations (µg/L)	Day 1250 Concentrations (µg/L)
cis-1,2-DCE	4,300	320	15	2.44	160	3
VC	7,300	500	570	58.7	800	14
Ethene	3100	4500	6500	NA	NA	NA

**Figure 2. Concentrations over Time in Well MW-9**



**CONCLUSION**

Overall, the results of this pilot test clearly show that when using 3-D Microemulsion, chlorinated ethene degradation via enhanced reductive dechlorination can be achieved both rapidly (60 days after injection) and successfully maintained over the long term.

**CONTACT**

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