Successful full dechlorination of DNAPL comprising chlorinated ethenes and ethanes under a commercially active site.

Jack Shore UK & Scandinavia District Manager REGENESIS

What can be achieved?



Challenges to overcome...





Metal Works- United Kingdom Groundwater Impacted with DNAPL TCE/TCA

Site investigation

- Identified a 1,500m² area Impacted with TCE and TCA
- Up to 20 mg/L of TCA and 33 mg/L TCE identified across the area
- Average total CHC concentrations 11 mg/L
- Impacted thickness 1 9m BGL
- Groundwater at 2.5m BGL
- Geology identified as glacial till/ clay underlain by coarse sands and granite bedrock



Remediation driver – contractual

Before REGENESIS: Initial Remediation Strategy – Dual / Multi Phase Vacuum Extraction







Dual / Multi Phase Vacuum Extraction – Results

- 75% Reduction not achieved
- Significant rebound when the system was switched off
- 3 yrs of physical treatment
- Targets not met
- Further investigation required



MIP Survey Results – Post SVE

Objectives:

- Assess residual mass
- Understand vertical plume profile
- Inform remedial strategy
- Evaluate risk



Metal Works- United Kingdom Groundwater Impacted with DNAPL TCE/TCA

The Challenge

- Active Metal Plaiting Works
- Multiple TCE spills over decades
- Into made ground, underlying clays with sand layers. To 9mBGL.
- Considerable DNAPL onsite
- Limited signs of reductive dechlorination
- DPVE System reached asymptomatic conditions



Metal Plating Works – United Kingdom

Upon Flushing and Removal of Adsorbed Mass "Back Diffusion" Continues





PRODUCTS



Enhanced Anaerobic Biodegradation (Reductive Dechlorination)

WHAT IT DOES

Makingenhancedreductivedechlorination(ERD)processpossible forin situ remediationprojects.situ remediationsitu remediation

HOW IT WORKS

Problematic chlorinated solvents such as tetrachloroethylene (PCE) and trichloroethene (TCE), dichloroethene (DCE) and vinyl chloride (VC) in groundwater are biologically transformed into less harmful end products such as ethene.

ADVANTAGES

- + Propagates widely within the subsurface
- + Treats wide areas around one injection point saving time and money
- + Immediate, mid-range and long-term, controlledrelease supply of organic acids



3DMicroemulsion An appropriately soluble controlled release electron donor



The molecular structure of 3-D Microemulsion[®]



3DMicroemulsion - Controlled Release of Hydrogen for up to 5 years



PRODUCTS



Enhanced Anaerobic Biodegradation (Reductive Dechlorination)

WHAT IT DOES

Provides **controlled-release** lactic acid to promote conditions and optimize the anaerobic enhanced reductive dechlorination process.

HOW IT WORKS

Provides a viable, long-term source of staged-release hydrogen, on the order of **2-5 years from a single application.**

ADVANTAGES

- + Easily monitored with in situ application
- + Highly compatible with anaerobic

bioaugmentation approaches using BDI Plus

- + Clean, low-cost, non-disruptive application
- + Eliminates the need for on-going operations and maintenance



PRODUCTS



Bioaugmentatio n

Rapidly dechlorinate contaminants during *in situ* bioremediation processes.

HOW IT WORKS

Bio-Dechlor INOCULUM stimulates the rapid and complete dechlorination of compounds such as tetrachloroethene (PCE), trichloroethene (TCE), dichloroethene (DCE), and vinyl chloride (VC).

ADVANTAGES

+ Contains microbes capable of dehalogenating
halomethanes (e.g. carbon tetrachloride and chloroform) and
haloethanes (e.g. 1,1,1 TCA and 1,1, DCA) as well as
mixtures of these halogenated contaminants.
+ Fast acting





MIP Injection proved difficult on site All parties concerned that direct push injection not possible to 9mBGL

Successfully reached 9m BGL











Full-scale application works

- 1,500m²
- 6.5m Treatment thickness
- 9,750m³ Treatment Volume

Direct Push Injection of HRC and 3DMe across 60 Points

1,804,866.96 DKK

Full-scale application works 16 Months Post Monitoring.. Chlorinated Ethenes

2. Mean Concentration Distribution Over Time (Cl-Ethanes)



- Following the injection works, quarterly validation monitoring was completed.
- Post injection monitoring showed no inhibition of parent compound degradation due to the mixed halogenated compound plume.
- 98% and 99% reduction in mean concentration of TCA and TCE respectively.
- 1.8m DKK



Remediation across occupied sites Is often possible and cost effective with minimal disruption

- Just because a site is occupied does not mean remediation cannot take place
- Communicating occupants expectations to the remediation contractor/ designer is key
- Continual stakeholder engagement is key to ensuring that the occupier knows what to expect and that REGENESIS understands commercial and technical limitations to the site.







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