

Remediation of Hexavalent Chromium in Bedrock - Former Saw Mill, UK

Source and Plume Reduced to Non-Detect in 2 Months

Geology	Bedrock
Contaminant Of Concern	Hexavalent Chromium (CrVI)
COC Range	up to 15,000 µg/L
Target Depth	2 to 6 m BGL
Treatment Area	Source: 2,400 m ² treatment grid Plume: 96 m barrier
Previous Site Use	Wood Treatment Yard
Project Driver	Regulatory Driven
Product Design details	MRC [®] and 3DMe [®]

Summary

REGENESIS were retained to carry out the remediation design and site application works to treat groundwater impacted with hexavalent chromium (Cr VI) on the site of a former saw mill. Metals Remediation Compound[®] (MRC) and 3D-Microemulsion[®] (3DMe) were applied into the groundwater to provide rapid reduction and immobilisation of the CrVI present.

Treatment

MRC and 3DMe were co-applied into wells to target the source area of contamination, and to install a 130m wide treatment zone, perpendicular to groundwater flow, at the down-gradient edge of the site to protect a nearby watercourse. As the geology comprises weathered and fractured limestone, treatment was carried out via pre-installed treatment wells at a 5 m spacing in the source area and 6 m in the barrier.

Metals Remediation Compound (MRC[®])

MRC is a controlled release remediation product designed specifically for the treatment of hexavalent chromium (Cr(VI)) in groundwater. MRC's active compound is an ester of cysteine (a sulfur-containing amino acid) on a carbon backbone molecule of glycerol and sorbitol. A cysteine-based product such as MRC is well suited for in situ Cr(VI) immobilisation, since it has a strong affinity for metal contaminants and does not alter the properties of the subsurface. The active compound in MRC (sorbitol hexacysteinate) is embedded in a polylactate matrix that provides a carbon source and electron donor for subsurface bacteria. This combination of materials makes MRC a viscous but injectable material that slowly releases the cysteine ester to a contaminated aquifer via hydrolysis by water or enzymatic action by microbes. MRC's slow-release property allows for a longevity of 12 to 18 months in an aquifer, allowing for an effective approach to metals immobilisation.

3-D Microemulsion (3DMe[®])

3DMe provides an immediate, mid-range and long-term, controlled release supply of hydrogen (electron donor) to rapidly create and then sustain anaerobic conditions. This will reduce the Cr(VI) to Cr(III), which will then settle out as a solid. Reversion to natural conditions following the 3DMe treatment (in perhaps five years or more) will not cause this process to reverse.

3DMe is also designed to distribute over very wide areas from each injection point. This is achieved through the molecule having hydrophilic and oliophilic properties (see figure 4), hence upon mixing with water, 3DMe forms a microemulsion made of tiny micelles, which propagate through and coat the aquifer. This micelles are also able to transport MRC molecules within them,



Fig. 1 and 2 - REGENESIS carrying out the injection of MRC and 3DMe on site

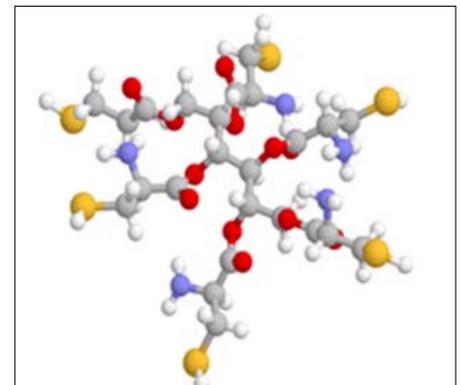


Fig. 3 - The molecular structure of MRC

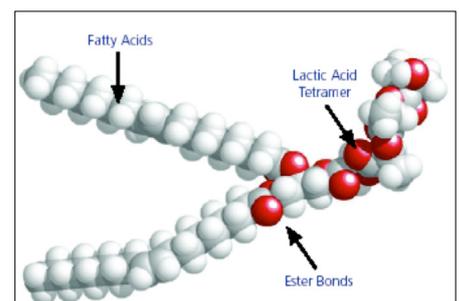
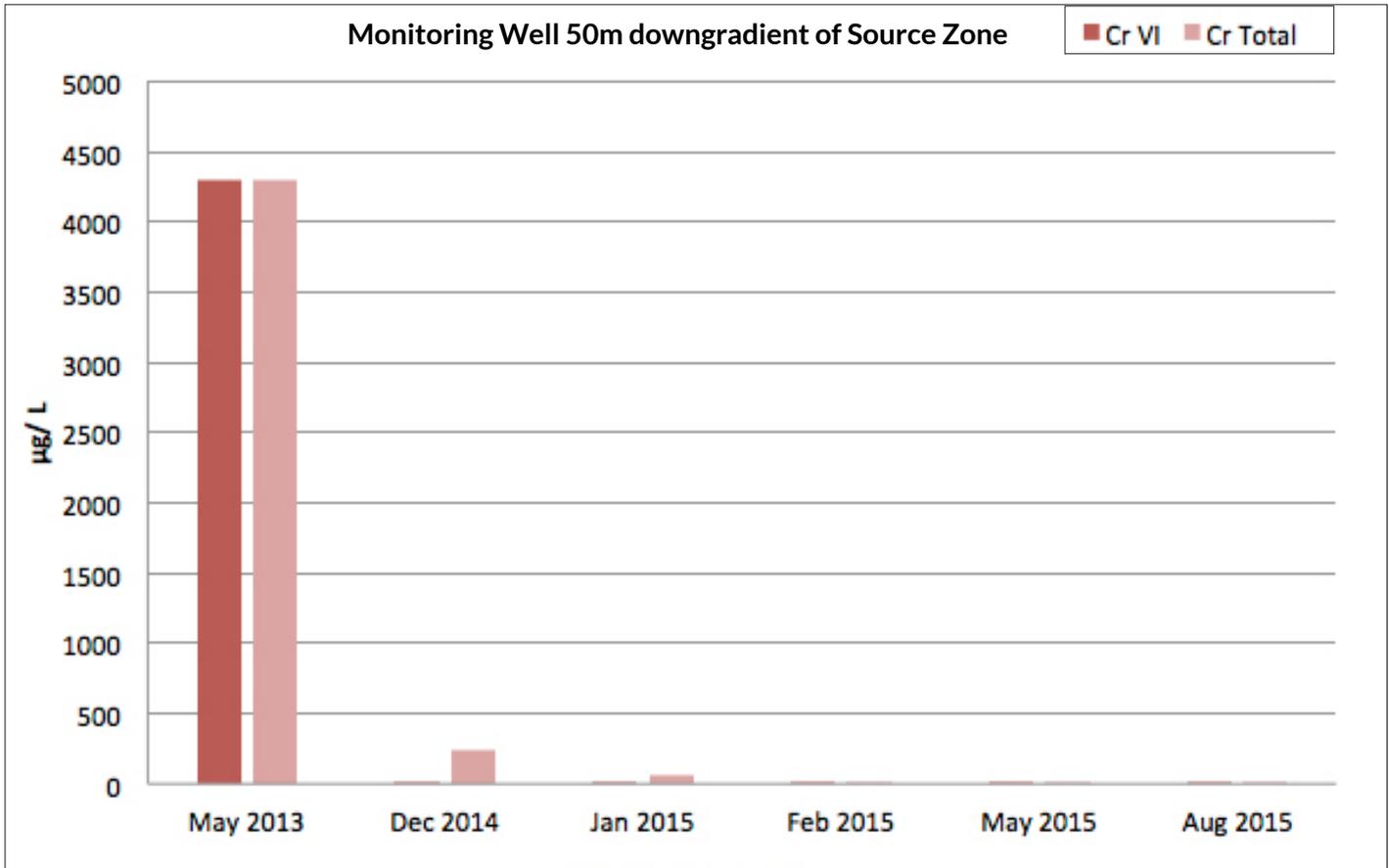


Fig. 4 - The molecular structure of 3DMe



creating a wide and effective treatment zone, which is then sustained for many years.

In this case, the source area was treated, removing the supply of Cr(VI) and a downgradient barrier rapidly prevented any further migration of the plume from the site and treatment of further dissolved phase contamination between the source area and barrier area as it migrates across the site.

Results

The 3DMe/MRC application achieved rapid reductions from concentrations of up to 15,000 µg/L CrVI to below detection limits within 2 months. These low concentrations were then maintained throughout the validation period.

What's Special?

- Regenesi's injection team completed the site works ahead of schedule to allow the groundwork contractor to prepare the site for housing development.
- The use of MRC and 3DMe allowed for wide spacing of the injection wells and therefore lower drilling costs.
- The treatment approach achieved rapid reductions within two months, expediting regulatory sign-off and unlocking the site for redevelopment.
- Source treatment and the prevention of the plume migrating over the site boundary was achieved rapidly.
- The remainder of the plume on the site, between the source and the barrier, will be effectively treated as it migrates into the barrier zone, due to the longevity of the MRC and 3DMe.



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