HRC TECHNICAL BULLETIN #4.1.1

Hydrogen Release Compound HRC™

HRC and Active Mechanical Operations

HRC technology is a passive approach for the accelerated bioremediation of chlorinated hydrocarbons such as perchloroethene (PCE) trichloroethene, (TCE) and other compounds. How then does the HRC technology contrast with active mechanical operations that are currently in use?

Active mechanical systems include processes such as pump and treat and air sparging. These methods have a place in the remediation arsenal for dense non-aqueous phase liquid (DNAPL) source treatment, and as such are compatible with HRC applications that can clean up the dissolved phase plume outside the area of heavy impact. However, as a stand-alone technology for plume management, in direct competition with HRC, active mechanical systems have significant limitations.

The primary limitation is cost. Using pump and treat as an example, the use of this technology to remove large quantities of source DNAPL as a free phase liquid is a reasonable option in some cases, however, its on-going use for clean-up is not reasonable. The capital costs associated with design and installation of mechanical systems are generally much higher than that of an HRC application. Furthermore, the on-going operation and maintenance costs associated with mechanical treatment systems continue to drive the remediation program costs ever higher as the amount of pollution removed continues to decrease with each month of operation. Mechanical systems are simply expensive to run, and become less efficient and more costly to operate with time.

Even before presenting an economic comparison one must recognize that the mechanical methods may not work well under certain conditions. A list of limiting criteria includes the presence of low permeability soils, interference from buildings or other surface infrastructure, visual aesthetics, safety and vandalism.

In summary, the various limitations of mechanical solutions for in situ remediation, such as pump-and-treat or air sparging, are well documented. Given that bioremediation is a viable option for the accelerated natural attenuation of contaminated sites, the following are some advantages of using an HRC slow release hydrogen strategy.

1. Low Capital, Design, and O&M Costs:

HRC is a passive, in situ approach and avoids substantial design, capital, and operations/maintenance (O&M) costs. Sometimes even the design costs alone of mechanical systems will approach or exceed the costs of an ORC or HRC treatment.

Minimal Site Disturbance:

HRC offers the potential for in situ treatment without the requirement for aboveground equipment after initial injection, thereby allowing remediation without disrupting normal business or commercial activities. Applying these slow-releasing substrates to the subsurface is fast and easy.

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After application, there are no aboveground indications that the product has been applied because it works silently below ground.

3. Applicability at Difficult to Manage Sites

HRC is ideal for sites where geological or physical conditions make active systems inappropriate. Particularly in clay soils, where pumping is difficult and sparging promotes channeling, the slow release of diffusible materials has advantages.

4. Limited Disturbance of the Contaminant Plume

Any mechanical action in the aquifer has the potential to distort the dynamics of a contaminant plume—usually not to the benefit of the project. Sparging is of particular concern in this regard where volumes of injected air tend to "push" the contaminant in an uncontrolled fashion away from the injection area. An additional consideration when considering air sparging is the fact that introduced air will raise the redox potential in the contaminated subsurface such that natural attenuation (primarily due to anaerobic dechlorination) will be inhibited. Injections of HRC are minimally invasive and limit site disturbance. Furhtermore, the HRC treatment does not inhibit natural attenuation, but rather it dramatically accelerates the natural attenuation process, often resulting in orders of magnitude increases in the rate of contaminant degradation.

Usefulness at Remote Sites

HRC is ideal at geographically remote sites, particularly in regions that are difficult to access. The HRC process, being passive in nature, requires no utilities such as power or water. This represents a great advantage over mechanical remediation systems which require utilities and constant attention for operation and maintenance.