

HRC TECHNICAL BULLETIN # 2.7.2

Hydrogen Release Compound **HRC™****Can I Use HRC in a High Sulfate Environment?**

When a site is evaluated for HRC applications we first screen through some basic issues such as fundamental hydrogeologic considerations that impact the proper and reasonable placement of HRC. When this is complete, if we have reason to continue, we must then address the question of "wasteful side reactions" that may impact the feasibility of using HRC. In these reactions the HRC-derived lactic acid and the hydrogen that is produced from the lactic acid is "wasted". In essence, this means it does not get a chance to support the microbes that are responsible for reductive dechlorination.

When HRC is applied to a contaminated groundwater setting, it supplies hydrogen as an electron donor to the microbes responsible for the desired degradation. These are anaerobic dechlorinating bacteria. The contaminant in this suite of reactions is the electron acceptor, taking the electron from the bacterium and consequently being dechlorinated. This set of reactions, however, is complicated by the presence of competing electron acceptors (CEAs) - the common ones are oxygen, nitrate, iron and sulfate.

The presence of these CEAs will "waste" the electron donor hydrogen, as they themselves are reduced through various reactions. Furthermore, these same competing electron acceptors can also be involved in the microbial consumption of lactic acid before it can even generate hydrogen.

Of the common CEAs the worst is sulfate – simply because it can be present in very high concentrations due to its solubility. It is not unusual to see levels in the hundreds or even thousands of parts per million. On this basis the impact of other CEAs is almost negligible when sulfate is really high.

In the design of an HRC application, sacrificial lactic acid is provided to overcome these CEA concentrations and drive the contaminant dechlorination. Due to the ubiquitous nature of microbes in the subsurface environment, it is possible to carry out reductive dechlorination in the presence of elevated sulfate concentrations.

While it is true that sulfate reducing reactions will siphon off HRC and its by-products, all of the sulfate does not have to be reduced before reductive dechlorination can take place. Also, different redox zones will exist in different parts of the aquifer thus allowing the various reductive processes to exist simultaneously. Unfortunately we don't see this when we pull a water sample from a well in which everything is mixed. One stratum may have a very high sulfate condition and, given limited vertical mixing, it will not impact a zone elsewhere that is actively supporting reductive dechlorination.

If faced with a high sulfate condition, simply input the concentration into the HRC Application Software and complete the design. If the design output generated has unacceptable physical application or economic requirements for HRC (i.e., too costly), Regenesys recommends a small field

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pilot test to determine the economic feasibility of the HRC application in the presence of the existing sulfate. It could well turn out that rapid dechlorination occurs with moderate HRC application even in the presence of high sulfate. To determine the appropriate pilot test design, please contact Regenesys directly for technical support.

So, in conclusion, the presence of high levels of sulfate in the aquifer is not automatically a problem for accelerating reductive dechlorination in the aquifer. Increasing the amount of HRC applied usually overcomes the additional demand imposed by the sulfate. If in the initial design stage, it appears that supplying the additional HRC for the

sulfate demand results in exorbitant costs, Regensis recommends performing a field pilot test to determine if a modest HRC application can generate adequate contaminant degradation in the presence of the existing sulfate

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