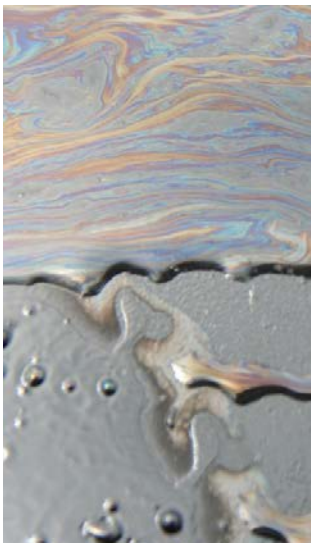
Top 5 Tips for Electron Donor Injection & Anaerobic Bioremediation

While an established treatment strategy at chlorinated solvent sites, the effectiveness of electron donor addition for biostimulation can be limited by a number of complicating factors such as competing electron accepting processes, the presence of inhibitory co-contaminants, and inadequate electron donor mass or distribution. Below are some of our top tips when considering and preparing for electron donor injection:

1. Submit pre-injection (baseline) groundwater samples from select monitoring wells for **QuantArray®-Chlor** or **CENSUS® qPCR** analysis.



Quantification of baseline concentrations of *Dehalococcoides* and other key halorespiring bacteria will allow site managers to answer key questions including: (1) Is bioaugmentation warranted or just an additional expense? (2) What are the concentrations of halorespiring bacteria and functional genes under initial site conditions? These baseline concentrations serve as the benchmark for evaluating the effectiveness of electron donor injection (see **Top Tip 5**).

2. Carefully evaluate electron donor mass requirements and consider submitting samples for **maximum oil retention (OR_M)** if recommended by your electron donor vendor.

Underestimation of the required electron donor mass leads to limited long-term performance while overestimation increases costs without improving treatment. Electron donor vendors have design tools to estimate the required mass of their products. OR_M, the maximum mass of oil that will be retained per unit mass of aquifer solids, is considered by some EVO suppliers to be a critical input parameter.

3. If the addition of a buffer is being considered for pH control, submit groundwater and sediment (if available) samples for **Acidity Testing** when recommended by your electron donor supplier.

Acidity analysis provides the equivalents of base needed to overcome aquifer acidity and maintain a near neutral pH for optimum biological activity. Your electron donor vendor can then advise on the best course of action to control pH in conjunction with electron donor injection.

4 Consider an ***In Situ* Microcosm (ISM)** study to provide the chemical, geochemical, and microbiological lines of evidence needed to cost-effectively screen remediation options.

At some sites, additional assessment is needed to screen remediation options (MNA vs Biostimulation vs Bioaugmentation) before implementing a remedy at full scale. Results from laboratory microcosms do not always correlate to the field and pilot studies are too expensive to be a screening tool. ISMs provide a cost-effective approach to simultaneously evaluate multiple treatment options in the field.

5 Incorporate **QuantArray®-Chlor** or **CENSUS® qPCR** analysis along with chemcial and geochemical lines of evidence during post-injection performance monitoring.

Did concentrations of key halorespiring bacteria increase after injection? Did *Dehalococcoides* reach the 10^4 cells/mL threshold recommended for effective rates of reductive dechlorination? Conversely, did sulfate reducing bacteria or methanogens outcompete halorespiring bacteria and hinder biodegradation?

In other words, was electron donor injection effective? Incorporating **QuantArray®-Chlor** or **CENSUS® qPCR** analysis into post-injection performance monitoring provides direct and quantitative evidence of the impact of electron donor addition on the concentrations of key halorespiring bacteria, functional genes, and competing microorganisms and thus the effectiveness of biostimulation.

Bonus Tip

Prior to electron donor injection and periodically during performance monitoring, consider submitting groundwater samples from select monitoring wells for **compound specific isotope analysis (CSIA)**. CSIA is an environmental molecular diagnostic that is used to conclusively determine whether contaminant degradation has occurred. CSIA of baseline and post-injection samples from select monitoring wells will permit site managers to conclusively determine if degradation of parent and daughter compounds has occurred in response to biostimulation.

For more information, please visit the Resources section of the Microbial Insights website (www.microbe.com) and download the full white paper.

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