

Terra Systems Core Competencies Pre and Post Sales Support

Terra Systems, Inc. pre and post sales support helps to ensure that our clients are using the best carbon substrate loading for their site to achieve the desired results.

It begins with a **free** site evaluation by Terra Systems technical staff led by Dr. Mike Lee one of the emulsified vegetable oil substrate patent holders – US patent 6,398,960 for “*Method for remediation of aquifers*”.

We begin with the **ESTCP Substrate Estimating Tool** and the data you provide to calculate the proper carbon loading using our patented 60% SRS[®]-SD small droplet emulsified vegetable oil (EVO) or our 60% QRS[®] or QRS[®]-Plus sodium lactate substrate (**download the customer site hydrogen demand tool**).

Description	Unit of Measure
Treatment Width	feet
Treatment Length	feet
Treatment Depth	feet
pH	
Porosity	percent
Hydraulic Conductivity	feet/day
Hydraulic Gradient	feet/feet
Calculated GWFR	Feet/day or Feet/year
DO	mg/L
NO ₃	mg/L
Sulfate	mg/L
Mn Produced	mg/L
Fe ²⁺ Produced	mg/L
Methane Produced	mg/L
PCE	mg/L
TCE	mg/L
cDCE	mg/L
Cr ⁶⁺	mg/L
Vinyl Chloride (VC)	mg/L
Ethene	mg/L

We use the key geochemical drivers important for the dechlorination process, which include:

- The size of the area to be treated
- The concentration of the competing electron acceptors
- The concentration of contaminants of concern
- The pH
- The groundwater flow rate
- The presence or absence of vinyl chloride, ethene and ethane

- *Dehalococcoides* and functional gene numbers

Unlike other suppliers, we don't just take the demand that is calculated from the model and regurgitate it back to our clients. The Terra Systems technical team reviews the site maps and client's objectives to determine a recommended dosage. Another factor that is considered is how much total organic carbon (TOC) is available from the substrate injection. Based on our extensive site experience, we recommend that the minimum dosage of TOC from the carbon substrate injections be at least 500 mg/L. This is based upon achieving adequate distribution of the substrate and the desired longevity.

The technical team also reviews the pH data at the site to determine if a buffering agent is required. If only the pH of the groundwater is known and it is between 5 and 6 we typically recommend adding 2-8 g/L of sodium bicarbonate during the manufacturing process to counter the acids produced during the fermentation process. This is a “**no charge option**” at the request of the PM. Additional sodium bicarbonate may need to be added to the chase/dilution water. Saturated soil sample typically have a much higher buffering capacity than groundwater. If the pH of the saturated soil sample is low, then we may recommend a stronger buffer like sodium carbonate or magnesium oxide.

The technical team will also evaluate whether bioaugmentation is required based on the presence or absence of vinyl chloride, ethene, and ethane, and the numbers of *Dehalococcoides* and TCE and VC reductase genes (if available) and calculate the recommended volumes of TSI-DC[®] *Dehalococcoides mccartyi* Bioaugmentation Culture.

Cradle to Grave: Once an order is placed the Terra Systems team will track the shipment and keep the PM informed of its progress. Once on site the PM has access to the technical team to review dosage per point, dilution modifications based on actual vs. planned injection volumes, etc.

Project Review: The Terra Systems team will review the site data and provide its interpretation of how the project is going.