



INCORPORATED



Terra Systems Core Competencies

Pre and Post Sales Support

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

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.

We begin with the **ESTCP Substrate Estimating Tool** and the data you provide to calculate the proper carbon loading using our patented SRS[®] family of emulsified vegetable oil substrates (EVO) or our sodium or potassium lactate substrates.

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 and depth 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*

We don't just regurgitate the results from the model. The technical team reviews the site maps

and client's objectives to determine a recommended dosage. Another factor 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 be 500 mg/L or greater to achieve adequate distribution 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 5.5 and 6, we typically recommend adding 2-4 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 demand than groundwater. If the pH of the saturated soil sample is low, then we may recommend a stronger buffer like calcium carbonate, sodium carbonate, or magnesium oxide.

The technical team also evaluates 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 calculates the recommended volumes of TSI-DC[®] *Dehalococcoides mccartyi* Bioaugmentation Culture.

Just-in-Time Logistics: The team will track the shipment, keep the PM informed of its progress and once the product is 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 and data visualization of how the project is going.

To discuss a remediation site call or email Michael Free at mfree@terrasystems.net or 484-889-2214.