50/50 Mixed TSI DC (DHC) and TSI TCA (DHB) *Dehalococcoides mccartyi/Dehalobacter* Bioaugmentation Culture®

Containing >5 x 10^{10} Dehalococcoides cells/L and >5 x 10^{10} Dehalobacter

Terra Systems 50/50 mix of TSI DC *Dehalococcoides mccartyi* and TSI TCA *Dehalobacter* Bioaugmentation Cultures® is added to the groundwater at sites where the native microorganisms of Dehalococcoides and *Dehalobacter* are not present, not in sufficient quantity or when the client wants to decrease the remediation time frame for the biodegradation of chlorinated solvents such as tetrachloroethene (PCE), trichloroethene (TCE) and trichloroethane (TCA).

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Key Communication Points

- TSI DC *Dehalococcoides mccartyi* and TSI TCA *Dehalobacter* Bioaugmentation Culture® is an enriched natural bacteria culture that contains *Dehalococcoides* and *Dehalobacter* species for bioaugmentation.
- TSI DC® contains >5 x 10^{10} *Dehalococcoides cells/L* and TSI TCA contains >5 x 10^{10} *Dehalobacter cells/L*
- This culture dechlorinates tetrachloroethene (PCE) and trichloroethene (TCE) to the non-toxic product ethene and biodegrades 1,1,1-trichloroethane to 1,1-dichloroethene, 1,1-dichloroethane, and chloroethane.
- It also can biodegrade carbon tetrachloride and chloroform to methylene chloride and innocuous products.
- It can be used at sites where bacteria capable of complete reductive dechlorination are not present or there is a need to decrease the remediation time frame. It is estimated that *Dehalococcoides* and *Dehalobacter* are not present in 10 to 40 percent of chlorinated solvent contaminated sites.

Key Benefits of TSI DC *Dehalococcoides mccartyi and TSI TCA Dehalobacter* Bioaugmentation Culture®

- The 50/50 mix of TSI DC and TSI-TCA *Dehalococcoides mccartyi/ Dehalobacter* Bioaugmentation Cultures® has been proven to be effective with a growing body of laboratory and field data demonstrating that the *Dehalococcoides* group of microorganisms is solely responsible for the complete dechlorination of PCE and TCE to ethene. At sites where *Dehalococcoides* microorganisms are not present or are found at low numbers, the process will often "**stall**" at cis-1,2-dichloroethene. TSI-DC® will promote the complete dechlorination of PCE or TCE and contains greater than **5 x 10^{10}** *Dehalococcoides*/L.

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- TSI TCA biodegrades 1,1,1-trichloroethane to 1,1-dichloroethene, 1,1-dichloroethane, and chloroethane and contains >5 x 10^{10} *Dehalobacter cells/L*

Composition

Ingredient	Synonyms	CAS #	Percent	Hazardous
Non-hazardous ingredients	DHC	Not applicable	50%	No
Non-hazardous ingredients	DHB	Not applicable	50%	No

Terra Systems QA/QC

With every shipment, we include a QA/QC sheet for the actual batch that the customer receives. Included are the date manufactured, batch#, DHC concentration (cells/L), PCE dechlorination activity, cDCE dechlorination activity and DHB concentration (cells/L).

Manufacturing Quality Control Checklist for a mixed 50/50 TSI DC and TSI TCA Bioaugmentation Culture

I. Product Information

Parameter	Value
Product manufactured	50/50 TSI-DC and TSI TCA
Date manufactured	3/16/17
Batch#	789-45/35
Customer packaging	Keg
Customer	WSP
Volume of culture	18 L
Date shipped	4/18/2017
Date delivered	4/19/2017
Site location	Wytheville, VA.

II. Ingredients Information

Test	Results	Acceptable Range	Date	Method
DHC content of pre-concentrated culture (copies/L)	1.6E11	≥1E11	03/17/17	qPCR
PCE dechlorination activity, mg/h per gram of dry weight	307	≥50	03/22/17	Bottle Assay
cDCE declorination activity, mg/h per gram of dry weight	155	≥50	03/22/17	Bottle Assay
DHB content of pre-concentrated culture TSI TCA (copies/L)	2.1E11	≥5E10	04/17/17	qPCR

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Date

The TSI DC® and TSI-TCA® Bioaugmentation Culture is cost effective and is typically a minor component of the total remediation project cost. At sites where the *Dehalococcoides* or *Dehalobacter* are present, but at low numbers or poorly distributed, bioaugmentation can be used to reduce the treatment time. Bioaugmentation can also reduce the time required to grow the *Dehalococcoides* and *Dehalobacter* populations to effective cell densities. Therefore, future costs can be reduced.

- The TSI DC® and TSI-TCA® works with all commonly used electron donors.
- The TSI DC® and TSI-TCA® Bioaugmentation Culture is not genetically modified or engineered.
- The TSI DC® and TSI-TCA® Bioaugmentation Culture is certified to be free of known human pathogens.
- Each purchase comes with free technical phone support from an experienced Terra Systems microbiologist.
- The TSI DC® and TSI-TCA® Bioaugmentation Culture has rigorous quality control procedures in place to ensure that each shipment is of the highest quality, stable, safe, effective and free of chlorinated volatile organic compounds.
- The TSI DC® and TSI-TCA® Bioaugmentation Culture is shipped overnight in specially designed stainless-steel containers that prevent exposure to air and are safe & easy to handle.
- A senior level microbiologist is also available to be on-site to support the successful application at $1,200 per day plus travel expenses.

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