

## Technical Note 2

### MODE OF ACTION

DCL-Biosolv provides the means by which naturally occurring anaerobic bacteria such as *Dehalococcoides* can rapidly degrade chlorinated contaminants into harmless compounds. DCL-Biosolv contains a range of ingredients designed to provide rapid, medium term and long term activity in the aquifer. The main ingredient in DCL-Biosolv is emulsified vegetable oil comprising of a range of triglycerides which are responsible for its long term activity.

Under anaerobic conditions chlorinated hydrocarbons undergo a series of microbially mediated reactions involving reductive dechlorination. For example, tetrachloroethene (TeCE) is reduced to trichloroethene (TCE), which degrades primarily to cis 1,2-dichloroethene (cDCE), which in turn degrades to vinyl chloride (VC), which is ultimately dechlorinated to ethene. During each of these transformations, the parent compound releases one chloride ion and gains one hydrogen, with two electrons being transferred during the process. The ultimate source for the hydrogen and electrons in this reaction is DCL Biosolv.

Triglycerides undergo anaerobic fermentation whereby the ester linkages between the glycerol and fatty acids are hydrolysed releasing free fatty acids and glycerol into solution. The glycerol is then degraded to acetate via the intermediate 1,3 propanediol whilst the fatty acids are broken down by beta-oxidation resulting in the release of hydrogen. Acetate and hydrogen are then consumed in a range of different reactions.

Where high energy electron acceptors (e.g. oxygen and nitrate) are present the hydrogen and acetate are rapidly oxidised to carbon dioxide and water. Once these are consumed, excess hydrogen and acetate can then be used for the reductive dehalogenation of the target contaminants. The degrading bacteria substitute the chlorine atoms on the contaminant molecule with the molecular hydrogen. This results in the sequential chemical reduction of the chlorinated organic compounds eventually producing harmless end products such as ethene and ethane which are ultimately degraded to carbon dioxide and water.