

**APPENDIX B**  
**POTENTIAL IN-SITU TREATMENT MATERIALS**

**B-1**

**KB-1™ (courtesy SiREM Laboratories)**



Leading Science - Lasting Solutions

# KB-1<sup>®</sup>

## Bioaugmentation Culture

For bioaugmentation  
of chlorinated ethene  
contaminated sites



Contact SiREM for a quotation or  
more information on our line of  
leading bioaugmentation cultures

toll free: 1-866-251-1747

phone: (519) 822-2265

KB-1<sup>®</sup> is a naturally occurring, non-pathogenic microbial culture that contains *Dehalococcoides* (*Dhc*), the only group of microorganisms documented to promote the complete dechlorination of chlorinated ethenes to non-toxic ethene. Although *Dhc* are found in the environment, research indicates these microorganisms are not ubiquitous and not all *Dhc* are capable of complete dechlorination of chlorinated ethenes. At sites where *Dehalococcoides* are absent, tetrachloroethene (PCE) and trichloroethene (TCE) dechlorination typically stalls at cis-1,2-dichloroethene (cDCE), despite ample electron donor availability. KB-1<sup>®</sup> is used to establish complete dechlorination at sites that do not contain *Dhc* (or the right *Dhc*), and to accelerate dechlorination rates to achieve treatment goals. Bioaugmentation of aquifer systems with KB-1<sup>®</sup> provides an active microbial community capable of complete reductive dechlorination, ensuring that PCE, TCE, cDCE and vinyl chloride (VC) are completely dechlorinated to ethene, without undue acclimation periods, and at rates that are suitable for achieving remedial goals.

**KB-1<sup>®</sup> is the most field-demonstrated culture of its type, and its robustness has been demonstrated for both source area and plume remediation in both porous media and fractured bedrock environments.**

### Benefits of KB-1<sup>®</sup> Include:

- Low cost: single application
- Works with all commonly used electron donors
- Natural microbial culture (not genetically modified or engineered)
- Certified to be free of known human pathogens
- Rigorous quality control procedures ensure each shipment is of the highest quality, stable, safe, effective and free of chlorinated volatile organic compounds
- Shipped overnight in specially designed stainless steel vessels that prevent exposure to air and which are safe and easy to handle

### All KB-1<sup>®</sup> purchases include:

- Technical support from an experienced SiREM field technician to support successful application to your site
- Complimentary Gene-Trac<sup>®</sup> *Dehalococcoides* tests to verify the successful delivery and persistence of KB-1<sup>®</sup> in site groundwater
- KB-1<sup>®</sup> guarantee - complete dechlorination to ethene\*

\*Some conditions apply



siremlab.com

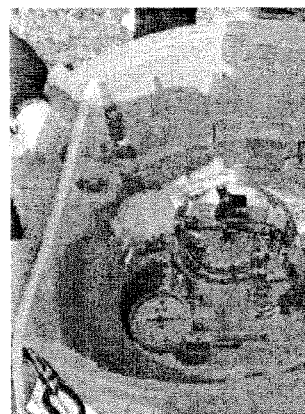
KB-1® and KB-1® Plus bioaugmentation cultures enhance bioremediation success by introducing critical dechlorinating microbes where they are absent or present at insufficient concentrations. Bioaugmentation leads to faster bioremediation, which means efficient use of electron donors, reduced O&M requirements, lowering overall project costs.

SiREM's comprehensive quality control program and high quality shipping vessels ensure that each batch of bioaugmentation culture arrives at your site in prime condition ready to perform.

Our technical experts help you achieve bioaugmentation success with additional peace of mind provided by our bioaugmentation guarantee.

### **KB-1® the Gold Standard in Bioaugmentation**

KB-1® is the most widely used bioaugmentation culture in the world having successfully introduced dechlorinating *Dehalococcoides* microbes at hundreds of sites across North America and Europe for the remediation of PCE, TCE, DCE, vinyl chloride and 1,2-DCA.



### **Questions Regarding Bioaugmentation and KB-1®**

#### **Q. What are signs that a site may require bioaugmentation with KB-1®?**

A. There are several parameters that may indicate the need for KB-1® bioaugmentation:

Dechlorination stalls at cis-1,2-dichloroethene (cDCE) even after months of electron donor addition

Vinyl chloride (VC) accumulates with little or no ethene production

Gene-Trac® tests for total *Dehalococcoides* (Gene-Trac® *Dhc*) or vinyl chloride reductase (Gene-Trac® V) negative

Indigenous *Dehalococcoides* strains are present at low population densities or sparsely distributed based on Trac® testing

#### **Q. What is the cost of Bioaugmentation?**

A. Bioaugmentation with KB-1® or KB-1® Plus typically costs between \$1 to \$2 per cubic yard of saturated matrix depending on scale and site conditions. Contact SiREM for a fixed price quotation for bioaugmentation.

#### **Q. Do I need to bioaugment more than once?**

A. No. Bioaugmentation is typically a one-time event. In rare cases where re-bioaugmentation is required our guarantee may include extra culture free of charge.

#### **Q. If *Dehalococcoides* are present at my site, should I still bioaugment with KB-1®?**

A. Maybe. It depends on the need to achieve results quickly and the effectiveness of the indigenous *Dehalococcoides* (*Dhc*). A sparse or low population density of indigenous *Dhc* may require a long acclimation period which bioaugmentation can reduce. research indicates that not all strains of *Dhc* have the same reductive dechlorination capacity; therefore, addition of more competent dechlorinators through bioaugmentation may be of benefit even if there is an existing population.

#### **Q. Am I limited to which electron donors I can use with KB-1® or KB-1® Plus?**

A. No. KB-1® and KB-1® Plus has been demonstrated to work with most commonly used electron donors, including alcohols (methanol, ethanol), organic acids (e.g., lactate), sugars (e.g., glucose, molasses) and slow release compounds such as emulsified vegetable oils. A general rule is any electron donor, that when fermented produces hydrogen, will support the activity of KB-1® Plus.

#### **Q. Can bioaugmentation save money?**

A. Yes. The introduction of a robust community of dechlorinating microorganisms reduces the use of electron donors on unwanted microbial processes such as sulfate reduction or methanogenesis. Also, rapid post-bioaugmentation dechlorination rates reduce remediation time and associated O&M costs.

#### **Q. How long will it take for bioaugmentation to have noticeable impacts at a site?**

A. Impacts due to bioaugmentation, including complete dechlorination leading to increasing concentrations of ethene typically within 3 months of bioaugmentation and frequently faster. Under rare circumstances where bioaugmentation does not have an impact within 3 months SiREM's bioaugmentation guarantee covers re-bioaugmentation culture costs.

#### **Q. Is it difficult to obtain regulatory approval to use KB-1®?**

A. No. KB-1® has been approved for use by regulatory authorities in more than half of US States, Canada, the United Kingdom, Denmark, Sweden, Germany, Hungary and Malaysia. As with other subsurface injectables, many jurisdictions require application. SiREM is pleased to provide manufacturing, quality control and safety information regarding our bioaugmentation products to support regulatory approvals.

**B-2**

**LactOil™ (courtesy JRW Bioremediation, Inc.)**



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913-438-5544

ORDERS  
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LOADING RATES  
INJECTION STRATEGIES



LactOil® Product Sheet



LactOil® MSDS

#### REFERENCES

**Use of Multiple Technologies to Address Contamination at a Former Fire Training Area, Progress to Date**

Anthony Tingle, Tarek Ladaa, Robert Mayer, and Brian McInturff (Shaw Environmental, Inc.), Cathy Jerrard (Air Force Real Property Agency), and Robert Zaruba (US Army Corps of Engineers)

Seventh International Conference Remediation of Chlorinated and Recalcitrant Compounds, Monterey, California; May 24-27, 2010

**Using True Microemulsion Technology to Simplify the Delivery of Vegetable Oil-Based Substrate**

Michael R. Sieczkowski (JRW Bioremediation), Seventh International Conference Remediation of Chlorinated and Recalcitrant Compounds, Monterey, California; May 24-27, 2010

**In Situ Treatment of Chlorinated Ethenes at the Treasure Island Site 24 Source Area**

Michael Yurovsky, P.E. (Shaw E&I) and Scott D. Anderson (NAVFAC) Seventh International Conference Remediation of Chlorinated and Recalcitrant Compounds, Monterey, California; May 24-27, 2010

**Working on a bench-scale study?**  
Contact JRW today for a free sample. 913-438-5544

#### FUN FACT:



In the saturated zone, microemulsion particles will act as colloids. A variety of natural colloids exists, including clays, oxides, minerals, bacteria, and organics, with the concentration ranging from 108 to 1017 particles/L.



**LONGEVITY • EASY HANDLING • GREAT DISTRIBUTION  
NOT JUST ANOTHER EMULSIFIED VEGETABLE OIL**



#### BENEFITS

##### HIGH FERMENTABLE CONTENT

High organic content (80%) provides up to 25% more fermentables than standard emulsified vegetable oils.

##### EASY MATERIAL HANDLING

- Low viscosity; readily mixes with water; no high shear mixing needed
- Low injection pressure
- Longer shelf life

##### INCREASED SUBSURFACE DISTRIBUTION

- Thermodynamically stable
- Small particle size

#### USES

##### CONTAMINANTS TREATED:

- Chlorinated solvents
- Perchlorate
- RDX
- Reduction of metals

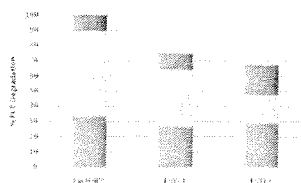
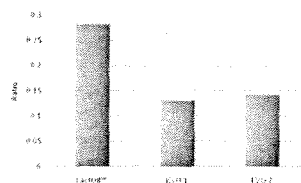
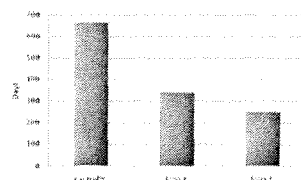
##### TREATMENT CONFIGURATIONS:

- Source area treatment
- Biobarrier treatment
- Plume-wide treatment

##### DELIVERY METHODS:

- Permanent injection wells
- Direct push methods

#### MICROCOSM STUDY RESULTS



#### LONGEVITY

LactOil® has an estimated electron donor longevity that is 2-3 times greater than other commercially available emulsified vegetable products.

#### EFFICIENCY

When compared to other commercially available emulsified vegetable oil products, LactOil® has a higher ratio of electrons stimulating dechlorination than consumed by methanogenesis and acetogenesis.

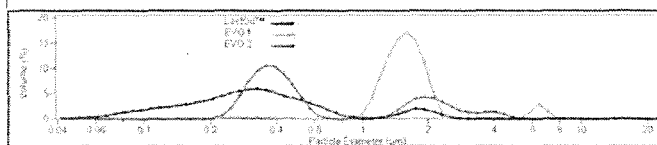
#### KINETICS

LactOil® can degrade PCE to cis-DCE, vinyl chloride, and ethene quicker than other commercially available emulsified vegetable oil products.

Factors that affect the distribution of colloids include advection, diffusion, dispersion, and sorption. Straining of particles occurs when the pore throats are too small to allow the particle passage, which can reduce permeability (Bradford, S. et al. 2002. Physical factors affecting the transport and fate of colloids in saturated porous media. Water Resources Research, Vol. 38, no.12, 1327.)

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#### PARTICLE SIZE ANALYSIS



A particle size analysis shows LactOil® particles are consistently smaller than 1 micron. Small particle size and stability allow for physical transport of material in the aquifer.

#### TYPICAL PROPERTIES

- Oleaginous material (wt/wt): 35%
- Ethyl lactate (wt/wt): 35%
- Emulsifier (wt/wt): 10%
- water (wt/wt): 20%
- pH: buffered to > 6.5
- Specific gravity: 1.043 at 20°C
- Miscible in water; self-emulsifies
- Color: clear brown liquid
- Zeta potential: -83.0 mV
- Particle size: < 1 micron
- Viscosity: 25 cP at 70°F. Temperatures below 50°F will cause the material to become more viscous, and may solidify to the consistency of bacon grease. If this should happen, move the material to a warmer location and mix

#### HANDLING

- Store unopened under dry conditions at temperatures between 50°F and 85°F.
- Diluted product should be used within 3 days to avoid microbial growth and activity which may cause gas buildups in containers and visible growth which may foul equipment.
- Following injection of material, wells should be flushed with clean water to prevent microbial growth.

#### PACKAGING

##### 5-gallon pails

- 43lbs
- 2-3 weeks lead time required past receipt of a PO



##### 55-gallon polyethylene drums

- 450lbs
- 2-3 weeks lead time required past receipt of PO



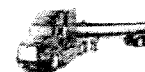
##### 265-gallon IBC totes

- 2200 lbs
- Special order - 4 weeks lead time required past receipt of PO



##### Tankers

Special order



14321 W. 96th Terrace  
Lenexa, KS 66215  
913-438-5544  
913-438-5554 (fax)  
info@jrwbiorem.com

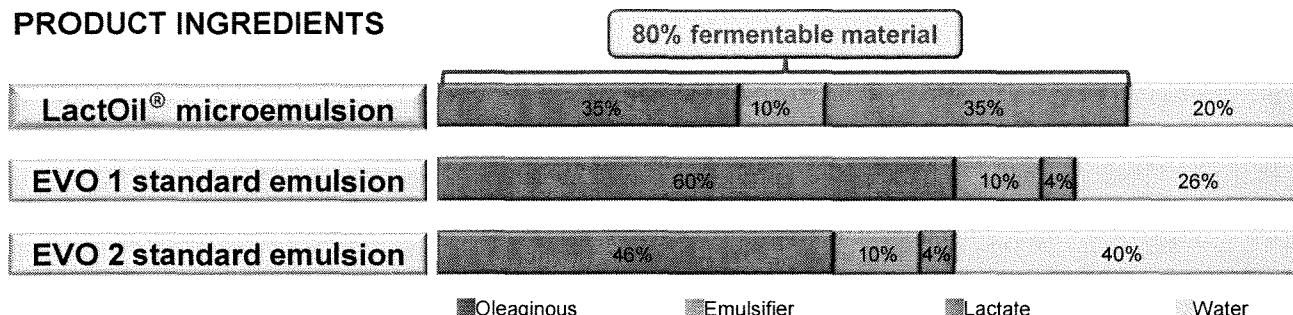
# LACTOIL<sup>®</sup>

## SOY MICROEMULSION

UNIQUE FORMULATION PROVIDES SAVINGS THROUGH IMPROVED SUBSTRATE LONGEVITY, EFFICIENCY, AND DEGRADATION RATES

LactOil<sup>®</sup> is a thermodynamically stable microemulsion formulation designed to offer the user greater product shelf life, ease of mixing and injection, and enhanced aquifer distribution at a cost lower than other commercially available emulsified vegetable oil products.

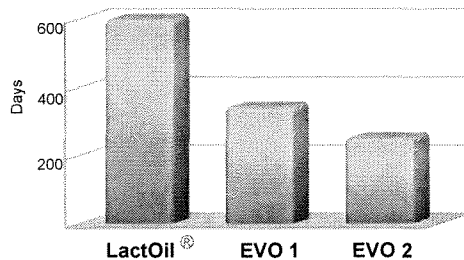
### PRODUCT INGREDIENTS



On a per pound basis, LactOil<sup>®</sup> contains up to 27.5% more fermentable material than other commercially available emulsified vegetable oil products; providing cost savings on both product as well as shipping costs.

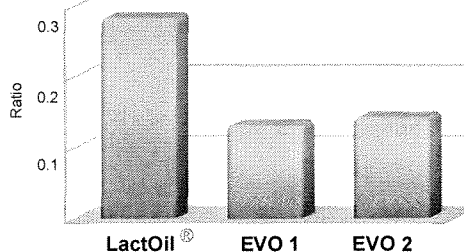
### LACTOIL<sup>®</sup> ESTIMATED LONGEVITY

Microcosm studies have shown that LactOil<sup>®</sup> has an estimated electron donor longevity that is 2-3 times greater than other commercially available emulsified vegetable oil products.



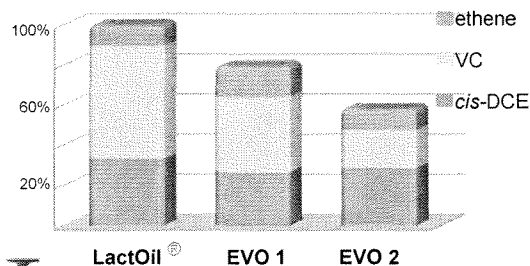
### LACTOIL<sup>®</sup> DONOR EFFICIENCY

Microcosm studies have shown that compared to other commercially available emulsified vegetable oil products, LactOil<sup>®</sup> has a higher ratio of electrons stimulating dechlorination than consumed by methanogenesis and acetogenesis.



### LACTOIL<sup>®</sup> DEGRADATION RATES

Microcosm studies have shown that LactOil<sup>®</sup> can degrade PCE to *cis*-DCE, vinyl chloride, and ethene quicker than other commercially available emulsified vegetable oil products.



**JRW BIOREMEDIATION LLC**

[www.jrwbioremediation.com](http://www.jrwbioremediation.com)

(913)438-5544

[info@jrwbiorem.com](mailto:info@jrwbiorem.com)



**MATERIAL SAFETY DATA SHEET****SECTION I PRODUCT IDENTIFICATION**

PRODUCT NAME: LactOil® Soy Microemulsion  
 PRODUCT USE: In-situ Bioremediation  
 SUPPLIER: JRW Bioremediation, LLC  
 14321 W. 96<sup>th</sup> Terrace  
 Lenexa, KS 66215  
 913-438-5544  
 EMERGENCY TELEPHONE: 800-779-5545 x 116 (Mon-Fri 9am-5pm CST)  
 913-961-6644 (afterhours)  
 DATE REVISED: 06-27-2011

**SECTION II COMPOSITION/INFORMATION ON INGREDIENTS**

Name	CAS #	% by Weight
LactOil®	Proprietary blend	100%

**SECTION III PHYSICAL/CHEMICAL CHARACTERISTICS**

Boiling point:	Not applicable
Vapor pressure (Mg Hg):	Not determined
Vapor density (air = 1):	Not determined
Solubility in water:	Not determined
Appearance and odor:	Brown to yellow with bland odor
Specific gravity (H <sub>2</sub> O = 1):	Not determined
Melting point:	Not determined
Evaporation rate:	Not determined
Density	1.05
pH:	7.5
Molecular Weight:	Not determined
Physical State:	Liquid

**SECTION IV FIRE AND EXPLOSION HAZARD DATA**

Closed cup Flash point:	>75C vis Pensky-Martens Closed Cup Test
Open cup Flash point:	(ASTM std D93)
Auto Ignition:	Not determined
Fire Point:	Not determined
Flammable limits:	Not determined
LEL:	Not determined
UEL:	Not determined
Extinguishing media:	Dry chemical, foam, carbon dioxide, or water fog.
Special Fire Fighting procedures:	Wear full protective clothing and positive pressure breathing apparatus

**SECTION V REACTIVITY DATA**

Stability: Unstable ☐ Stable ☒  
 Conditions to avoid: Hydrolysis may occur in the presence of strong acids

Incompatibility (materials to avoid): or bases.  
May react with strong oxidizing agents.  
Hazardous decomposition or byproducts: None known

## **SECTION VI HEALTH HAZARD DATA** Based on concentration as sold

### Route/s of Entry:

Inhalation: Inhalation of vapors or mist may cause mild irritation of respiratory system. If symptoms are experienced, remove source of contamination or move to fresh air. If affected person is not breathing, apply artificial respiration. If breathing is difficult, give oxygen.

Skin contact: In case of contact with skin, immediately wash with plenty of soap and water while removing contaminated clothing. Seek medical attention if skin irritation develops or persists.

Eye contact: In case of contact with eyes, immediately flush eyes with water for at least 15 minutes, lifting eyelids to facilitate irrigation. Get medical attention if necessary.

Ingestion: If swallowed, get medical attention.

Carcinogenicity: Not determined.

Signs and symptoms of exposure: Slight irritation to skin, eyes, respiratory system, headache, nausea, drowsiness. May cause abdominal discomfort, nausea, and diarrhea.

Medical conditions aggravated by exposure: Soybean derived product. Avoid if sensitive to soy products.

## **SECTION VII PRECAUTIONS FOR SAFE HANDLING AND USE**

Steps to be taken in case material is released or spilled: Contain spill with absorbant materials such as clay or soil and shovel and place material in drum for disposal. Surfaces may become slippery after spillage. Dispose of according to all local, state, and federal regulations at an approved waste treatment facility.

Precautions to be taken in handling and storage: Use personal protective equipment. Prevent spills, contamination, and leakage. Keep container tightly closed. Keep in properly labeled containers. Store in a cool, dry area. Avoid freezing or excessive heat.

Other precautions: Prevent material from entering waterways.

## **SECTION VIII CONTROL MEASURES**

Respiratory protection (specify type): Respiratory protection may be required if material is used in poorly ventilated areas or if material is sprayed or heated. OSHA respiratory regulations found in 29 CFR 1910.134. Use an NIOSH approved respirator when necessary.

Ventilation: General ventilation and local exhaust are recommended.

Protective gloves: Chemical resistant gloves recommended.

Eye protection: Chemical goggles recommended.

Other protective clothing or equipment: Unnecessary if other control measures are used.

Hygiene practices: Avoid contact with skin. When using, do not eat,

drink, or smoke. Remove and wash contaminated clothing before re-use.

**SECTION IX**

DOT hazard class:  
Labeling:  
Proper Shipping Name:  
NMFC#:  
Class

**DOT INFORMATION**

Not Applicable, non-regulated  
Not Applicable  
LactOil<sup>®</sup> Soy Microemulsion  
144920  
**65**

**B-3**

**EHC™ (courtesy FMC Environmental Solutions)**



Environmental Solutions



Soil & Groundwater remediation

PRODUCT SHEET

## EHC® ISCR Reagent

**EHC® The Original ISCR Reagent – the top choice for fast initial impact and higher contamination**

EHC® *in situ* chemical reduction (ISCR) reagent is the FMC patented product for the treatment of groundwater and saturated soil impacted by persistent organic compounds, including chlorinated solvents, pesticides and organic explosives. The EHC formula is the culmination of years of research and successful field use. EHC is comprised of a synergistic mixture of zero valent iron (ZVI) and a solid carbon source, providing both direct and indirect abiotic pathways for reduction as well as the biotic reduction of contaminants.

### The benefits of EHC

- Stimulation of biotic reductive dechlorination through the generation of strong reducing conditions
- Creation of a thermodynamic environment conducive to the decomposition of chlorinated solvents via strong reducing conditions
- Minimization of the production of problematic DCE and VC through direct chemical reduction of contaminants with ZVI
- Indirect chemical reduction of contaminants from dissolved iron and iron corrosion products created
- pH neutrality does not create acidic conditions that impact indigenous reducing bacteria
- Demonstrated longevity of 4-5 years in field conditions

### Contaminants treated

- Chlorinated solvents such as PCE, TCE, TCA, DCA, CCl<sub>4</sub>, chloroform and methylene chloride
- Chlorobenzenes including di- and tri-chlorobenzene
- Energetic compounds such as TNT, DNT, HMX, RDX, nitroglycerine and perchlorate
- Most pesticides including DDT, DDE, dieldrin, 2,4-D and 2,4,5-T
- Haloalkanes such as Freon 11, 12, and 113
- Nitrate compounds

### Case studies

FMC has a significant number of case studies for EHC treatment of a wide range of contaminants. One example of EHC treatment in a particularly challenging site due to its bedrock nature was located in Colorado, USA. A TCE plume containing up to 3600 mg/L at 35-45' bgs was treated with EHC. After 9 months, the reduction of TCE ranged from 50% for areas with lower starting TCE, lower amendment mass, fewer fractures and distance between boreholes to 90% for highest TCE concentration with more amendment, more fractures and less distance between boreholes. This particular case study can be found at

[http://environmental.fmc.com/media/resources/FMC\\_EHC\\_Case\\_Study-TCE-Atlas\\_Missile\\_Site-Windsor\\_CO.pdf](http://environmental.fmc.com/media/resources/FMC_EHC_Case_Study-TCE-Atlas_Missile_Site-Windsor_CO.pdf)

Please see our website at [www.environmental.fmc.com](http://www.environmental.fmc.com) for more case studies.

### The sound science of EHC

The combination of solid carbon source and ZVI in EHC® generates very strong reducing conditions - redox potentials (Eh) as low as -500 mV. These potentials are significantly lower than those achieved when using either organic materials (e.g. lactate and molasses) or reduced metal alone. Eh potentials in this range facilitate the timely and effective removal of recalcitrant chlorinated organic compounds and other persistent compounds with less formation of intermediates such as cis-DCE and VC from the



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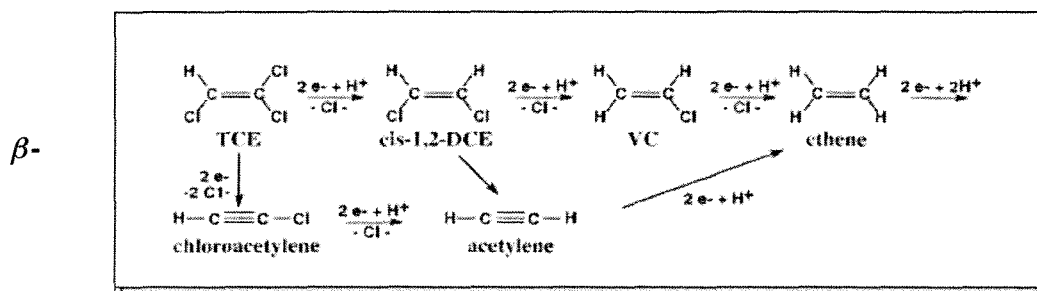
Soil & Groundwater remediation

## PRODUCT SHEET

anaerobic degradation of PCE and TCE. Similarly, generation of chloroform and dichloromethane from anaerobic degradation of carbon tetrachloride can be reduced or eliminated. The low Eh potentials not only improve the kinetics of the dechlorination reactions but further support decomposition of chlorinated solvents.

Providing a carbon source for fermentation to product VFA's and hydrogen to stimulate anaerobic dehalogenators is one of the key mechanisms of action for EHC as shown below – the biogenolysis/hydrogenolysis pathway.

### Biogenolysis/ hydrogenolysis



The other mechanism of action is the pathway on the bottom that is taken with the zero valent iron. The benefit of the  $\beta$ -elimination pathway is the minimization or elimination of DCE and VC formation. Not only does ZVI directly react with contaminants by donating electrons and using the beta-elimination pathway, but also once oxidized, the iron also creates iron minerals and precipitates that further support dechlorination. These iron minerals create a cycle of reduction and oxidation that continues treatment over a long period of time.

EHC can be used for both plume and source treatments given its high reducing potential. It can also be used as a permeable reactive barrier.

### Application Methods

#### Injection methods

- Direct push injection
- Hydraulic fracturing
- Pneumatic fracturing
- Permeable reactive barriers

#### Direct placement methods

- Trenching
- Excavation
- Deep soil mixing

*(EHC is not recommended for gravity feed/existing well applications)*

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Document 27-01-ESD-13



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Soil & Groundwater remediation

## DATA SHEET

# EHC<sup>®</sup> ISCR Reagent

## Introduction

EHC<sup>®</sup> ISCR Reagent is an *in situ* chemical reduction (ISCR) product for remediation of impacted groundwater. It is composed of a mixture of food grade organic carbon and micro-scale zero-valent iron in a blended powder. EHC is composed of natural compounds that are non-toxic to humans and the environment. EHC is not intended for treatment of potable water or for human or animal consumption.

Typical Data	
Iron Content	Approx. 35%
Particle Size Distribution	> 99.5 % less than 2.000 mm
	> 95.0 % less than 1.000 mm
	> 80.0 % less than 0.500 mm
	> 70.0 % less than 0.300 mm
Typical Properties	
Appearance	Light-tan powder
Density	0.65 – 0.75 g/mL (40.6 – 46.8 lb/ft <sup>3</sup> )
Bulk Density	0.50 – 0.60 g/mL (31.2 – 37.5 lb/ft <sup>3</sup> )
pH (28.6% aqueous suspension, w/w)	5.1 – 7.4

## Standard Containers

50 lb bags on pallets; 40 bags per 1 pallet (2,000 lb net wt). Available in supersacs upon request and on a made to order basis.

EHC is classified as non-hazardous by the US DOT.

Under cool, dry storage conditions the shelf life of EHC is 4 years.

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Prior to working with EHC consult the Material Safety Data Sheet to understand proper safety, handling, storage and disposal procedures.

Any vessel that contains wet EHC or EHC and water must be vented due to potential pressure build up from fermentation gasses.

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# Material Safety Data Sheet

## EHC® ISCR Amendment

MSDS #: EHC-C  
Revision Date: 2013-04-16  
Version 1.03



## ENVIRONMENTAL SOLUTIONS

This MSDS has been prepared to meet U.S. OSHA Hazard Communication Standard 29 CFR 1910.1200 and Canada's Workplace Hazardous Materials Information System (WHMIS) requirements.

### 1. PRODUCT AND COMPANY IDENTIFICATION

<b>Product name</b>	<b>EHC® ISCR Amendment</b>
<b>Recommended use</b> <b>Uses advised against</b>	Bioremediation product for the remediation of contaminated soil and groundwater Not for use in potable drinking water.
<b>Manufacturer</b>	<b>Emergency telephone number</b>
FMC CORPORATION Environmental Solutions 1735 Market Street Philadelphia, PA 19103 Phone: +1 215/ 299-6000 (General Information) E-Mail: msdsinfo@fmc.com	For leak, fire, spill or accident emergencies, call: +1 703-527-3887 (CHEMTREC) 1 303 / 595 9048 (Medical - U.S. - Call Collect)

### 2. Hazards identification

#### Emergency Overview

**CONTAINMENT HAZARD:**  
Any vessel that contains wet wet EHC must be vented due to potential pressure build up from fermentation gases

#### **Potential health effects**

<b><u>Acute Toxicity</u></b>	No significant health effects anticipated
<b><u>Eyes</u></b>	Product dust may cause mechanical eye irritation.
<b><u>Skin</u></b>	None known.
<b><u>Inhalation</u></b>	Inhalation of dust in high concentration may cause irritation of respiratory system.
<b><u>Ingestion</u></b>	Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea.
<b><u>Chronic Toxicity</u></b>	No known chronic effects of components present at greater than 1%.



**3. Composition/information on ingredients****Ingredients**

Chemical Name	CAS-No	Weight %
Organic amendment	Proprietary	52-82
Iron	7439-89-6	18-48

**4. First aid measures**

Eye contact	In case of contact, immediately flush skin with plenty of water. Get medical attention if irritation develops and persists.
Skin contact	Wash off with soap and water.
Inhalation	Remove person to fresh air. If signs/symptoms continue, get medical attention.
Ingestion	Rinse mouth with water and afterwards drink plenty of water or milk. Call a poison control center or doctor immediately for treatment advice.

**5. Fire-fighting measures**

Flammable properties	Combustible material.
Suitable extinguishing media	Dry chemical, CO <sub>2</sub> , sand, earth, water spray or regular foam.
Explosion Data	
Sensitivity to Mechanical Impact	not applicable
Sensitivity to Static Discharge	not applicable
Specific hazards arising from the chemical	Dry or powdered ingredients are combustible. Dispersal of finely divided dust from products into air may form mixtures that are ignitable and explosive. Minimize airborne dust generation and eliminate sources of ignition.

NFPA	Health Hazard 1	Flammability 1	Stability 0	Special Hazards -
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**6. Accidental release measures**

Personal precautions	Avoid dust formation. For personal protection see section 8.
Methods for containment	Cover powder spill with plastic sheet or tarp to minimize spreading and keep powder dry.
Methods for cleaning up	Sweep or vacuum up spillage and return to container. The waste may be recovered and recycled.

**7. Handling and storage**

Handling	Minimize dust generation and accumulation. Keep away from open flames, hot surfaces and sources of ignition. Refer to Section 8.
Storage	Keep tightly closed in a dry and cool place. Keep away from open flames, hot surfaces and sources of ignition. Any vessel that contains wet EHC must be vented due to potential pressure build up from fermentation gases.

**8. Exposure controls/personal protection**Exposure guidelines

Local nuisance dust standards apply.

Occupational exposure controls**Engineering measures**

None under normal use conditions. Provide appropriate exhaust ventilation at places where dust is formed.

**General Information**

If the product is used in mixtures, it is recommended that you contact the appropriate protective equipment suppliers. These recommendations apply to the product as supplied.

**Respiratory protection**

Whenever dust in the worker's breathing zone cannot be controlled with ventilation or other engineering means, workers should wear respirators or dust masks approved by NIOSH/MSHA, EU CEN or comparable organization to protect against airborne dust.

**Eye/face protection**

Safety glasses with side-shields

**Skin and body protection**

No special precautions required.

**Hand protection**

Use gloves if extended exposure is anticipated.

**Hygiene measures**

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and immediately after handling the product.

**9. Physical and chemical properties**9.1 Information on basic physical and chemical properties

Appearance	Tan brown flakes,
Physical state	solid
Odor	odorless
Odor Threshold	not applicable
pH	5.6 (as aqueous solution)
Melting Point/Range	No information available.
Freezing point	No information available.
Boiling Point/Range	not applicable
Flash Point	not applicable
Evaporation rate	not applicable
Flammable properties	Combustible material
Vapor pressure	No information available.
Vapor density	No information available.
Density	0.80 g/mL
Bulk density	No data available
Water solubility	practically insoluble
Percent volatile	No information available.
Partition coefficient:	not applicable
Viscosity	No information available.

9.2 Other information**Autoignition Temperature**

No information available.

**10. Stability and reactivity**

Stability	Stable.
Conditions to avoid	Heat, flames and sparks
Materials to avoid	Oxidizing agents Strong acids
Hazardous decomposition products	Burning produces obnoxious and toxic fumes.
Hazardous polymerization	Hazardous polymerization does not occur.
Hazardous reactions	May react with water to release flammable hydrogen gas.

**11. Toxicological information**Acute effects

Remarks	The product has not been tested. Data is based on component.
Eye irritation	No data available for the formulation. Non-irritating (rabbit) (based on components)
Skin irritation	No data available for the formulation. Non-irritating (rabbit) (based on components)
LD50 Oral	Iron: 98.6 g/kg (rat)
LD50 Dermal	No information available.
LC50 Inhalation:	Iron: > 100 mg/m <sup>3</sup> 6 hr (rat)

Chronic Toxicity

Chronic Toxicity	No known chronic effects of components present at greater than 1%.
Carcinogenicity	Contains no ingredient listed as a carcinogen

**12. Ecological information**Ecotoxicity

Contains no substances known to be hazardous to the environment or that are not degradable in waste water treatment plants

Persistence and degradability	Biodegradability does not pertain to inorganic substances.
Bioaccumulation	Does not bioaccumulate.
Mobility	Is not likely mobile in the environment due its low water solubility.
Other adverse effects	None known

**13. Disposal considerations****Waste disposal methods**

This material, as supplied, is not a hazardous waste according to Federal regulations (40 CFR 261). This material could become a hazardous waste if it is mixed with or otherwise comes in contact with a hazardous waste, if chemical additions are made to this material, or if the material is processed or otherwise altered. Consult 40 CFR 261 to determine whether the altered material is a hazardous waste. Consult the appropriate state, regional, or local regulations for additional requirements.

**Contaminated packaging**

Dispose of in accordance with local regulations.

**14. Transport information****DOT**

not regulated

**TDG**

not regulated

**ICAO/IATA**

not regulated

**IMDG/IMO**

not regulated

**15. Regulatory information****International Inventories****TSCA Inventory (United States of America)**

Complies

**DSL (Canada)**

Complies

**NDSL (Canada)**

Complies

**EINECS/ELINCS (Europe)**

Complies

**ENCS (Japan)**

-

**IECSC (China)**

Complies

**KECL (Korea)**

Complies

**PICCS (Philippines)**

Complies

**AICS (Australia)**

Complies

**NZIoC (New Zealand)**

Complies

**U.S. Federal Regulations****SARA 313**

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

**SARA 311/312 Hazard Categories****Acute Health Hazard**

no

**Chronic Health Hazard**

no

**Fire Hazard**

no

**Sudden Release of Pressure Hazard**

no

**Reactive Hazard**

no

**CERCLA**

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

**International Regulations****Mexico - Grade**

No information available.

**Canada**

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

**WHMIS Hazard Class**

not determined

**16. Other information**

HMIS	Health Hazard 1	Flammability 1	Stability 0	Special precautions -
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**NFPA/HMIS Ratings Legend**

Severe = 4; Serious = 3; Moderate = 2; Slight = 1; Minimal = 0

**Revision Date:**

2013-04-16

**Reason for revision:**

No information available.

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End of Material Safety Data Sheet