

January 31, 2013

Technical Memorandum

From: Parsons Staff

Subject: Solid Waste Management Unit (SWMU) B-3 Bioreactor Lactate Injection Assessment

This document evaluates lactate injections into the SWMU B-3 Bioreactor, which is situated within the Inner Cantonment at Camp Stanley Storage Activity (CSSA). Anaerobic conditions (lack of oxygen) are required for reductive dechlorination of chlorinated ethenes (e.g. tetrachloroethene, trichloroethene, etc.), present in the subsurface at SWMU B-3, to occur. Reductive dechlorination of chlorinated aliphatic hydrocarbons (CAHs) is dependent upon redox conditions in the subsurface, specifically the relative amount of organic carbon (electron donor) and electron acceptors (CAHs) present. Thus, increasing the amount of electron donor present (via lactate amendment) will permit more reductive dechlorination to occur, that is availability of electron donor will not be the limiting factor for CAH reduction. Depletion of dissolved oxygen (DO) is an indication that favorable redox conditions exist and that sufficient electron donor is present for anaerobic reductive dechlorination to proceed. Anaerobic reductive dechlorination is most favorable when DO concentrations are 0.5 mg/L or less (Parsons, 2004).

The following is a discussion of the lactate injection activities performed on October 10, 2012 within the SWMU B-3 Bioreactor Trenches 1 and 6, and an evaluation of dissolved oxygen data garnered prior to and following lactate injection.

**Lactate Injection**

Lactate injection activities were completed on October 10, 2012. 55 gallons of WilClear Sodium Lactate 60% Solution (Appendix A) were applied to trenches 1 and 6 via an injection port installed within the newly constructed Bioreactor Building injection system. A diaphragm pump was used to transfer the lactate solution from the drum into the injection lines downstream from the transfer pump. Once the lactate was introduced into the injection lines, the transfer pump was turned on and water from the injection system storage tanks was pumped through the lines, flushing the lactate solution into Trenches 1 and 6.

**Anaerobic Conditions Monitoring**

DO concentrations in groundwater may be used as an indicator of anaerobic conditions in shallow groundwater within the Bioreactor trench sumps. A YSI 556 multi probe meter was used to collect field parameter data in saturated trenches prior to and following lactate injection. Sump field parameter data collection results are provided in Table 1 and Figures 1 – 3. Although no lactate was injected directly into Trench 2, field parameters for sumps within this trench are also included due to its proximity to Trench 1. Generally, when Trench 1 is saturated, Trench 2 has sufficient water to accommodate the YSI probe.

Although an influx of rainwater/runoff may increase DO concentrations in groundwater, no rainfall event of significance was recorded in the months prior to and following lactate injection that

appeared to affect DO concentrations within the bioreactor trenches. Only slight variations in DO concentrations were observed within trench sumps prior to and following lactate injection. Slight decreases in DO concentrations were observed in all three trenches, and only sump 1-1 (in Trench 1) indicated an increase in DO immediately following lactate injection. Additionally, DO concentrations remained below the 0.50 mg/L threshold for optimal reductive dechlorination following injections with two exceptions (T 1-2 at 0.55 mg/L on 11/15/12 and T 6-1 at 0.70 mg/L on 11/30/12). Three possible reasons for these results include:

- DO concentrations within saturated trench sumps are currently too low to be affected by lactate injection.
- The volume of lactate injected was too small to affect the volume of water contained within active trenches.
- Lactate did not affect DO concentrations and the variations in concentration are due to normal fluctuations in groundwater geochemistry.

### **Recommendations**

Based on the current DO concentrations and due to the recent addition of mulch to the trenches, Parsons recommends no further additions of lactate within the Bioreactor in the near future. Current DO concentrations within trench sumps indicate that sufficient electron donor (organic carbon) is present to maintain anaerobic conditions and effectively reduce available CAHs. Though fluctuations of DO concentrations at times rose above 0.5 mg/L, under normal Bioreactor operation conditions (with no additional lactate injection) the DO concentrations fell to within the optimal range relatively quickly. This is likely due to the deciduous tree mulch currently emplaced within the trenches that contributes much more organic carbon than the injected lactate. Moreover, the addition of more mulch to the trenches is anticipated. This increase in available organic carbon increases the available electron donor source, depletes DO in groundwater, and maintains appropriate redox conditions for anaerobic reductive dechlorination of CAHs at SWMU B-3.

Once the organic carbon supply from emplaced tree mulch becomes depleted, the addition of lactate may be required to ensure optimal redox conditions are maintained for anaerobic reductive dechlorination to continue within the bioreactor. Bioreactor performance monitoring, including active trench sump field parameter collection of both DO and ORP, will be the most straightforward indicator of electron donor availability. Should DO concentrations above 1.0 mg/L and ORP values greater than 100 eV (indicating reducing conditions no longer exist) be sustained within active trench sumps for a prolonged period (6 months), then the addition of lactate should be considered to restore anaerobic and reducing conditions. Considerations for lactate injection should include: number of active trenches, volume of water maintained within active trenches, contaminant concentrations, time since mulch was recharged last, and anticipated bioreactor lifespan.

### **References**

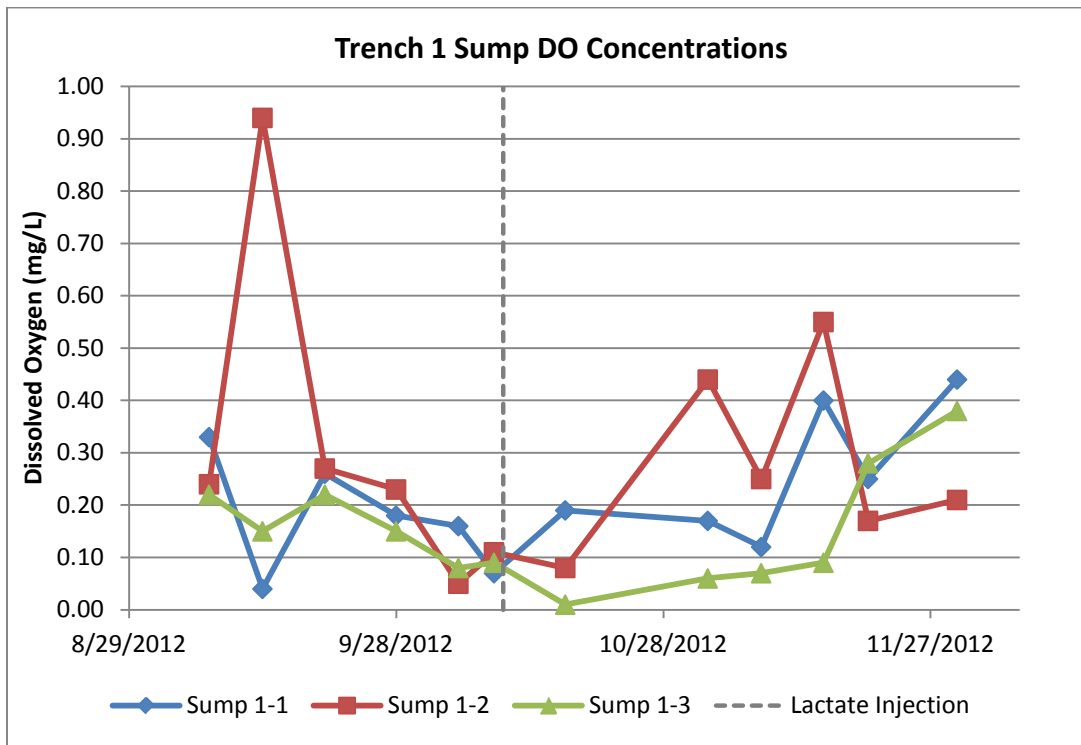
Parsons, 2004. Final Principles and Practices of Enhanced Anaerobic Bioremediation of Chlorinated Solvents. August 2004.

**Table 1 Trench Sump Dissolved Oxygen Concentrations (mg/L)**

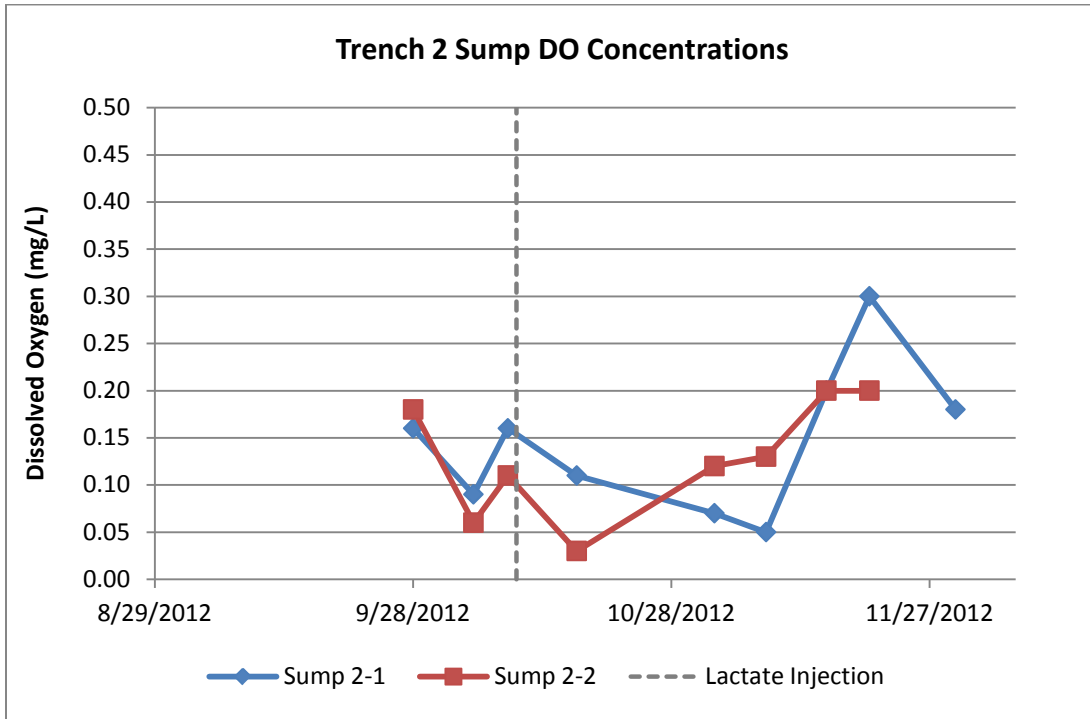
Sample Date	Sump 1-1	Sump 1-2	Sump 1-3	Sump 2-1	Sump 2-2	Sump 6-1	Sump 6-2
9/7/2012	0.33	0.24	0.22			0.15	0.1
9/13/2012	0.04	0.94	0.15			0.00	0.03
9/20/2012	0.26	0.27	0.22			0.06	0.1
9/28/2012	0.18	0.23	0.15	0.16	0.18	0.15	0.1
10/5/2012	0.16	0.05	0.08	0.09	0.06	0.04	0.03
10/9/2012	0.07	0.11	0.09	0.16	0.11	0.06	0.01
10/10/12	WilClear Sodium Lactate 60% Solution Injection						
10/17/2012	0.19	0.08	0.01	0.11	0.03	-0.03	-0.01
11/2/2012	0.17	0.44	0.06	0.07	0.12	0.03	0.08
11/8/2012	0.12	0.25	0.07	0.05	0.13	0.08	0.07
11/15/2012	0.40	0.55	0.09	0.2	0.2	0.04	0.06
11/20/2012	0.25	0.17	0.28	0.3	0.2	0.19	0.23
11/30/2012	0.44	0.21	0.38	0.18		0.70	0.35

Note: Anaerobic reductive dechlorination is most favorable when DO concentrations are less than 0.5 mg/L.

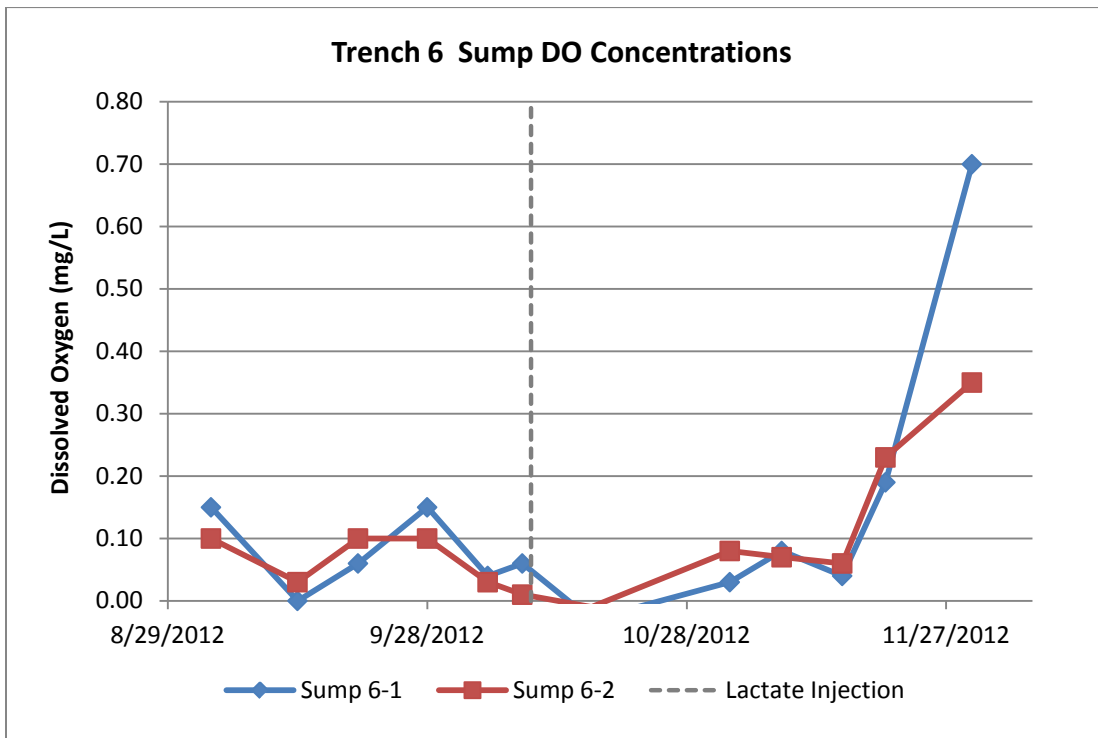
**Figure 1 Changes in Dissolved Oxygen Concentrations (mg/L) in Trench 1 Sumps**



**Figure 2 Changes in Dissolved Oxygen Concentrations (mg/L) in Trench 2 Sumps**



**Figure 3 Changes in Dissolved Oxygen Concentrations (mg/L) in Trench 6 Sumps**



# **Appendix A**

## **WilClear Lactate Solution Product Information**



# JRW *BIOREMEDIATION* LLC

JRW Bioremediation is a leader in the development of environmentally-friendly products used to remediate contaminated soil and groundwater based on innovative patented technology involving the anaerobic degradation of contaminants in the environment. Our mission is to supply "green" products to our clients around the world, in order to provide them with an accepted and economically sound remediation technology that will increase the quality of life and economic vitality of the community at large. We envision extending sustainable and feasible bioremediation technologies into market segments with the goal of replacing or enhancing existing environmental remediation processes which are insufficient and costly to implement.

JRW's products are being used by our clients to clean up groundwater contaminated with chlorinated solvents, perchlorates, acid mine drainage, and heavy metals. Our products have been deployed at U.S. Department of Energy sites and military installations, Superfund sites, mining sites, Brownfields, industrial sites, private chemical plants, and dry cleaners across North America and Europe. To date, our products have been used at over 300 projects in nearly every state in the US, including Hawaii and Alaska.

JRW's products have saved our clients millions of dollars every year by reducing the time necessary to clean up contaminated sites (in many cases reducing the project length by years and in some cases decades), and by reducing overhead costs associated with maintaining and monitoring mechanical remediation installations. At JRW, we strive to provide our clients with economically-feasible alternatives to costly remediation options.

JRW Bioremediation is a small business, NAICS code 425120, DUNS number 143681711.

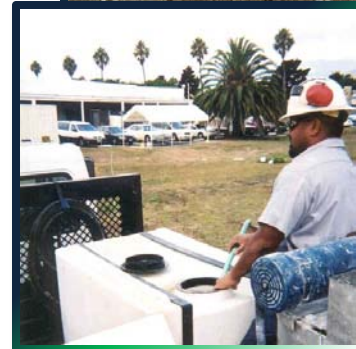
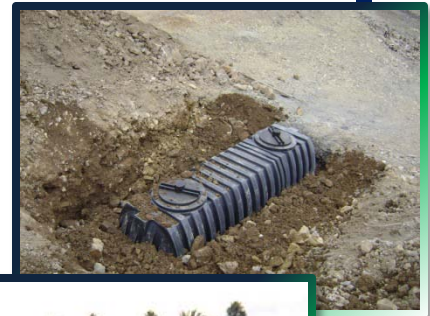


Photo courtesy of Dr. Rachel A. Brennan



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Lenexa, KS 66215  
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913-438-5554 (fax)  
[www.jrwbioremediation.com](http://www.jrwbioremediation.com)

# WILCLEAR PLUS™

## LACTATE w/ACCELERITE™

**PROVEN ELECTRON DONOR EFFICIENCY AND RAPID DECHLORINATION KINETICS OF SODIUM LACTATE ENHANCED BY ACCELERITE™ NUTRIENT BLEND**

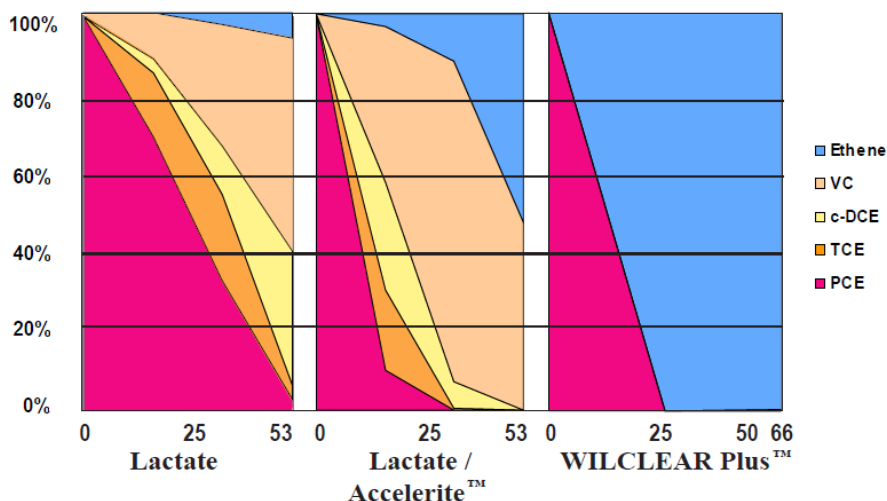
Wilclear Plus™ lactate with Accelerite™ is a proprietary blend of neutral pH fatty acids combined with Accelerite™ nutrient blend for use in enhanced anaerobic reductive dechlorination. Wilclear Plus™ contains 61% fermentable material providing a high fermentable fraction with minimum amount of water.

### BENEFITS OF WILCLEAR PLUS™

- Lactate provides carbon for rapid establishment of anaerobic conditions.
- Volatile fatty acids and fermentables provide a range of material to help promote the growth of an assortment of dechlorinating microbial populations.
- Accelerite™ provides growth factors to increase efficiency and kinetics.

### RAPID DECHLORINATION KINETICS

Microcosm studies comparing Wilclear Plus™ to lactate and lactate plus Accelerite™ showed that Wilclear Plus™ demonstrated dechlorination kinetics faster than the other substrates. At 25 days, the Wilclear Plus™ microcosm converted more than 99% of PCE to ethene.



### TYPICAL PROPERTIES

- Sodium lactate (wt/wt): 29-35%
- Sodium propionate (wt/wt): 0-8%
- Sodium acetate (wt/wt): 0-8%
- Sodium butyrate (wt/wt): 0-8%
- Carbohydrates/metabolites (wt/wt): 21-25%
- pH: 7 ±1.0
- Viscosity: 500 - 1000cP at 20°C
- Specific gravity: 1.2 - 1.3
- Soluble in water
- Color: light to dark brown



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# LACTOIL™

## SOY MICROEMULSION

UNIQUE FORMULATION PROVIDES SAVINGS THROUGH HIGHER FERMENTABLES, LOW VISCOSITY, AND SMALLER PARTICLE SIZE

### MICROEMULSIONS ARE SUPERIOR TO STANDARD OIL-IN-WATER EMULSIONS

- LactOil™ soy microemulsion is a complex mixture of solute and solution present as reversed water-in-oil microemulsion which together comprise a homogenous transparent liquid that is easy to handle and provides greater subsurface distribution.

### MORE FERMENTABLE MATERIAL THAN STANDARD EVO PRODUCTS

- High organic content (80%) provides up to 25% more fermentables than standard emulsified vegetable oils (EVOs).
- LactOil™ contains 45% oleaginous compounds (slowly soluble substrate), 35% ethyl lactate (readily soluble substrate), 20% water.

### EASY MATERIAL HANDLING

- Low viscosity; readily mixes with water; no high shear mixing needed; self-emulsifies.
- Low injection pressure; readily injects into low permeability sediment.
- Longer shelf life; lab studies suggests microemulsion is still stable at 200 days.



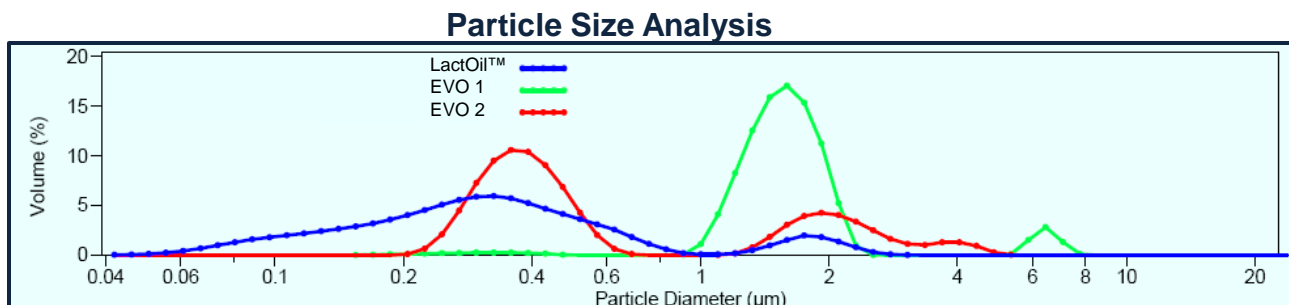
Neat LactOil™



LactOil™/Water  
After 4 Weeks

### INCREASED SUBSURFACE DISTRIBUTION

- Thermodynamically stable; zeta potential of -83.0 mV. According to ASTM Standard D 4187-82, colloids with zeta potential more than  $\pm 61$  have excellent stability.
- Small particle size (consistently smaller than 1 micron).
- Stability and smaller particle size allow for physical transport of material in the aquifer.



Analysis conducted using 1:10 dilution on a Beckman Coulter Light Scattering Particle Size Analyzer



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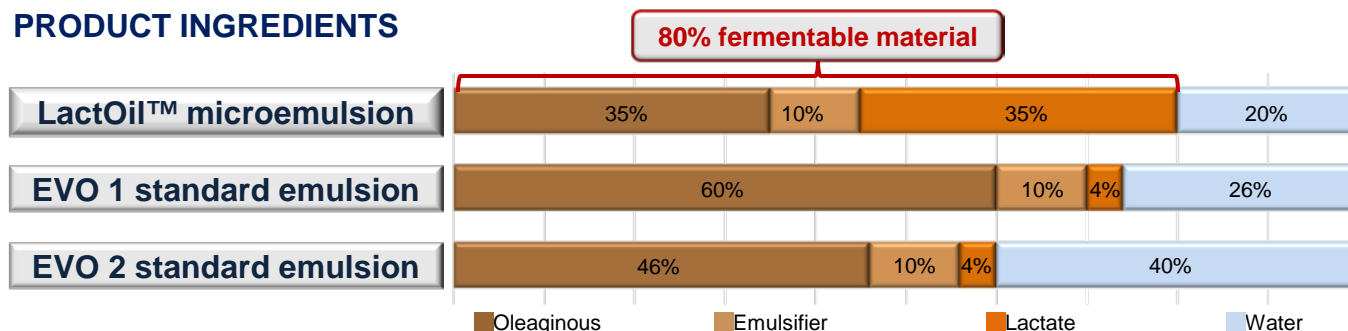


# LACTOIL™ SOY MICROEMULSION

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

LactOil™ 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.

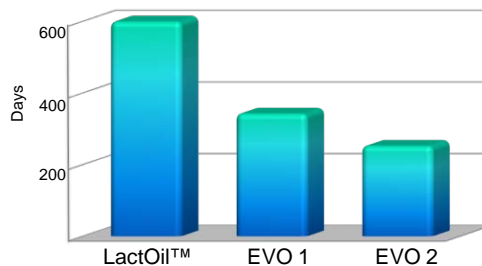
## PRODUCT INGREDIENTS



On a per pound basis, LactOil™ 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.

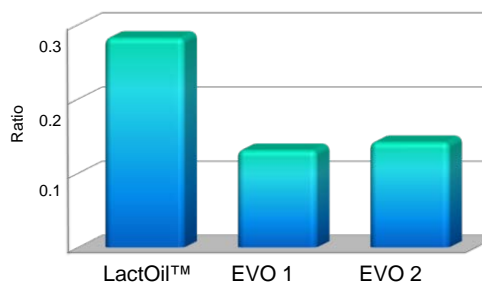
## LACTOIL™ ESTIMATED LONGEVITY

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



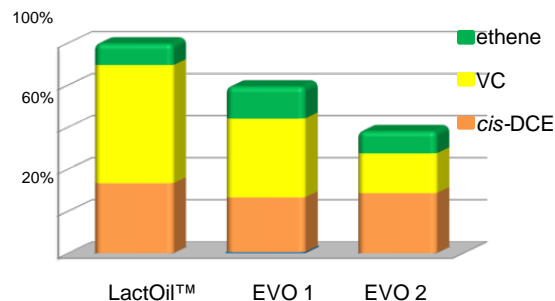
## LACTOIL™ DONOR EFFICIENCY

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



## LACTOIL™ DEGRADATION RATES

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



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# ACCELERITE™

## BIOREMEDIATION NUTRIENT

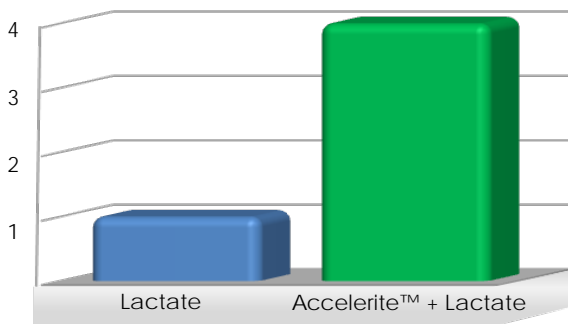
### UNIQUE NUTRIENT FORMULATION INCREASES ELECTRON DONOR KINETICS AND EFFICIENCY

#### BENEFITS OF ACCELERITE™

Accelerite™ is a patented<sup>1</sup> formulation of growth factors, B-vitamins and micronutrients. Studies have shown that adding Accelerite™ to your electron donor can:

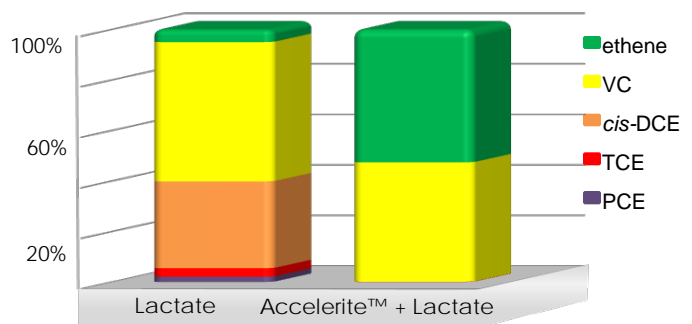
- ▶ Increase the kinetics and efficiency of your electron donor
- ▶ Stimulate anaerobic bacteria
- ▶ Promote the production of propionate over acetate

#### INCREASE ELECTRON DONOR EFFICIENCY WITH ACCELERITE™



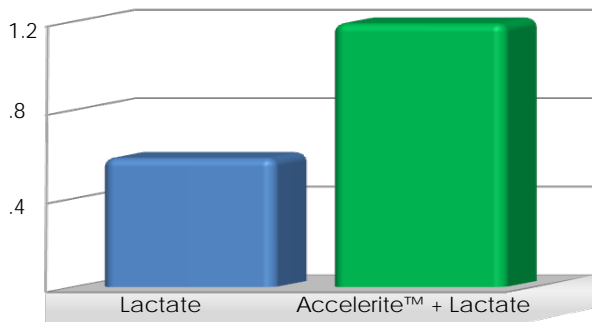
Accelerite™ increases the efficiency of sodium lactate by greater than 3 times. Microcosm results shown at 84 days<sup>2</sup>.

#### INCREASE DECHLORINATION KINETICS WITH ACCELERITE™



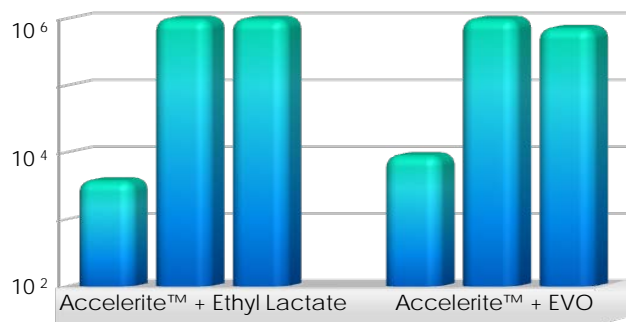
Accelerite™ increases the rate of dechlorination to ethene. Microcosm results shown at 53 days<sup>2</sup>.

#### INCREASE PROPIONATE:ACETATE RATIO WITH ACCELERITE™



Studies show that Accelerite™ promotes the production of propionate over acetate. Microcosm data shown at 11 days.

#### INCREASE ANAEROBIC BACTERIAL POPULATIONS WITH ACCELERITE™



Field data shows that Accelerite™ increases microbial biomass by greater than 2 times in just one week. PLFA data shown<sup>3</sup>.

<sup>1</sup>United States Patent Application US20080227179

<sup>2</sup>Smith and Sieczkowski 2007. Ninth International In Situ and On-Site Bioremediation Symposium. ISBN 978-1-57477-161-9, Battelle, Columbus, OH

<sup>3</sup>Sieczkowski et al. 2008. Sixth International Conference on Remediation of Chlorinated and Recalcitrant Compounds. ISBN 1-57477-163-9, Battelle, Columbus, OH



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# WILCLEAR®

## LACTATE CONCENTRATE

### PROVEN ELECTRON DONOR EFFICIENCY AND DECHLORINATION KINETICS AT A LOW COST

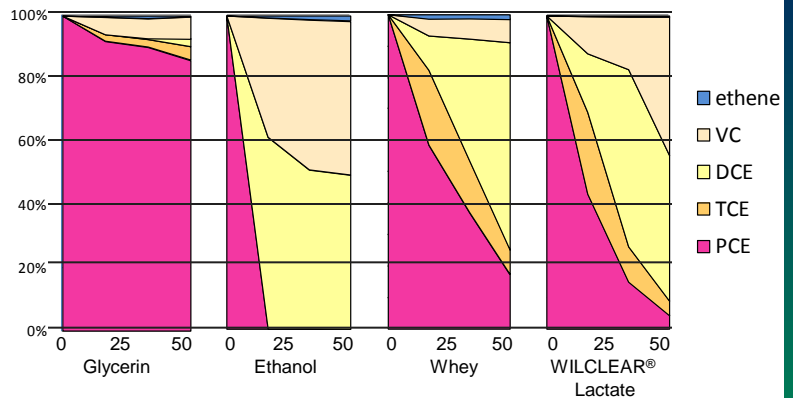
WILCLEAR® is a food grade 60% sodium or potassium lactate solution that has been deployed at U.S. Department of Energy sites and military installations, Superfund sites, mining sites, Brownfields, industrial sites, private chemical plants, and dry cleaners across North America and Europe. To date, WILCLEAR® has been used on over 250 projects in nearly every state in the US, including Hawaii and Alaska.

#### BENEFITS OF WILCLEAR®

- Provides carbon for rapid establishment of anaerobic conditions needed for reduction of nitrate, hexavalent chromium, perchlorate, and RDX.
- Miscibility in water and low viscosity allow for advective transport with groundwater; enhancing subsurface distribution and minimizing the number of injection points.
- Effective for both dissolved phase and DNAPL source area treatment.

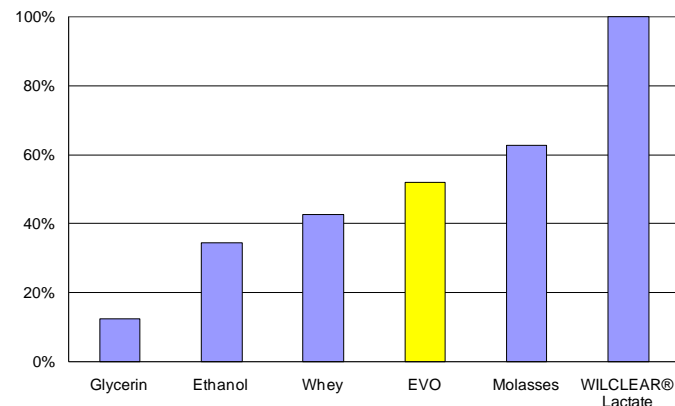
#### RAPID DECHLORINATION KINETICS

Microcosm studies comparing WILCLEAR® to other soluble donors show that while all four donors stimulate complete dechlorination of PCE to ethene, WILCLEAR® and ethanol have the fastest dechlorination kinetics.



#### GREATER DONOR EFFICIENCY

Efficiency (amount of contaminant remediated per unit donor added) should be considered when determining donor cost performance. Of the three donors that show both complete dechlorination and reasonable remediation rates, lactate has the best efficiency.



#### TYPICAL PROPERTIES

- WILCLEAR® sodium lactate (% wt/wt): 60 ± 1.2
- pH: 7 ± 1.0
- Viscosity: 110cP at 20°C
- Specific gravity: 1.32 – 1.35
- Soluble in water
- Color: clear to light straw



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# CHITOREM<sup>®</sup>

## CHITIN COMPLEX

PROVIDING BOTH A FAST AND SLOW  
RELEASE CARBON SOURCE ALONG  
WITH AN INHERENT BUFFERING AGENT

CHITOREM<sup>®</sup> is a 100% natural product that is comprised of chitin (a natural polysaccharide), proteinaceous material, and calcium carbonate. This product is used in bioremediation as a carbon source and subsequent electron donor for the microbial degradation of chlorinated solvents, heavy metals, perchlorates, and acid mine drainage in contaminated aquifers.

### BENEFITS OF CHITOREM<sup>®</sup>

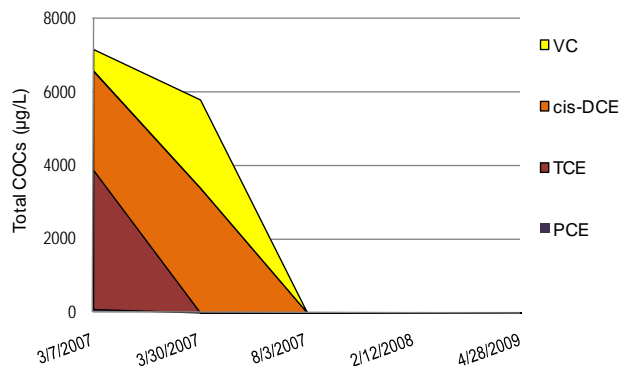
- Provides both fast (more soluble fraction) and slow releasing carbon source.
- Provides both carbon and nutrients.
- Niche application for acid mine drainage and low alkalinity halogenated solvent remediation; contains an inherent buffering agent to maintain moderate pH.

### DECHLORINATION IN OPEN EXCAVATIONS

*Former Dry Cleaning Site: Jacksonville, FL*

Following excavation of the source area, CHITOREM<sup>®</sup> was applied to the excavated area. Dechlorination of residual PCE and its daughter products to below MCLs was seen in less than two years.

(Data courtesy of Steve Buser, Golder Associates, Florida Remediation Conference 2009)

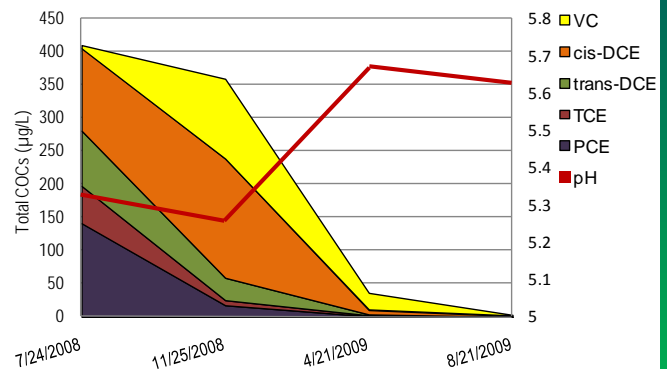


### DECHLORINATION IN LOW pH AQUIFERS

*Electroplating Facility: Ormond Beach, FL*

CHITOREM<sup>®</sup> has been used successfully at sites with low pH aquifers. At a site with pH in the range from 4-5.5, dechlorination of residual PCE and its daughter products to below MCLs was seen in less than two years.

(Data courtesy of Steve Buser, Golder Associates, Florida Remediation Conference 2009)



### ACID MINE DRAINAGE APPLICATIONS

*National Tunnel Superfund Site: Black Hawk, CO*

CHITOREM<sup>®</sup> has been used successfully as a carbon substrate in biochemical reactors:

- Shown to remove metals including Fe, Zn, Cu, and Mn to below treatment objective levels.
- Increased pH from 4.55 to 6.98.
- Increased alkalinity from 0 to 2,000 mg/L (as CaCO<sub>3</sub>).



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# SOLULAC™

## ETHYL LACTATE

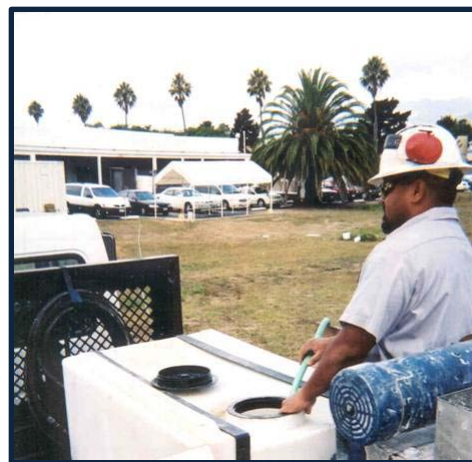
**98% FERMENTABLE ELECTRON DONOR FOR SITES WHERE SODIUM AND METALS ARE A CONCERN**

### BENEFITS OF SOLULAC™ ETHYL LACTATE

- 98% fermentable material.
- Ideal for sites requiring certified low metals substrates.
- Used at sites in lieu of WILCLEAR® sodium lactate where sodium content is a concern.
- Certificates of Analysis are available on a lot by lot basis.
- Increases the dissolution of chlorinated solvents sorbed on soil or residing as DNAPL in groundwater.
- Low viscosity enhances subsurface distribution, minimizing the number of injection points needed.
- Effective for both dissolved phase and residual (DNAPL) contaminants.

### TYPICAL PROPERTIES

Boiling Point: 154° C  
Flash Point: 51.7°C  
Specific Gravity (20°C): 1.029 - 1.032  
Viscosity (20°C): 2.71 cP  
Refractive Index (20°C): 1.410 – 1.420  
Color: APHA 5 Maximum  
Non Volatile Matter (gm/100ml): 0.1% Maximum  
Assay (GC): 98% Minimum  
Sodium (Na): 5 ppb Maximum  
Iron (Fe): 5 ppb Maximum  
Potassium (K): 5 ppb Maximum  
Copper (Cu): 5 ppb Maximum  
Silicon (Si): 5 ppb Maximum  
Calcium (Ca): 5 ppb Maximum  
Magnesium (Mg): 5 ppb Maximum  
Manganese (Mn): 5 ppb Maximum  
Moisture: 0.1% Maximum  
Acidity, as lactic acid: 0.05% Maximum



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# MATERIAL SAFETY DATA SHEET



## SECTION I

## PRODUCT IDENTIFICATION

**PRODUCT NAME:** Wilclear® Sodium Lactate 60% Solution  
**PRODUCT USE:** 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:** 05-13-2011  
**FORMULA:** CH<sub>3</sub>-CHOH-COONa

## SECTION II

## COMPOSITION/INFORMATION ON INGREDIENTS

Name	CAS #	% by Weight
Sodium lactate	72-17-3	60%
Water	7732-18-5	40%

## SECTION III

## PHYSICAL/CHEMICAL CHARACTERISTICS

**Boiling point:** 221°F  
**Vapor pressure (Mg Hg):** Not determined  
**Vapor density (air = 1):** Not determined  
**Solubility in water:** Soluble  
**Appearance and odor:** Clear to light yellow / slight to no odor  
**Specific gravity (H<sub>2</sub>O = 1):** 1.32 H<sub>2</sub>O=1 @ 20°C  
**Melting point:** Not determined  
**Evaporation rate:** Not determined  
**pH:** 6.0-8.5  
**Pour Point:** Not applicable  
**Viscosity:** 100cP @ 20°C  
**Molecular Weight:** 112.07  
**Physical State:** Liquid

## SECTION IV

## FIRE AND EXPLOSION HAZARD DATA

**Closed cup Flash point:** Not determined  
**Open cup Flash point:** Not determined  
**Auto Ignition:** Not determined  
**Fire Point:** Not determined  
**Flammable limits:** Not determined  
**LEL:** Not determined  
**UEL:** Not determined  
**Extinguishing media:** Water, carbon dioxide, or dry chemical.  
**Special Fire Fighting procedures:** Wear self-contained breathing apparatus  
**Unusual Fire Fighting hazards:** Thermal decomposition may lead to release of irritating or toxic gases and vapors.

**SECTION V****REACTIVITY DATA**

Stability: Unstable  Stable   
 Conditions to avoid: Not Applicable  
 Incompatibility (materials to avoid): Not Applicable  
 Hazardous decomposition or byproducts: Not Applicable  
 Hazardous polymerization: May Occur  Will Not Occur

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

## Route/s of Entry:

Inhalation: Inhalation of mist may cause mild irritation of respiratory system. Move to fresh air.  
 Skin contact: In case of contact with skin, immediately wash with soap and water while removing contaminated clothing.  
 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.  
 Health hazards (acute and chronic): No specific data. Low order of toxicity. The chemical, physical, and toxicological properties have not been thoroughly examined.  
 Carcinogenicity: Not determined.  
 Signs and symptoms of exposure: Not determined.  
 Medical conditions aggravated by exposure: Not determined.

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

Steps to be taken in case material is released or spilled: Contain spill and place material in drum for disposal. 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 and leakage. Keep container tightly closed. Keep in properly labeled containers. Store in a cool, dry area.  
 Other precautions: No special environmental precautions required.

**SECTION VIII****CONTROL MEASURES**

Respiratory protection (specify type): No personal respiratory protective equipment normally required in well ventilated areas.  
 Ventilation: Use adequate mechanical ventilation, especially in confined spaces. Local exhaust is recommended.  
 Protective gloves: Recommended.  
 Eye protection: Safety glasses 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

Not Applicable

Wilclear<sup>®</sup> Sodium Lactate 60% Solution

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