de maximis, inc.

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November 6, 2015

Mr. George Jacob
U.S. Environmental Protection Agency, Region II
Emergency and Remedial Response Division
Central New York Remediation Section
290 Broadway, 20th Floor
New York, NY 10007-1866

Subject: Revised **LactOil® Injection Work Plan**
York Oil Superfund Site
Moira, New York

Dear Mr. Jacob:

Attached for your review is the revised LactOil® Injection Work Plan prepared by CDMSmith, Inc. on behalf of Alcoa, Inc. for the York Oil Superfund Site. This Work Plan discusses the installation of permanent injection wells, and an initial injection of LacOil®, to treat chlorinated volatile organic compounds (cVOCs), primarily *cis* 1,2-dichloroethene (cDCE) in the groundwater, and has been revised to address EPA's comments regarding the hydraulic fracturing aspect of the work

Analysis of groundwater data has identified lack of electron donor as a limiting factor for successful biological degradation of cDCE. Installation of permanent injection wells will allow for cost effective and efficient implementation of additional injections in the future, as indicated necessary by site data.

Please contact me if you have any questions.

Sincerely,

Bruce Thompson

Enclosure

cc: Mr. Greg Handley – NYSDEC
Mr. Anthony Sturtzer – Alcoa Remediation
Mr. Peter Swallow – Alcoa Remediation
Mr. Ryan Kingsley – CDM Smith, Inc.

2015 Work Plan

Background

The United States Environmental Protection Agency (EPA) Region 2 issued the Fourth Five-Year Review (FYR) for the York Oil Site (Site) on December 29, 2014. Issues / Recommendations were identified in Table 4 of the FYR. The following responses to EPA's Issues / Recommendations were provided on April 15, 2015, updated to identify the status of the activities:

Issue 1: Natural attenuation parameters are not being evaluated in the monitoring wells.

Recommendation 1: Conduct a full evaluation of the extent of natural attenuation parameters in monitoring wells where degradation should be occurring.

Response 1: An evaluation of natural attenuation will be conducted. See attached table of proposed monitoring wells and parameters for sampling to be conducted Spring and Fall 2015. Monitoring to evaluate performance of any additional reagent injection will be proposed at the time such injection is scoped to EPA.

Status 1: A first round of parameters was collected during the Spring 2015 sampling event. A second round will be collected during the Fall 2015 sampling event.

Issue 2: Monitoring results indicate increasing concentrations of chlorinated volatile organic compounds and the presence of benzene, toluene, ethylbenzene and xylene in the deep aquifer monitoring wells**.**

Recommendation 2: Update the conceptual site model to better understand acetone, 2-butunone and bedrock groundwater flow.

Response 2: The conceptual site model will be updated to better understand acetone and 2-butanone source(s) and distribution, and to better depict bedrock groundwater flow. With respect to acetone, we propose to evaluate the distribution and concentrations of detections, to define if and where site-related acetone is located versus locations of naturally occurring acetone created through fermentation reactions (note that acetone is detected in monitoring wells where no site-related VOC have ever been detected). With respect to 2-butanone, which we believe was created as a result of EHC injection, we will review both the current delineation above MCLs and the concentration trends. The bedrock groundwater flow will be depicted on cross-sections that will be created, along with concentration and gradient data.

Status 2: An analysis of the acetone and 2-butanone data will be performed after the Fall 2015 sampling event, and incorporated into the 2015 Annual Report. An additional bedrock monitoring well is proposed to be installed to improve the bedrock conceptual site model.

Issue 3: Groundwater contaminant concentrations are increasing in Southern Wetland and natural attenuation is not adequately addressing the plume.

Recommendation 3: Evaluate technologies to address the contaminant plume.

Response 3: The extent and magnitude of concentration increases, potential for further downgradient migration, extent of natural attenuation, and risk to receptors will be updated after completion of the additional natural attenuation monitoring and update of the site conceptual model. At that point, specific enhancements to electron donor and/or electron acceptor distribution can be identified as necessary to address potential risk to receptors and to more effectively meet the OU2 RAOs. At this point, we expect the analysis will include locations, numbers and depths of permanent injection points and selection of the appropriate injection reagent(s) to provide sufficient electron acceptor (e.g., sulfate) and electron donor to support and improve biodegradation of cis-1,2-DCE and BTEX.

Status 3: We believe that additional electron donor is needed to enhance the biodegradation of 1,2-DCE. The injection of additional electron donor is expected to improve the biodegradation of toluene, based on experience at other sites. For benzene, we may see some improved anaerobic degradation. BTEX concentrations will continue to be monitored, and if some form of additional treatment is needed to reduce the migration of BTEX, it will be proposed based on site data.

Four permanent injection locations will be installed in the area where the prior EHC injection occurred (see attached Figure 1), with hydraulic fracturing at each well to create distribution pathways for the electron donor ("reagent"). These injection wells will be installed to top of rock, in order to facilitate treatment of the deep portion of the aquifer (see attached Figures 2 and 3). The installation of permanent injection wells will allow for future injections, if needed.

The use of injection wells means that instead of the solid / slurry EHC, we will use a liquid reagent. An analysis of four commercially available reagents (LactOil®, EOS Pro, NewmanZone, and SRS-SD) identified Lact Oil® as the best alternative for the Site. Vendor descriptions of LactOil® and a MSDS are attached. A 5% solution of LactOil® will be pumped into the four injection wells, with a total of 5,000 pounds of LactOil® injected this fall. Groundwater monitoring will occur during 2016 to evaluate the effectiveness of this treatment, and provide a basis to determine the periodicity of future reagent injections. Our initial expectation is that re-injections will occur every 1-2 years over the next 5-10 years.

Work Plan

Task 1 – Install Injection and Monitoring Wells

CDM Smith will subcontract with ARS Technologies (now Zebra Technical Services, LLC) to perform drilling and fracking at the four injection well locations.

Zebra Technical Services, LLC (Zebra) will utilize sonic drilling to obtain core samples of the soil down to bedrock. Locations and vertical intervals for fracture intervals will be determined in the field, once the soil stratigraphy is known. Zebra will fracture at the determined intervals for fracture layers at up to four depths per location using the drilling equipment and upper and lower packers fracturing from the deepest depth to the shallowest depth requested. Once fracturing has occurred, the hole will be drilled out to a larger diameter for the installation of the 4-inch injection well. The injection wells will be installed with up to 20 feet of stainless steel wire wrapped 0.020 slot screen in the fractured zones of soil. Depending on the soil conditions observed during the investigation, nested well pairs may be installed at some of the injection well locations using 2-inch wells with shorter lengths of stainless steel wire wrapped 0.020 slot screen to take advantage of permeable lenses, if such are observed. Well screens will not extend down into the bedrock.

An environmental fracturing process will be used to emplace enhanced permeability sand lenses out to a radius of approximately 15 to 20 ft from the injection boreholes. As noted above, the injection boreholes will first be drilled to total depth, and then packers will be placed to isolate the injection zones, starting with the deepest zone first. The permeability enhancement injection process (environmental fracturing) will cause a "tensile parting" of the soil to emplace a sand and guar mixture in a planar lens extending out from the injection borehole. As the soil parts during the injection, very little displacement of pore fluid occurs because the sand and guar mixture is filling new volume created by the parting of the soil. Once the guar breaks down or is extracted during well development, the sand-filled lens remains to provide a high permeability injection pathway that can be used multiple times to inject electron donor to sustain a biological treatment zone between OU1 and OU2. The extent of the injection lenses from the borehole will be controlled to a large extent through managing the volume of sand and guar injected. The use of packers to isolate the injection zones provides excellent control over the vertical distribution of electron donor, as opposed to conventional injection, which simply follows the highest permeability zone within a well screen. Once all four injection wells are completed, an interconnected network of high permeability injection lenses will be created that can "loaded" with electron donor to stimulate biodegradation of 1,2-DCE as it migrates from OU1 toward OU2.

Zebra will utilize sonic drilling to install a 2-inch monitoring well approximately 400' south of OU-1 into the wooded area of OU-2. The monitoring well will be installed to an approximate depth of 45 feet with a 10 foot section of 0.020 slotted PVC screen installed in bedrock.

Task 2 – Injection of Reagent

CDM Smith will prepare the injection wells for injection of reagent by developing them to establish hydraulic connection with the surrounding soils and facilitate injection of the reagent into those soils. Well development will be performed using a combination of Waterra pumps with surge blocks and a Grundfos pump. The monitoring well in OU-2 will also be developed to prepare it for future sampling.

CDM Smith will purchase the reagent and inject it into each of the four injection wells. CDM Smith is recommending LactOil® from JRW Bioremediation due to its high fraction of ethyl lactate that will quickly create dechlorinating conditions and sustain the conditions for one to two years. The LactOil® will be mixed with water in the onsite tanks in the treatment building and injected into each well. An estimated 1,200 gallons will be injected at each well location. This estimate is based on the anticipated fracturing volume to be used during well installation and on the conditions of the soils. The effectiveness of LactOil® has been documented to be reduced if the substrate mixture is cold before it is injected. Due the temperatures anticipated at the time of field work, the treatment building will be used to keep the LactOil® mixture heated to 50 degrees Fahrenheit. We are estimating that the injection work will take six days but the work could take longer depending on ambient temperatures, the soil conditions and degree of fracturing in the soil.

Task 3 – Summary Memorandum

CDM Smith will document all field activities and develop a summary memorandum at the completion of the work. The memorandum will include a description of the work that occurred, soil boring and injection well construction logs, the quantity of reagent injected and observations during well installation, fracturing and reagent injections.

N

BB
FIG 3

AA
FIG 2

YO-29X
YO-29DX
YO-110S
YO-110D
YO-120
YO-118
YO-119
YO-14X
YO-14ALX
YO-117D
YO-117S
YO-116D
YO-116R
YO-116S
YO-12RX
YO-12AX
YO-57A
YO-57
YO-2X
YO-2RX
YO-56A
YO-56D
YO-101R
YO-101S
YO-58
YO-58A
YO-102R
YO-102S
YO-115R
YO-113D
YO-111D
YO-114R
YO-112D

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CDM Smith
Camp Dresser McKee & Smith

EXISTING MONITORING WELL LOCATIONS
2009 EHC INJECTION LOCATIONS
PROPOSED 2015 INJECTION LOCATION
PROPOSED 2015 MONITORING LOCATION

1"=150'
0 150'

York Oil Superfund Site - Moira, New York

YORK OIL SITE
MONITORING WELL LOCATION PLAN

FIGURE 1

WEST

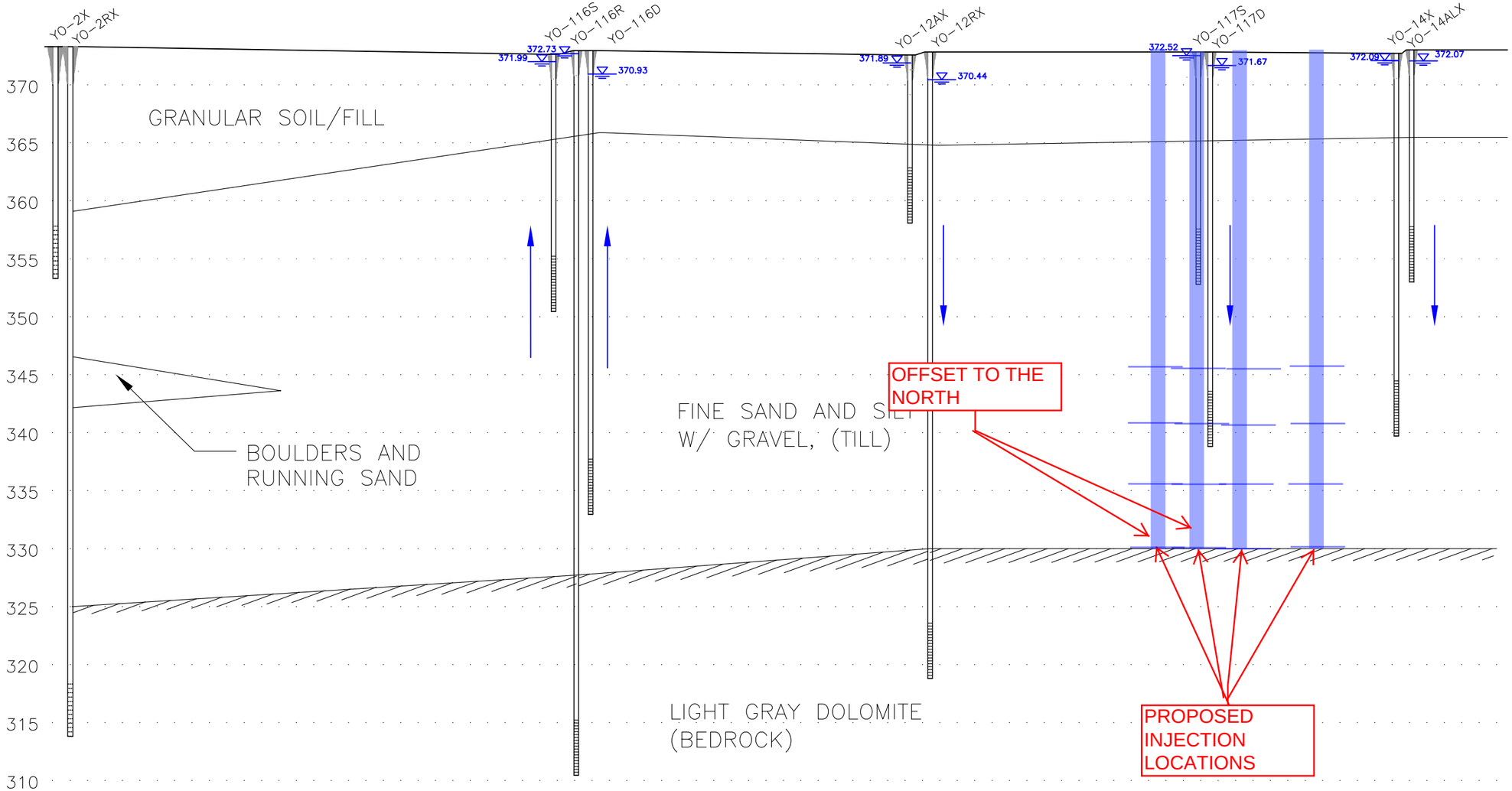
EAST

VOC Data	YO-116S	YO-116R	YO-116D
Benzene	<0.7	<0.7	<0.7
cDCE	<1	<1	<1
Ethylbenzene	<1	<1	<1
Toluene	<1	<1	<1
Vinyl Chloride	<1	<1	<1
Xylenes	<2	<2	<2

VOC Data	YO-12AX	YO-12RX
Benzene	---	5.6J
cDCE	---	<10
Ethylbenzene	---	<10
Toluene	---	<10
Vinyl Chloride	---	<10
Xylenes	---	<20

VOC Data	YO-117S	YO-117D
Benzene	5.9J	28
cDCE	5.3J	190
Ethylbenzene	4J	5.9J
Toluene	<10	23
Vinyl Chloride	4.3J	84
Xylenes	<20	9.3J

VOC Data	YO-14X	YO-14ALX
Benzene	26	1.1
cDCE	<10	0.81J
Ethylbenzene	15	0.6J
Toluene	<10	<1
Vinyl Chloride	<10	<1
Xylenes	<20	0.43J



NOTE: DATA PRESENTED FROM MAY 2014

CDM Smith
Camp Dresser McKee & Smith

KEY:
371.99 WATERLEVEL
INJECTION POINT
HYDRAULIC GRADIENT DIRECTION

HORIZONTAL SCALE: 1" = 40' (16 0 40)
VERTICAL SCALE: 1" = 10' (4 0 10)

York Oil Superfund Site - Moira, New York

CROSS SECTION AA
MONITORING WELL CROSS SECTION

FIGURE 2

NORTH

SOUTH

VOC Data	YO-119
Benzene	<0.7
cDCE	<1
Ethylbenzene	2.1
Toluene	0.36J
Vinyl Chloride	<1
Xylenes	<2

VOC Data	YO-117S	YO-117D
Benzene	5.9J	28
cDCE	5.3J	190
Ethylbenzene	4J	5.9J
Toluene	<10	23
Vinyl Chloride	4.3J	84
Xylenes	<20	9.3J

VOC Data	YO-56A	YO-56D
Benzene	<0.7	2.2
cDCE	0.47J	5.4
Ethylbenzene	<1	<1
Toluene	<1	<1
Vinyl Chloride	<1	0.91J
Xylenes	<2	<2

VOC Data	YO-111D
Benzene	0.67J
cDCE	33
Ethylbenzene	<1
Toluene	<1
Vinyl Chloride	6.1
Xylenes	<2

VOC Data	YO-112D
Benzene	0.7U
cDCE	<1
Ethylbenzene	<1
Toluene	<1
Vinyl Chloride	<1
Xylenes	<2

OFFSET TO THE WEST

OFFSET TO THE EAST

YO-119

FW-02 DECOMMISSIONED

YO-117S

YO-117D

YO-56A

YO-56D OFFSET 80FT WEST

YO-111D

YO-112D

373.53

372.52

371.67

369.78

368.67

366.07

366.00

375
370
365
360
355
350
345
340
335
330
325
320
315
310

GRANULAR SOIL/FILL

GRAY CLAY

FINE SAND AND SILT
W/ GRAVEL, (TILL)

SAND

BOULDERS AND SAND

LIGHT GRAY DOLOMITE
(BEDROCK)

PROPOSED INJECTION LOCATION

MW SCREENED ELEV.
SAME AS YO-111D

PROPOSED NEW MONITORING LOCATION

NOTE: DATA PRESENTED FROM MAY 2014

KEY:

371.99 WATERLEVEL

INJECTION POINT

HYDRAULIC GRADIENT DIRECTION

HORIZONTAL SCALE: 1" = 80'
40 0 80

VERTICAL SCALE: 1" = 10'
5 0 10

CDM Smith
Camp Dresser McKee & Smith

York Oil Superfund Site - Moira, New York

CROSS SECTION BB
MONITORING WELL CROSS SECTION

FIGURE 3

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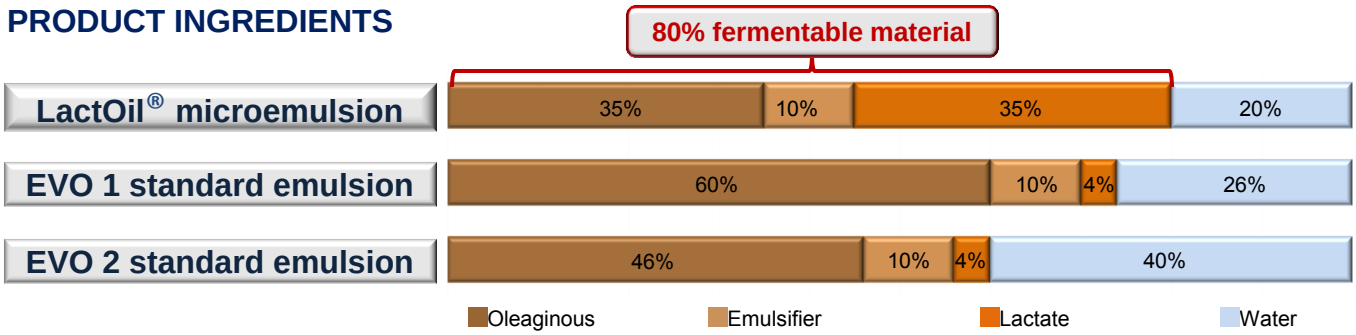
LACTOIL® SOY MICROEMULSION

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.

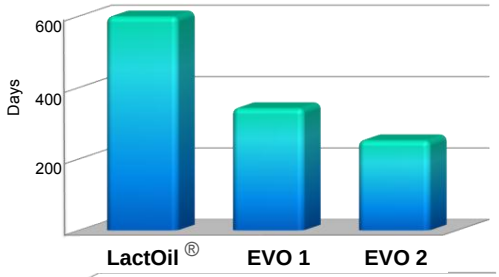
PRODUCT INGREDIENTS



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.

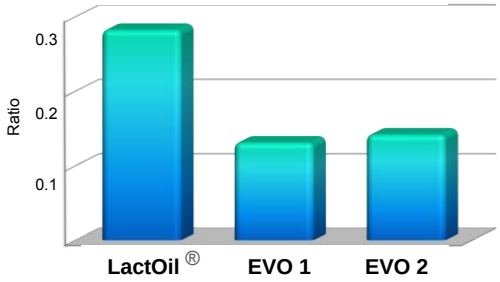
LACTOIL® ESTIMATED LONGEVITY

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.



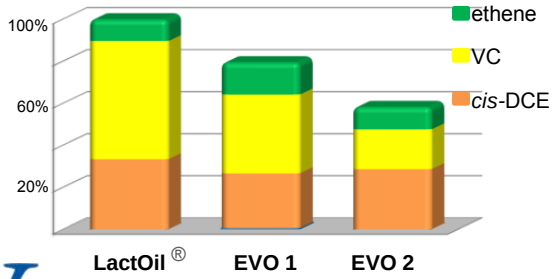
LACTOIL® DONOR EFFICIENCY

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.



JRW BIOREMEDIATION LLC
www.jrwbioremediation.com
(913)438-5544
info@jrwbiorem.com

MATERIAL SAFETY DATA SHEET

LACTOIL®
SOY MICROEMULSION

SECTION I PRODUCT IDENTIFICATION

PRODUCT NAME:	LactOil® Soy Microemulsion
PRODUCT USE:	In-situ Bioremediation
SUPPLIER:	JRW Bioremediation, LLC 14321 W. 96th 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_2O = 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 (ASTM std D93
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:	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 [X]
Conditions to avoid:	Hydrolysis may occur in the presence of strong acids

	or bases.
Incompatibility (materials to avoid):	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 INFORMATION**
DOT hazard class:	Not Applicable, non-regulated
Labeling:	Not Applicable
Proper Shipping Name:	LactOil® Soy Microemulsion
NMFC#:	144920
Class	**65**