April 10, 2018

Jim Delwiche
Wisconsin Department of Natural Resources
141 NW Barstow St, Room 180
Waukesha, WI 53188

Re: Remediation Injection Request

Dear Mr. Delwiche:

EnviroForensics is proposing a subsurface injection utilizing products that create and support enhanced reductive dechlorination as a method of groundwater treatment at the One Hour Martinizing facility in Elm Grove, Wisconsin (Site). On behalf of the responsible party, we are requesting review and approval of the attached request. Site information is provided below.

Site Details:	OHM Holdings – Elm Grove 13405 Watertown Plank Rd Elm Grove, WI 53122 BRRTS# 02-68-552102
Site Owner:	OHM Properties 5 LLC W229 N2494 County Highway F Waukesha, WI 53186
Responsible Party:	Brian Cass W229 N2494 County Highway F Waukesha, WI 53186 (262) 521-9710 brian@ohmholdings.com
Consultant:	EnviroForensics LLC Kyle Heimstead, Project Manager Wayne Fassbender, Senior Project Manager N16 W23390 Stone Ridge Drive, Suite G, Waukesha, WI 53188 262-290-4001 wfassbender@enviroforensics.com

An injection request and WPDES general permit application are attached. A Technical Assistance review fee of $700 is enclosed with the copy of this letter sent to Mr. Yang.

Sincerely,
EnviroForensics LLC

Wayne Fassbender, PG, PMP
Senior Project Manager

Brian Kappen, PG
Project Manager

cc: Chue Yee Yang, WDNR

enclosure

INJECTION REQUEST
ONE HOUR MARTINIZING
13405 WATERTOWN PLANK ROAD, ELM GROVE, WI

EnviroForensics is requesting approval to perform injections for groundwater remediation at the One Hour Martinizing (OHM) facility in Elm Grove, Wisconsin (Site). The objective of the remedial injections is to reduce concentrations of tetrachloroethene (PCE) and associated degradation compounds in groundwater.

The geological profile at the Site consists of interbedded mixtures of clay, silt, sand and gravel to 15 feet below ground surface (bgs). Underlying this upper unit is a fine to medium-grained sand to approximately 50 feet bgs, where dolomitic bedrock is encountered. An approximately 2 to 3-foot thick layer of anthropogenic subgrade fill is present below the parking areas and driveways and in proximity to Underwood Creek. The water table is generally encountered at around 17 feet bgs; however, the water table has been observed over several years of monitoring to occasionally fluctuate between a minimum depth of 13 feet and a maximum depth of 19 feet bgs. The direction of groundwater flow is toward the southeast. Groundwater elevation data indicates that there is a consistent upward vertical gradient to groundwater flow.

The nearest surface water body is Underwood Creek, which is located west of, and adjacent to, the Site and flows northwest to southeast. Underwood Creek is contained within a concrete causeway that is open to the surface at this location. Localized storm water drainage is directed to this waterway. The depth of the basin is approximately 20 feet and the water depth is typically approximately six inches, depending upon rainfall amounts.

The target compound for treatment is PCE, identified in Site groundwater at concentrations up to 900 micrograms per liter (µg/L). The target treatment depth is 15 to 25 feet bgs. The remedial technology selected for groundwater treatment is enhanced reductive dechlorination (ERD). The proposed ERD solution to be injected is a combination of the following products manufactured by Regenesis:

- 3-D Microemulsion® (electron donor emulsion);
- Chemical Reducing Solution® (CRS), an iron-based reagent designed to establish and maintain subsurface reducing conditions; and
- Bio-Dechlor Inoculum Plus® (BDI), a microbial consortium containing species of dehalococcoides.

Product brochures prepared by the manufacturer are provided in **Attachment 1**. All products are non-hazardous and safe to handle with level D personal protective equipment.

INJECTION REQUEST
FORMER ONE HOUR MARTINIZING
13405 WATERTOWN PLANK ROAD, ELM GROVE, WI

Implementation Plan

EnviroForensics and Regenesis developed an injection design plan based on groundwater volatile organic compounds (VOC) concentrations and the hydrogeological properties of the aquifer. Two (2) separate target remediation areas have been designated based on the distribution of groundwater impacts defined during the site investigation. Area A is located in the northern part of the Site, extending into a Village of Elm Grove right-of-way. Area B is located along the northeast Site boundary around a hot-spot identified at boring B-10. The injection plan is summarized below.

Area A

- Advance 30 direct-push injection points on a grid as shown on **Figure 1** (attached).
- Mix 13 gallons of 3-D Microemulsion and 6 gallons of CRS with water to produce 166 gallons of solution. Inject the 166 gallons of solution into each of the 30 injection points shown on **Figure 1** (attached).
- Mix 0.25 gallon BDI with water to produce 10 gallons of solution and inject the solution into each of the 30 injection points.

Area B

- Advance six (6) direct-push injection points at the locations shown on **Figure 1**. Three (3) of the points will be angled to the northeast to reach beneath the railroad right-of-way.
- Mix 24 gallons of 3-D Microemulsion and 8 gallons of CRS with water to produce 487 gallons of solution. Inject the 487 gallons of solution into each of the 6 injection points shown on **Figure 1** (attached).
- Mix 0.25 gallon BDI with water to produce 10 gallons of solution and inject the solution into each of the six (6) injection points.

The products will be mixed with potable water to achieve the desired solution concentrations. The volume of solutions injected will be approximately 5,280 gallons, or 176 gallons per point for Area A; and 2,982 gallons or 497 gallons per point for Area B. The application design summary is provided in **Attachment 2**. The products will be stored in a secured container prior to mixing.

Mixing will be performed in large, trailer-mounted tanks with continuous agitation. The solution will then be pumped from the tanks, through a manifold to the injection points via hose. Injection will occur at up to four (4) points simultaneously. Pressure and flow rate will be monitored separately at each injection point and recorded to confirm that injection design parameters are met. Injections will occur through direct-push rods with a retractable screen injection tool similar to http://ectmfg.com/product/2-25-retractable-injection-tool-24-exposed/.

The direct-push tooling will be removed from each location after the prescribed volume of solution is injected, and the boreholes will be abandoned in accordance with s. NR 141.25 and patched with asphalt.

Monitoring Plan

Groundwater elevation measurements will be collected from Site monitoring wells before, during, and after injections to evaluate the temporary effect of injection on potentiometric surfaces and flow direction. The depth to water in each well will be measured to the nearest 0.01 foot using an electronic water level indicator. Additionally, discharge from the potable well at the Site will be checked during the Area B injections to confirm that the water supplied to the building is not affected. The well intake is at least 25 feet below the bottom of the target treatment zone. As such, no impact to the potable well is anticipated. As a precaution employees working in the building will be advised to drink bottled water, which is provided by the Site owner.

The post-injection groundwater monitoring program is detailed on **Table 1** (attached). The objectives of monitoring are to verify that aquifer conditions are conducive to reductive processes and to document decreasing VOC concentration trends. Monitoring will be conducted for a minimum of two (2) years following injections. A third year of monitoring will be implemented if needed to demonstrate continuing reductions.

Existing monitoring wells MW-5, -6, -7 and PZ-2 will be used for remediation performance monitoring purposes. The monitoring well locations are depicted on **Figure 2**. Groundwater samples will be collected via low-flow methods and analyzed for VOCs according to EPA test method 8260. In addition, samples will be collected from select wells for analysis of dehalococcoides species and population, dissolved gases, total and dissolved iron, nitrate, nitrite, and sulfate. Water quality data including electrical conductivity, temperature, dissolved oxygen, total dissolved solids, pH and oxidation-reduction potential (ORP) will be measured in the field with a portable meter during each sampling event.

Investigation-derived media (IDM), including purge water and decontamination fluids, will be containerized in 55-gallon drums. A licensed contractor will be retained to remove drums following each monitoring event. The IDM will be managed under existing non-hazardous waste profiles.

Vapor Screening

Methane can be produced via in-situ ERD processes. Methane concentrations in groundwater and vapor will be measured during groundwater monitoring events, both as an indication of microbial activity and to assess the potential for hazardous conditions beneath the existing commercial building. We are also in the process of designing and implementing a soil vapor extraction system (SVE) to treat PCE-contaminated soil within the shallow unsaturated zone. The SVE system is expected to limit or eliminate methane accumulation in the subsurface. As a contingency, methane concentrations will be evaluated using a portable gas analyzer during groundwater monitoring events.

Methane concentrations in vapor will be measured in the headspace of monitoring wells, and from sub-slab vapor sampling ports installed in the Site building. If the methane concentration exceeds 10% of the LEL (i.e., 0.5% by volume methane), then additional soil vapor extraction and/or sub-slab depressurization in the site building will be considered to reduce methane concentrations.

Timeframe

The remedial injections are tentatively scheduled to begin in June 2018. EnviroForensics anticipates the injection activities can be completed in eight (8) days. Post-injection monitoring will be performed as prescribed on **Table 1**, with the first monitoring event to occur approximately two (2) months after the injection activities are completed. EnviroForensics is requesting injection approval through the end of 2020 in case repeat injections are necessary.

INJECTION REQUEST
FORMER ONE HOUR MARTINIZING
13405 WATERTOWN PLANK ROAD, ELM GROVE, WI

Certifications

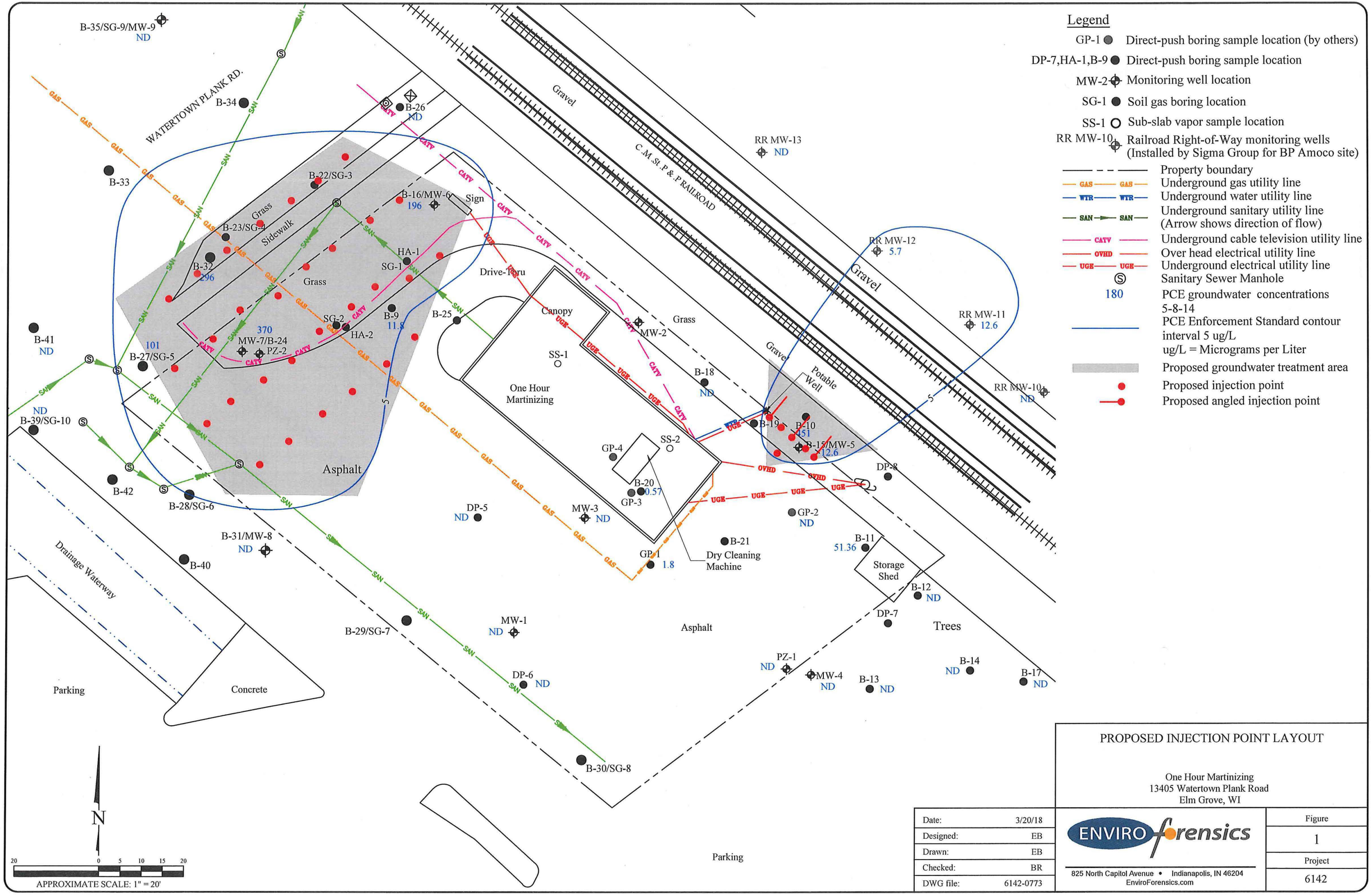
I, Andrew Horwath, hereby certify that I am a registered professional engineer in the State of Wisconsin, registered in accordance with the requirements of ch. A-E 4, Wis. Adm. Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch. A-E 8, Wis. Adm. Code; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code.

Andrew D. Horwath 2018.04.10 15:29:08 -04'00'

Dir. of Engineering and Remediation Svcs
Signature, title and P.E. number — PE# E-43831-6 — P.E. stamp

I, Brian Kappen, hereby certify that I am a hydrogeologist as that term is defined in s. NR 712.03 (1), Wis. Adm. Code, am registered in accordance with the requirements of ch. GHSS 2, Wis. Adm. Code, or licensed in accordance with the requirements of ch. GHSS 3, Wis. Adm. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code.

Project Manager — 4/10/18
Signature and title — Date



PROPOSED INJECTION POINT LAYOUT

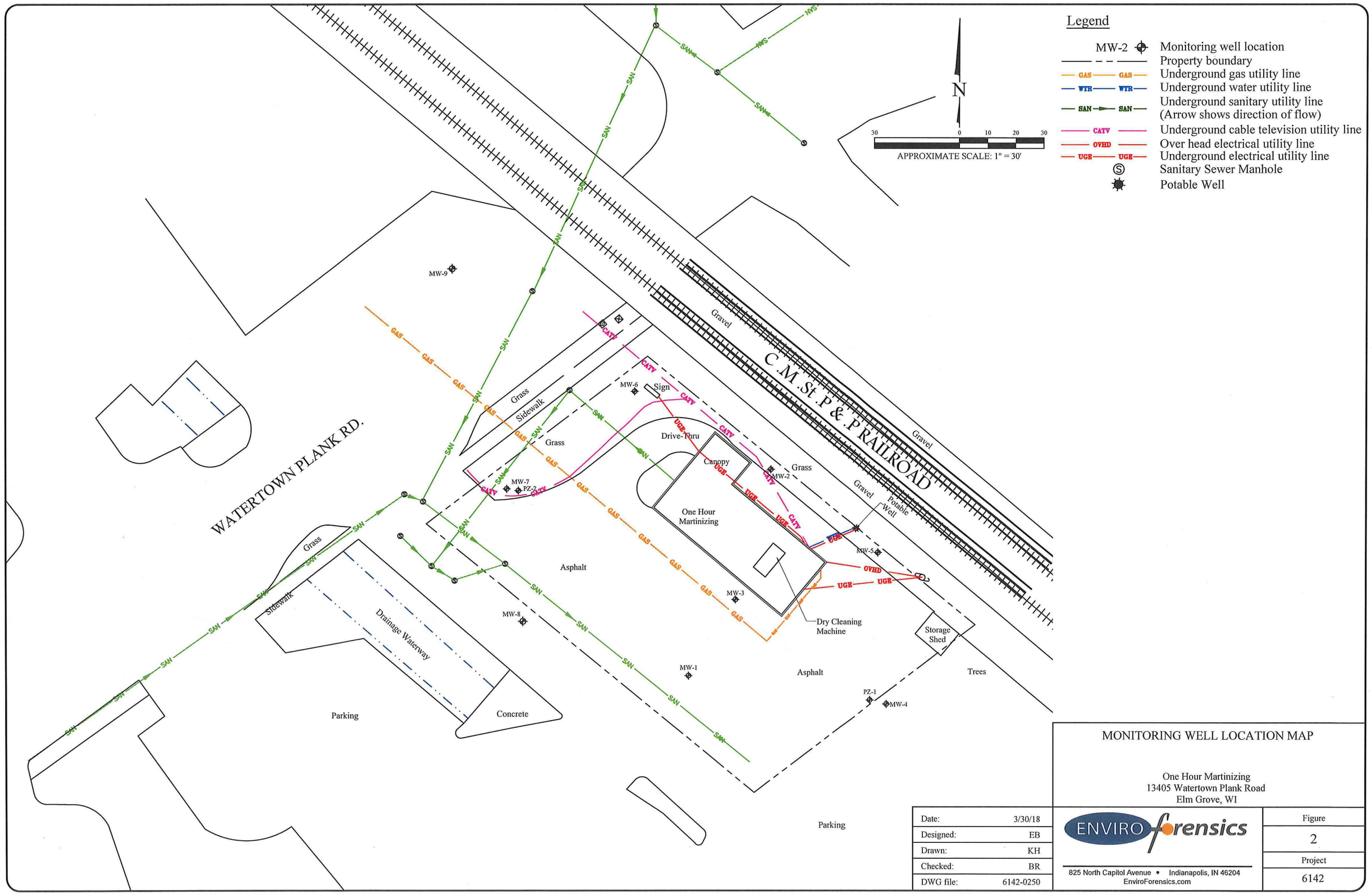
One Hour Martinizing
13405 Watertown Plank Road
Elm Grove, WI

Date:	3/20/18
Designed:	EB
Drawn:	EB
Checked:	BR
DWG file:	6142-0773

ENVIROforensics
825 North Capitol Avenue • Indianapolis, IN 46204
EnviroForensics.com

Figure 1

Project 6142



MONITORING WELL LOCATION MAP

One Hour Martinizing
13405 Watertown Plank Road
Elm Grove, WI

Date:	3/30/18
Designed:	EB
Drawn:	KH
Checked:	BR
DWG file:	6142-0250

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Figure
2
Project
6142

TABLE 1
REMEDIATION PERFORMANCE MONITORING PROGRAM
One Hour Martinizing
Elm Grove, Wisconsin

Year 1								
Parameter	**VOCs**	**Total Fe**	**Dissolved Fe**	**Sulfate**	**Nitrate**	**Nitrite**	**Ethene/Ethane/Methane**	**DHC Population/Species**
MW-5	Q	Q	Q	Q	Q	Q	Q	S
MW-6	Q	Q	Q	Q	Q	Q	Q	S
MW-7	Q	Q	Q	Q	Q	Q	Q	S
PZ-2	Q							

Year 2								
Parameter	**VOCs**	**Total Fe**	**Dissolved Fe**	**Sulfate**	**Nitrate**	**Nitrite**	**Ethene/Ethane/Methane**	**DHC Population/Species**
MW-5	Q	S	S	S	S	S	S	A
MW-6	Q	S	S	S	S	S	S	A
MW-7	Q	S	S	S	S	S	S	A
PZ-2	Q							

Year 3								
Parameter	**VOCs**	**Total Fe**	**Dissolved Fe**	**Sulfate**	**Nitrate**	**Nitrite**	**Ethene/Ethane/Methane**	**DHC Population/Species**
MW-5	S	S	S	S	S	S	S	A
MW-6	S	S	S	S	S	S	S	A
MW-7	S	S	S	S	S	S	S	A
PZ-2	S							

Notes:

The first monitoring event will be performed approximately 2 months after injections

Q = Sample collected for analysis quarterly

S = Sample collected for analysis semi-annually

A = Sample collected for analysis annually

DHC = Dehalococcoides

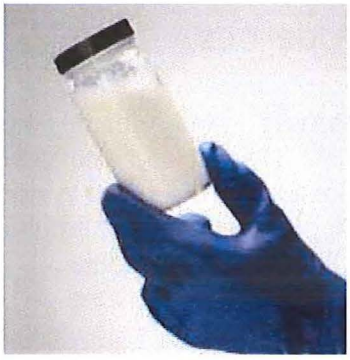
Fe = Iron

VOCs = Volatile Organic Compounds

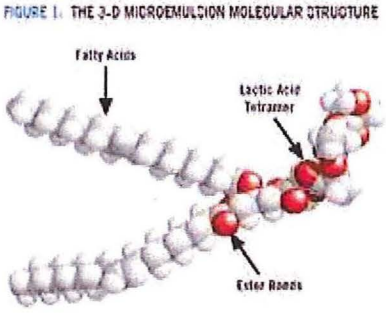
Attachment 1

3-D Microemulsion® Factory Emulsified Technical Description

3-D Microemulsion (3DME®) is comprised of a patented molecular structure containing oleic acids (i.e., oil component) and lactates/polylactates, which are molecularly bound to one another (figure 1). The 3DME molecule contains both a soluble (hydrophilic) and in-soluble (lipophilic) region. These two regions of the molecule are designed to be balanced in size and relative strength. The balanced hydrophilic/lipophilic regions of 3DME result in an electron donor with physical properties allowing it to initially adsorb to the aquifer material in the area of application, then slowly redistribute via very small 3DME "bundles" called micelles. These 3DME micelles spontaneously form within sections of the aquifer where concentrations of 3DME reach several hundred parts per million. The micelles' small size and mobility allow it to move with groundwater flow through the aquifer matrix, passing easily through the pore throats in between soil grains resulting in the further redistribution of 3DME within the aquifer. This allows for advective distribution of the oleic acids which are otherwise insoluble and unable to distribute in this manner, allowing for increased persistence of the lactate/polylactates component due to their initial attachment to the oleic acids.



Example of 3-D Microemulsion



Due to its patented molecular structure, 3DME offers far greater transport when compared to blended emulsified vegetable oil (EVO) products, which fail to distribute beyond the limits of pumping. 3DME also provides greater persistence when compared to soluble substrates such as lactates or simple sugars. The 3DME molecular structures capitalize on the best features of the two electron-donor types while at the same time, minimize their limitations. 3DME is delivered to the site as a ready-to-apply emulsion that is simply diluted with water to generate a large volume of a 3DME colloidal suspension.

Suspension of 3DME generated by this mixing range from micelles on the order of .02 microns to .05 microns in diameter, to "swollen" micelles, (termed "microemulsions") which are on the order of .05 to 5 microns in diameter. Once injected into the subsurface in high volumes, the colloidal suspension mixes and dilutes in existing pore waters. The micelles/microemulsions on the injection front will then begin to sorb onto the surfaces of soils as a result of zeta potential attraction and organic matter within the soils themselves. As the sorption continues, the 3DME will "coat" pore surfaces developing a layer of molecules and in some cases a bilayer. This sorption process continues as the micelles/microemulsion moves outward and disassociates into their hydrophilic/hydrophobic components. The specialized chemistry of 3DME results in a staged release of electron donors: free lactate (immediate); polylactate esters (mid-range) and free fatty acids & fatty acid esters (long-term). Material longevity of three years or greater has been seen at most sites as determined from biogeochemical analyses.

For a list of treatable contaminants with the use of 3DME, view the Range of Treatable Contaminants Guide

Chemical Composition

- Hydrogen Release Compound Partitioning Electron Donor – CAS #823190-10-9
- Sodium Lactate – CAS# 72-17-3
- Water – CAS# – 7732-18-5

Attachment 1

3-D MICROEMULSION
Factory Emulsified

3-D Microemulsion® Factory Emulsified Technical Description

Properties

- Density – Approximately 1.0 grams per cubic centimeter (relative to water)
- pH – Neutral (approximately 6.5 to 7.5 standard units)
- Solubility – Soluble in Water
- Appearance – White emulsion
- Odor – Not detectable
- Vapor Pressure – None
- Non-hazardous

Storage and Handling Guidelines

Storage
Store in original tightly closed container
Store in a cool, dry, well-ventilated place
Store away from incompatible materials
Recommended storage containers: plastic lined steel, plastic, glass, aluminum, stainless steel, or reinforced fiberglass

Handling
Avoid contact with eyes, skin, and clothing
Provide adequate ventilation
Wear appropriate personal protective equipment
Observe good industrial hygiene practices

Applications

- 3DME is diluted with water prior to application. Resulting emulsion has viscosity similar to water.
- Easily injects into formation through direct push injection points, injection wells or other injection delivery systems.

Application instructions for this product are contained here 3DME FE Application Instructions.

Health and Safety

Material is food grade and relatively safe to handle. We recommend avoiding contact with eyes and prolonged contact with skin. OSHA Level D personal protection equipment including vinyl or rubber gloves, and eye protection are recommended when handling this product. Please review the Material Safety Data Sheet for additional storage, usage, and handling requirements here: SDS-3DME FE.

REGENESIS

www.regenesis.com
1011 Calle Sombra, San Clemente CA 92673
949.366.8000

Attachment 1

CHEMICAL REDUCING SOLUTION

CRS® Technical Description

CRS® (Chemical Reducing Solution) is an iron-based reagent that facilitates biogeochemical *in situ* chemical reduction (ISCR) of halogenated contaminants such as chlorinated ethenes and ethanes. CRS is a pH neutral, liquid iron solution that is easily mixed with 3-D Microemulsion® Factory Emulsified before injection into a contaminated aquifer. CRS provides a soluble, food-grade source of ferrous iron (Fe^{2+}), designed to precipitate as reduced iron sulfides, oxides, and/or hydroxides. These Fe^{2+} minerals are capable of destroying chlorinated solvents via chemical reduction pathways, thus improving the efficiency of the overall reductive dechlorination process by providing multiple pathways for contaminant degradation in groundwater.

Example of CRS

For a list of treatable contaminants with the use of CRS, view the Range of Treatable Contaminants Guide.

Chemical Composition

• Water	7732-18-5
• Ferrous Gluconate	299-29-6

Properties

- Appearance – Dark green to black
- Odor – Odorless
- pH 6.0 to 8.0
- Density – Approximately 1.0 grams per cubic centimeter (0.9 to 1.1 g/cc)
- Solubility – Miscible
- Vapor Pressure – None
- Non-hazardous

Storage and Handling Guidelines

Storage

Store in original tightly closed container

Store away from incompatible materials

Recommended storage containers: plastic-lined steel, plastic, glass, aluminum, stainless steel, or reinforced fiberglass

Store in a cool, dry, well-ventilated place

Keep away from extreme heat and strong oxidizing agents

Handling

Avoid prolonged exposure

Observe good industrial hygiene practices

Wear appropriate personal protective equipment

Avoid contact with eyes, skin, and clothing

Avoid breathing spray mist

Use with adequate ventilation

Attachment 1

CHEMICAL REDUCING SOLUTION

CRS® Technical Description

Applications

- Permanent injection wells
- Direct-push injection points

Application instructions for this product are contained in the CRS Application Instructions.

Health and Safety

The manufacturer lists no ingredients as hazardous according to OSHA 29 CFR 1910.1200. Observe good industrial hygiene practices. Wash hands after handling. Store away from incompatible materials. Dispose of waste and residues in accordance with local authority requirements. Please review the CRS PLUS Material Safety Data Sheet for additional storage, usage, and handling requirements.

REGENESIS®

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949.366.8000

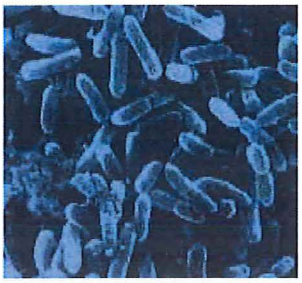
Attachment 1

BIO-DECHLOR INOCULUM

BDI PLUS® Technical Description

Bio-Dechlor INOCULUM Plus (BDI PLUS®) is an enriched natural consortium containing species of Dehalococcoides sp. (DHC). BDI PLUS has been shown to simulate the rapid and complete dechlorination of chlorinated solvents such as tetrachloroethene (PCE), trichloroethene (TCE), dichloroethene (DCE) and vinyl chloride (VC) to non-toxic end products, ethene, carbon dioxide and water.

The culture also contains microbes capable of dehalogenating halomethanes (e.g., carbon tetrachloride and chloroform) and haloethanes (e.g., 1,1,1-TCA and 1,1-DCA) as well as mixtures of these contaminants.



Species of Dehalococcoides sp. (DHC)

For a list of treatable contaminants with the use of BDI PLUS, view the Range of Treatable Contaminants Guide

Chemical Composition

- Non-hazardous, naturally-occurring, non-altered anaerobic microbes and enzymes in a water-based medium.

Properties

- Appearance – Murky, yellow to grey water
- Odor – Musty
- pH 6.0 to 8.0
- Density – Approximately 1.0 grams per cubic centimeter (0.9 to 1.1 g/cc)
- Solubility – Soluble in Water
- Vapor Pressure – None
- Non-hazardous

Storage and Handling Guidelines

Storage

Store in original tightly closed container

Store away from incompatible materials

Recommended storage containers: plastic lined steel, plastic, glass, aluminum, stainless steel, or reinforced fiberglass

Store in a cool, dry area at 4-5°C (39 - 41°F)

Material may be stored for up to 3 weeks at 2-4°C without aeration

Handling

Avoid prolonged exposure

Observe good industrial hygiene practices

Wear appropriate personal protective equipment

Attachment 1

BIO-DECHLOR INOCULUM

BDI PLUS® Technical Description

Applications

- BDI PLUS is delivered to the site in liquid form and is designed to be injected directly into the saturated zone requiring treatment.
- Most often diluted with de-oxygenated water prior to injection into either hydraulic push injection points or properly constructed injection wells.
- The typical dilution rate of the injected culture is 10 gallons of deoxygenated water to 1 liter of standard BDI PLUS culture.

Application instructions for this product are contained here BDI PLUS Application Instructions.

Health and Safety

Material is non-hazardous and relatively safe to handle; however avoid contact with eyes and prolonged contact with skin. OSHA Level D personal protection equipment including: vinyl or rubber gloves and safety goggles or a splash shield are recommended when handling this product. An eyewash station is recommended. Please review the Material Safety Data Sheet for additional storage, usage, and handling requirements here: BDI PLUS SDS.

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949.366.8000

Attachment 2

REGENESIS

Project Information		
One Hour Martinizing		
Elm Grove, WI		
Area A ERD		
Prepared For:		
EFI		
Target Treatment Zone (TTZ) Info	**Unit**	**Value**
Treatment Area	ft^2	4,000
Top Treat Depth	ft	15.0
Bot Treat Depth	ft	25.0
Vertical Treatment Interval	ft	10.0
Treatment Zone Volume	ft^3	40,000
Treatment Zone Volume	cy	1,481
Soil Type	---	sand
Porosity	cm^3/cm^3	0.33
Effective Porosity	cm^3/cm^3	0.20
Treatment Zone Pore Volume	gals	98,743
Treatment Zone Effective Pore Volume	gals	59,844
Fraction Organic Carbon (foc)	g/g	0.002
Soil Weight	lbs	4.3E+06
Hydraulic Conductivity	ft/day	25.0
Hydraulic Conductivity	cm/sec	8.82E-03
Hydraulic Gradient	ft/ft	0.003
GW Velocity	ft/day	0.38
GW Velocity	ft/yr	137
Sources of 3-D Microemulsion Demand	**Unit**	**Value**
Dissolved Phase Mass	lbs	0
Sorbed Phase Contaminant Mass	lbs	1
Competing Electron Acceptor Mass	lbs	74
Stoichiometric 3DME Demand	**lbs**	**78**
TTZ Groundwater Mass Flux	L/day	1,062
CVOC Mass Flux through TTZ	lb/yr	0
CEA Mass Flux through TTZ	lb/yr	77
Total Mass Flux through TTZ	lb/yr	77
Total Mass Flux 3DME Demand	**lbs**	**240**
Application Dosing		
3-D Microemulsion to be Applied	**lbs**	**3,200**
CRS to be Applied	**lbs**	**1,600**
BDI Plus to be Applied	**liters**	**30**
HRC Primer to be Applied	**lbs**	**0**

3-D Microemulsion®, BDI® Plus, CRS® Application Design Summary

Area A ERD		Field App. Instructions
Application Method	**Direct Push**	
Spacing Within Rows (ft)	8	**Spacing is approximate, may be modified in the field.**
Spacing Between Rows (ft)	16	
Application Points	**30**	
Areal Extent (square ft)	4,000	
Top Application Depth (ft bgs)	15	**Field Mixing Ratios**
Bottom Application Depth (ft bgs)	25	3DME Concentrate per Pt (lbs)
3DME to be Applied (lbs)	**3,200**	107
3DME to be Applied (gals)	383	Mix Water per Pt (gals)
3DME Mix %	8%	147
Volume Water (gals)	**4,410**	3DME Mix Volume per Pt (gals)
3DME Mix Volume (gals)	4,793	160
CRS to be Applied (lbs)	**1,600**	CRS Volume per Pt (gals)
CRS Volume (gals)	183	6
BDI Plus to be Applied (L)	**30**	BDI Volume per Pt (L)
BDI Mix Water Volume (gals)	300	1.0
Total Application Volume (gals)	**5,284**	Volume per pt (gals)
Estimated Radius of Injection (ft)	4	176
Prepared by: Doug Davis-Sr. Design Specialist		Volume per vertical ft (gals)
Date: 3/13/2018		18

Technical Notes/Discussion

Assumptions/Qualifications

In generating this preliminary estimate, Regenesis relied upon professional judgment and site specific information provided by others. Using this information as input, we performed calculations based upon known chemical and geologic relationships to generate an estimate of the mass of product and subsurface placement required to affect remediation of the site.

REGENESIS developed this Scope of Work in reliance upon the data and professional judgments provided by those whom completed the earlier environmental site assessment(s). The fees and charges associated with the Scope of Work were generated through REGENESIS' proprietary formulas and thus may not conform to billing guidelines, constraints or other limits on fees. REGENESIS does not seek reimbursement directly from any government agency or any governmental reimbursement fund (the "Government"). In any circumstance where REGENESIS may serve as a supplier or subcontractor to an entity which seeks reimbursement from the Government for all or part of the services performed or products provided by REGENESIS, it is the sole responsibility of the entity seeking reimbursement to ensure the Scope of Work and associated charges are in compliance with and acceptable to the Government prior to submission. When serving as a supplier or subcontractor to an entity which seeks reimbursement from the Government, REGENESIS does not knowingly present or cause to be presented any claim for payment to the Government.

Attachment 2

REGENESIS

Project Information		
One Hour Martinizing		
Elm Grove, WI		
Area B ERD		
Prepared For:		
EFI		
Target Treatment Zone (TTZ) Info	**Unit**	**Value**
Treatment Area	ft^2	400
Top Treat Depth	ft	15.0
Bot Treat Depth	ft	25.0
Vertical Treatment Interval	ft	10.0
Treatment Zone Volume	ft^3	4,000
Treatment Zone Volume	cy	148
Soil Type	---	sand
Porosity	cm^3/cm^3	0.33
Effective Porosity	cm^3/cm^3	0.20
Treatment Zone Pore Volume	gals	9,874
Treatment Zone Effective Pore Volume	gals	5,984
Fraction Organic Carbon (foc)	g/g	0.002
Soil Weight	lbs	4.3E+05
Hydraulic Conductivity	ft/day	25.0
Hydraulic Conductivity	cm/sec	8.82E-03
Hydraulic Gradient	ft/ft	0.003
GW Velocity	ft/day	0.38
GW Velocity	ft/yr	137
Sources of 3-D Microemulsion Demand	**Unit**	**Value**
Dissolved Phase Mass	lbs	0
Sorbed Phase Contaminant Mass	lbs	0
Competing Electron Acceptor Mass	lbs	7
Stoichiometric 3DME Demand	**lbs**	**8**
TTZ Groundwater Mass Flux	L/day	425
CVOC Mass Flux through TTZ	lb/yr	0
CEA Mass Flux through TTZ	lb/yr	31
Total Mass Flux through TTZ	lb/yr	31
Total Mass Flux 3DME Demand	**lbs**	**96**
Application Dosing		
3-D Microemulsion to be Applied	**lbs**	**1,200**
CRS to be Applied	**lbs**	**400**
BDI Plus to be Applied	**liters**	**6**
HRC Primer to be Applied	**lbs**	**0**

3-D Microemulsion®, BDI® Plus, CRS® Application Design Summary

Area B ERD	
Application Method	**Direct Push**
Spacing Within Rows (ft)	8
Spacing Between Rows (ft)	8
Application Points	**6**
Areal Extent (square ft)	400
Top Application Depth (ft bgs)	15
Bottom Application Depth (ft bgs)	25
3DME to be Applied (lbs)	**1,200**
3DME to be Applied (gals)	144
3DME Mix %	5%
Volume Water (gals)	**2,732**
3DME Mix Volume (gals)	2,876
CRS to be Applied (lbs)	**400**
CRS Volume (gals)	46
BDI Plus to be Applied (L)	**6**
BDI Mix Water Volume (gals)	60
Total Application Volume (gals)	**2,983**
Estimated Radius of Injection (ft)	7

Field App. Instructions

Spacing is approximate, may be modified in the field. Three of the 6 borings will be angled.

Field Mixing Ratios
3DME Concentrate per Pt (lbs)
200
Mix Water per Pt (gals)
455
3DME Mix Volume per Pt (gals)
479
CRS Volume per Pt (gals)
8
BDI Volume per Pt (L)
1.0
Volume per pt (gals)
497
Volume per vertical ft (gals)
50

Prepared by: Doug Davis-Sr. Design Special
Date: 3/13/2018

Technical Notes/Discussion

Assumptions/Qualifications

In generating this preliminary estimate, Regenesis relied upon professional judgment and site specific information provided by others. Using this information as input, we performed calculations based upon known chemical and geologic relationships to generate an estimate of the mass of product and subsurface placement required to affect remediation of the site.

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