REMEDIAL ACTION WORK PLAN

FOR:

VAILS GATE
MANUFACTURING, LLC
1073 ROUTE 94
VAILS GATE, NEW YORK

Leader
CONSULTING SERVICES

2813 WEHRLE DR., SUITE 1
WILLIAMSVILLE, NY 14221
716-565-0963
LEADERCS.COM

APRIL 2014

REMEDIAL ACTION WORK PLAN

IN-SITU BIOREMEDIATION OF AREA OF CONCERN 6 (AOC 6) AT VAILS GATE MANUFACTURING, LLC.
1073 ROUTE 94
VAILS GATE, NEW YORK
NYSDEC SITE NO. 336065

Prepared For:

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C/O
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Prepared By:

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April 2014

Project No. 737.003

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

1.0 INTRODUCTION

Leader Consulting Services Inc. ("Leader") was retained by Damon Morey, LLP, on behalf of Stora Enso, to prepare a Remedial Action Work Plan ("RAWP") to implement the In-situ bioremediation remedial alternative selected for Area of Concern 6 ("AOC 6") at the Vails Gate Manufacturing, LLC site ("the Site") in Vails Gate, New York. In-situ bioremediation was the selected remedial alternative identified in the February 2014 Corrective Measure Study ("CMS") for the Site. The CMS was approved for implementation by the New York State Department of Environmental Conservation ("NYSDEC") on March 7, 2014.

In March of 2012, Leader completed a Phase II Supplemental RCRA Facility Investigation ("RFI") report for the Vails Gate Manufacturing, LLC Site (formerly known as the Tarkett Site) that identified the presence of chlorinated solvents in excess of New York State Department of Environmental Conservation ("NYSDEC") standards in groundwater samples collected from three (3) monitoring wells (i.e., MW-5A/AR, MW-14 and MW-16). Two of these wells (i.e., MW-5A/AR and MW-14) had originally been installed to assess groundwater quality conditions near the belowground oil/water separator system, identified as Area of Concern 6 ("AOC 6"). The oil/water separator and ancillary tanks and vaults were remediated and closed as part of Interim Remedial Measure ("IRM") activities in 2007.

Based upon a review of the Phase II Supplemental RFI report, the NYSDEC requested that a CMS be developed to address the volatile organic compound ("VOC") groundwater contamination associated with AOC 6. The CMS identified general response actions, evaluated remedial technologies, and formulated and evaluated potential remedial action alternatives for the Site. The CMS process involved the identification of specific response actions, where a response was deemed necessary, to protect public health and the environment. Technologies for each response action were identified and preliminarily screened on the basis of their effectiveness and technical feasibility. The CMS evaluated remedial alternatives on the basis of effectiveness and implementability (Phase II FS). Those alternatives passing the Phase II FS underwent a detailed evaluation which considered: 1) overall protection of human health and the environment; 2) compliance with SCGs; 3) long term effectiveness and performance; 4) reduction of toxicity, mobility, and volume; 5) short term effectiveness; 6) implementability; 7) cost effectiveness; 8) community acceptance; and 9) land use. Alternatives were qualitatively compared to identify environmentally sound and cost effective remedial actions for the Site.

Based upon the evaluation of the remedial alternatives, In-situ bioremediation was the selected remedial alternative recommended for AOC 6 at the Site. This alternative involves the in-place biotreatment of the chlorinated contaminants associated with AOC 6. The In-situ bioremediation alternative was approved for implementation by NYSDEC on March 7, 2014.

The Site-specific Standards, Criteria and Guidance ("SCGs") applicable to this RAWP have been selected to meet the overall Remedial Action Objectives ("RAOs") of the CMS. An "unrestricted use remedy" has been established for the Site, which is based on the regulatory standard values for Class GA groundwater identified in 6 NYCRR Part 703.5. This In-situ bioremediation RAWP has been designed to address the SCGs and RAOs for the Site. This RAWP has been developed in accordance with NYSDEC Department of Environmental Remediation ("DER") Guidance Document DER-10 *Technical Guidance for Site Investigation and Remediation*, Chapter 5, *Remedial Design/Remedial Action*, Subsection 5.3, *Remedial Action Work Plan.*

2.0 REMEDIAL ACTIVITY DESCRIPTION

2.1 SITE PREPARATION AND MOBILIZATION

2.1.1 Notifications

Damon Morey, LLP will notify NYDEC DER no later than seven (7) calendar days prior to initiating any field activities identified in this RAWP, in accordance with DER-10, Chapter 1, Section 1.4(c). In addition, the Vails Gate Business Park ("VGBP") owner, Kessler Development, Company, and the Built NY distribution business within the Main Building near AOC 6 will be notified of upcoming remedial activities at the Site.

2.1.2 Utility Clearance

In-situ bioremediation requires the injection of bioremediation media into the subsurface of the selected application area. Mobile drilling equipment will be used to create subsurface penetrations near the Main Building of the VGBP to achieve the required depths for media injection. In preparation for these activities, a private utility location service will be retained to identify underground utilities at or near the proposed injections point ("IP") locations. The purpose of this effort is to limit the risk of interrupting necessary services (e.g., gas, electric and water) or damaging on-Site utility lines/pipes that supply the on-Site businesses within the VGBP, and to ensure the safety of the drilling contractor during injection activities.

2.1.3 Required Bioremediation Equipment and Material

The drilling contractor will utilize a geoprobe mobile drilling unit, pumps, 55-gallon mixing containers, and a 500-gallon poly tank for water storage during bioremediation injection activities. The bioremediation injection media will be contained in two (2) 400 pound poly containers, and one (1) 18-liter container. The materials will be temporarily staged near the Built NY distribution business warehouse, at a location approved by the current Site owner.

2.1.4 On-Site Water Usage

Application of the bioremediation media will require mixing of the media with municipal tap water. It is anticipated that approximately 900 gallons of water will be needed to create the specified media mixture, and an additional amount (i.e., less than 100 gallons) for decontamination of equipment. The availability of on-Site municipal water, and monetary compensation for the water consumed during remedial activities will be negotiated with the current Site owner.

2.1.5 Work Area Security

The application area of AOC 6 is located immediately adjacent to the Built NY distributorship loading dock on the west side of the Main Building. The adjacent access

road experiences vehicular traffic. Temporary fencing will be erected within the specific areas of AOC 6 where biotreatment activities will be occurring, while maintaining access to the loading dock and allowing for continuous access to vehicular traffic to businesses located at the south end of the Main Building. Appendix A provides greater detail concerning Site Control.

2.2 IN-SITU BIOREMEDIATION ACTIVITIES AND TECHNOLOGIES

This section identifies the materials and processes necessary to apply the selected bioremediation media to the subsurface at AOC 6.

2.2.1 Bioremediation Media

The area proposed for treatment is impacted by specific chlorinated VOCs. Two (2) distinct materials will be applied as bioremediation media at AOC 6. An enhanced anaerobic bioremediation material developed by Regenesis Corp., 3-D Microemulsion® ("3D") Factory Emulsified, designed specifically to enhance anaerobic bioremediation of chlorinated solvents, will be used. Enhanced anaerobic bioremediation is a method to accelerate the natural attenuation of chlorinated solvents by adding a fermentable carbon source to the subsurface. The carbon source is fermented by native microorganisms to produce hydrogen, which is utilized by native or introduced microorganisms to accelerate degradation of chlorinated hydrocarbons through a process called reductive dechlorination. 3D will be applied as a method to accelerate natural attenuation of the chlorinated compounds detected within AOC 6. 3D is engineered to be applied as a dilute suspension with unique subsurface distribution characteristics. Once emplaced in the subsurface, 3D will provide a controlled release of organic acids to the aquifer to stimulate reductive dechlorination in the aquifer for 2-3 years on average.

In addition, Bio-Dechlor INOCULUM® Plus ("BDI"), a natural microbial consortium containing species of Dehalococcoides sp. ("DHC"), also developed by Regenesis, will be applied to the subsurface in AOC 6. This microbial consortium has been enriched to increase its ability to rapidly dechlorinate contaminants such as tetrachloroethene ("PCE"), trichloroethene ("TCE"), dichloroethene ("DCE") and vinyl chloride ("VC") during in-situ bioremediation processes. In many instances the necessary microbes responsible for reductive dechlorination will be "cultured" in place after a period of time in the presence of a carbon source such as 3D. Addition of BDI Plus will result in the direct application to the subsurface (i.e., seeding) of a bacterial population capable of complete reductive dechlorination to ethene. BDI is an enhancement which is anticipated to accelerate the bioremediation process and/or minimize the potential for temporary build up of daughter products (e.g., cis-1,2-DCE) in the dissolved phase, which is commonly observed during reductive dechlorination. The amount of bioremediation media to be applied to AOC 6 was estimated by Regenesis based on empirical equations that take into account the contaminant levels, soil conditions and groundwater conditions. The remedial design requires 800 pounds of 3D and 12 Liters of BDI be applied to AOC 6. Table 2-1, Remedial Design Specifications, shows the loading amounts for each Injection Point ("IP") at AOC 6.

2.2.2 Remedial Design and Application of Bioremediation Media

The overall dimension of the treatment area is 30' x 30', covering 900 square feet. The injection point spacing is ten feet (10') on center within rows, fifteen feet (15') on center between rows. Six (6) injection points ("IPs") will be required. A ten feet (10') vertical treatment thickness will be achieved by beginning injection at a sixteen foot (16') depth, continuing up to a six foot (6') depth as the injection rods are withdrawn. After completion of the injections, each IP will be sealed with bentonite and an asphalt surface seal. Figure 2, Site Plan provides the location of AOC 6 to be treated and the IP locations within the treatment area.

2.2.3 Bioremediation Injection Process

2.2.3.1 3-D Microemulsion® Factory Emulsified Injection Process

The application of the dilute factory emulsified 3D will be accomplished by batch injection via direct-push points ("DPI"). The 3D will be pumped from the vendor container into a graduated temporary holding tank (e.g., metal drum, poly tank, etc.) The holding tank is used for mixing and diluting the 3D with the prescribed volume of water (see Table 2-1). The tank is graduated to measure the amount of material that is pumped into each injection point, as prescribed. The 3D is pumped from the mixing/holding tank to the geoprobe unit and a one and one half inch (1½") inside diameter ("ID") injection rod. The 3D is pumped under pressure or gravity feed into the subsurface at the IP at the volume and depth recommended in Table 2-1. If the subsurface does not readily accept the volume as designed, the contractor can reduce the amount of water, thereby lowering the volume of subsequent batches.

2.2.3.2 Bio-Dechlor INOCULUM® Plus Application Process

The BDI will be applied within the same injection points, in the same manner, and at the same time as the 3D. As recommended by Regenesis, the following application approach must be followed to allow for concurrent application of 3D and BDI:

- The BDI and 3D must be contained in separate holding tanks prior to injection. As per the BDI application specifications, the mix water for BDI must be purged of oxygen (typically using a nitrogen purge) prior to mixing with BDI product; and
- The injection of 3D and BDI can occur in either of the two fashions: 1) BDI can be injected from the top of the subsurface to be treated (6'depth) to the bottom of the IP (16' depth) i.e. " top to bottom", and then upon retrieval, the 3D can be applied from the bottom of the IP to the top of the desired treatment depth (6') or; 2) the 3D can be injected, starting at the bottom of the IP, ascend upward to a designated depth, and then BDI applied for approximately one (1) foot, then reapplying the 3D as the injection probe ascends. This process should be repeated until the quantities of BDI and 3D have been applied within the ten (10) foot treatment column in each IP as described in Table 2-1.

2.3 DECONTAMINATION

Contamination Control Zones will be maintained to prevent the spread of contamination and to prevent unauthorized people from entering AOC 6. If work activities require Level D protection, decontamination procedures will be limited to the equipment used to inject the bioremediation solution into the subsurface. Solid materials (i.e., soils) that adhere to the exterior of the equipment will be manually removed using buckets of water and alconox detergent. The waste water will be contained in a waste drum and transported off-Site for appropriate disposal. The interior surfaces of the equipment will be transported to a secured decontamination ("decon") pad located near AOC 6 and cleaned. The remaining solids will be collected and drummed, and the contained liquid waste water will be transported for appropriate disposal.

In the unlikely event that Level C protection is necessary to complete the project, all personnel working in the contaminated zone must undergo personal decontamination prior to entering the support zone. Contaminated clothing and equipment leaving a contaminated area will be appropriately disposed of or decontaminated. Decontamination procedures will be monitored by the Health and Safety Coordinator ("H&SC") to assess their effectiveness and appropriate steps will be taken to correct any deficiencies. Decontamination will be completed in areas that will limit the exposure of uncontaminated employees or equipment. The personnel decontamination will consist of the following stations:

- Station 1 - Personnel leaving the contaminated zone will remove the gross contamination from their outer clothing and boots. Washing or wiping down outer protective clothing may be necessary.
- Station 2 - Personnel will remove their outer garment and gloves and deposit them in the lined waste receptacles. Personnel will then decontaminate their hard hats, and boots with an aqueous solution of Alconox or other appropriate cleaning solution.

Biotreatment application technology requires a minimum of subsurface soil disturbance, and minimizes the potential exposure of potentially contaminated soil or groundwater to on-Site personnel, equipment and surrounding environment. The bioremediation treatment solutions are non-toxic and non-hazardous, and require no decontamination.

2.4 HEALTH AND SAFETY CONSIDERATIONS

Appendix A provides a Health and Safety Plan ("HASP") for activities at the Site. Based on an assessment of the proposed activities to implement this RAWP and their potential to impact the nearby community and surrounding environment, the development of a Remedial Action Monitoring Plan ("RAMP") and a Community and Environmental Monitoring Response Plan ("CERP"), as described in DER-10 Chapter 5, *Remedial Design/Remedial Action*, Section 5.1 will not be required. Site soils will be relatively undisturbed, and a release of airborne contaminants that could impact the surrounding community and environment is negligable. However, a Community Air Monitoring Plan ("CAMP") for the intrusive portion of the remedial program is included in Section 14.2 of Appendix A.

3.0 GROUNDWATER MONITORING PROGRAM

3.1 GROUNDWATER MONITORING PROGRAM OBJECTIVES

The primary objective of biotreatment at AOC 6 is to reduce the concentration of VOCs within the groundwater to levels at or below NYSDEC Class GA groundwater standards. The groundwater monitoring program for this RAWP has been designed to assess the effectiveness of the bioremediation media application in AOC 6 over time. To accomplish this, the following activities will be completed:

- Measure groundwater flow conditions (i.e., groundwater elevation and flow direction);
- Measure the reduction/oxidation conditions of the treated area over time to assess the ability of the treatment process to effectively reduce chlorinated VOC concentrations within the treated area;
- Measure the concentration of indicator parameters to assess bioremediation activity in the treated area; and
- Measure the concentrations of VOCs within the groundwater.

3.2 GROUNDWATER MONITORING SAMPLING LOCATIONS

Groundwater monitoring will be completed at monitoring wells MW-CHA-RFI-7, MW 5A/AR, MW-14 and MW-16. Samples collected from MW-CHA-RF- 7 will provide data representative of groundwater conditions upgradient of AOC 6 while samples from MW 5A/AR, MW-14 and MW-16 will be representative of groundwater conditions potentially impacted by the former oil/water separator in AOC 6.

3.3 GROUNDWATER SAMPLE PARAMETERS

3.3.1 Field Parameters

During groundwater sampling efforts, the depth to the groundwater surface from the top of the riser of each well will be measured using a Solinst Model # 101 Water Level Meter. The groundwater elevation will then be calculated based on the surveyed monitoring points. The monitoring well elevations have been previously established (see Section 2.9 of the 2012 Phase II RFI report). A groundwater contour map will be developed based on quarterly data generated from each sampling event.

Groundwater monitoring field instrumentation will be used to collect data for the reduction/oxidation parameters of pH, temperature, dissolved oxygen ("DO"), oxidation reduction potential ("ORP") and turbidity.

3.3.2 Laboratory Analysis

Groundwater samples will be collected from each of the four (4) monitoring wells and analyzed for the water quality parameters of sulfate, dissolved iron, and Total Organic Carbon ("TOC"), in addition to VOC analysis. Initial baseline sampling and analysis (pre-injection) of the four (4) wells will also include nitrate, total and dissolved iron and manganese and dissolved gases methane, ethane and ethene. The additional baseline parameters will be included to allow for future assessment of the level of bioremediation activity in the subsurface if VOC concentrations do not decline at a rate that would be expected.

3.4 GROUNDWATER MONITORING SCHEDULE

Prior to bioremediation media injection at AOC 6, each of the four (4) groundwater monitoring wells will be sampled for the field and laboratory parameters identified in Section 3.3 to assess baseline (pre-injection) groundwater quality conditions. Three (3) months after injection, routine quarterly sampling of each of the wells for field and laboratory parameters will be initiated. The delay between injection and the first round of quarterly sampling allows for the treatment media to impact water quality at a measurable level. Table 3-1 provides a tentative schedule of sampling events for AOC 6 at the Site.

It is anticipated that biotreatment media will be active for 24-36 months after application. Based upon the periodic review and evaluation of the data generated from the quarterly sampling program, the effectiveness and completeness of the bioremediation project will be assessed. If the results of in-situ bioremediation of AOC 6 indicate that the CMS RAO objectives have been met (i.e., overall protection of human health and the environment, as expressed by lowering the concentration of chlorinated compounds in groundwater at or below Class GA groundwater quality standards) groundwater monitoring will be discontinued. If chlorinated compounds remain within the groundwater at AOC 6 above the Class GA groundwater quality standards after the two (2) year proposed monitoring period, Site condition indicators will be assessed to evaluate if the treatment media appears to remain active in the subsurface. Based on this evaluation, it will be determined whether continued monitoring beyond the two (2) year period is warranted, or if a second application of treatment media would be effective in reducing chlorinated compound concentrations over the long-term.

3.5 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Field activities will be conducted in general accordance with NYSDEC protocols, the HASP in Appendix A, and the CHA 2006 Quality Assurance Project Plan ("QAPP", Appendix B of the RCRA Facility Investigation Work Plan, June 2006). Laboratory analysis and data reporting will conform to NYSDEC Analytical Services Protocol ("ASP") Category B reporting requirements for the VOC analysis portion of the monitoring program.

The post-remediation groundwater monitoring program to be implemented at the Site will require the collection of unique field data parameters in addition to those identified in Chapter 4.0 *Quality Assurance Objectives for Measurement Data*, Section 4.4, *Field Measurements* of the QAPP. To assess the level of bioremediation activity in the subsurface, dissolved oxygen, reduction/oxidation ("ReDox") potential and turbidity will be quantified in the field using parameter-specific, calibrated field instrumentation.

4.0 REPORTING REQUIREMENTS/SCHEDULE

A letter report will be submitted to NYSDEC on a quarterly basis (see Table 3-1). The reports will include a review and analysis of the groundwater data generated from the most recent sampling event to assess biotreatment activity, and will include the raw laboratory data and associated data summary tables. The reports will be prepared after receipt of final quarterly data from the analytical laboratory and a review of the data. The quarterly reports are expected to be generated between four (4) to six (6) weeks from the end of the sampling quarter.

5.0 SITE MANAGEMENT PLAN

A Site Management Plan ("SMP") will be prepared and submitted six (6) months prior to the completion of the two (2) year monitoring program discussed in Section 3 of this RAWP. The SMP will include the following items:

1) Institutional and Engineering Control ("IEC") Plan - If institutional actions are needed, an IEC plan will be included in the SMP. The IEC will identify all use restrictions and engineering controls for the Site and detail the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective:

    - Institutional Controls: The Environmental Easement discussed in Section 6.0;
    - Engineering controls: Maintenance of the Site cover in areas of near surface soil contamination (if any), the currently installed sub-slab depressurization system and any future systems installed or any future system modifications made at the Site;
    - Descriptions of the provisions of the environmental easement including any land use, and groundwater use restrictions;
    - An Excavation Plan which details the provisions for management of future excavation activities;
    - A provision for evaluation of the potential for soil vapor intrusion for any buildings reused or developed on the Site, including provision for implementing actions recommended to address exposures related to soil vapor intrusion;
    - Descriptions of the provisions of the environmental easement including any land use, and groundwater use restrictions;
    - Provisions for the management and inspection of the identified engineering controls;
    - Maintaining Site access controls and Department notification; and
    - The steps necessary for the periodic reviews and certification of the institutional and/or engineering controls.

2) Monitoring Plan – If residual concentrations of VOCs are present at the end of the two (2) year RAWP monitoring program, additional periodic monitoring will be included in the SMP. The Monitoring plan may include:

- Monitoring of groundwater, soil vapor, sub-slab vapor, and indoor air to assess the performance and effectiveness of the remedy;
- A schedule of monitoring and frequency of submittals to the Department; and
- Monitoring for vapor intrusion for any buildings developed on the site, as may be required by the Institutional and Engineering Control Plans discussed above.

b.) Operations and Maintenance ("O&M") Plan to ensure continued operation, maintenance, optimization, monitoring, inspection, and reporting of any mechanical or physical components of the remedy. The O&M plan may include:

- Compliance monitoring of treatment systems to ensure proper O&M as well as providing the data for any necessary permit or permit equivalent reporting;
- Maintaining Site access controls and Department notification; and
- Providing the Department access to the Site and O&M records.

6.0 INSTITUTIONAL CONTROLS

Following completion of the remedial action and monitoring program, institutional actions may be implemented for the Site, which may include restricting on-Site groundwater use and limiting subsurface activities near AOC 6. Appendix B includes a copy of the agreement between the Site owner and Stora Enso. Note that institutional actions may not be necessary based on the post-remediation conditions. Proposed Institutional Controls, to be in the form of an environmental easement. Would include the following items:

1) Remedial party or Site owner competes and submits to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8(h)(3);
2) Allows the use and development of the controlled property for commercial and industrial uses as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
3) Engineering controls: Maintenance of the Site cover in areas of near surface soil contamination (if any), the currently installed sub-slab depressurization system and any future systems installed or any future system modifications made at the Site;
4) Restricts the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDOH or County DOH; and
5) Owner consent that a DEC-approved SMP will be implemented in the future.

7.0 CERTIFICATION

I, Jeffrey A. Wittlinger, PE., BCEE, certify that I am currently a NYS registered Professional Engineer and that this Remedial Action Work Plan was prepared in accordance with applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Jeffrey A. Wittlinger P.E, BCEE

TABLES

TABLE 2-1

REMEDIAL DESIGN SPECIFICATIONS FOR THE VAILS GATE MANUFACTURING, LLC DISSOLVED PLUME

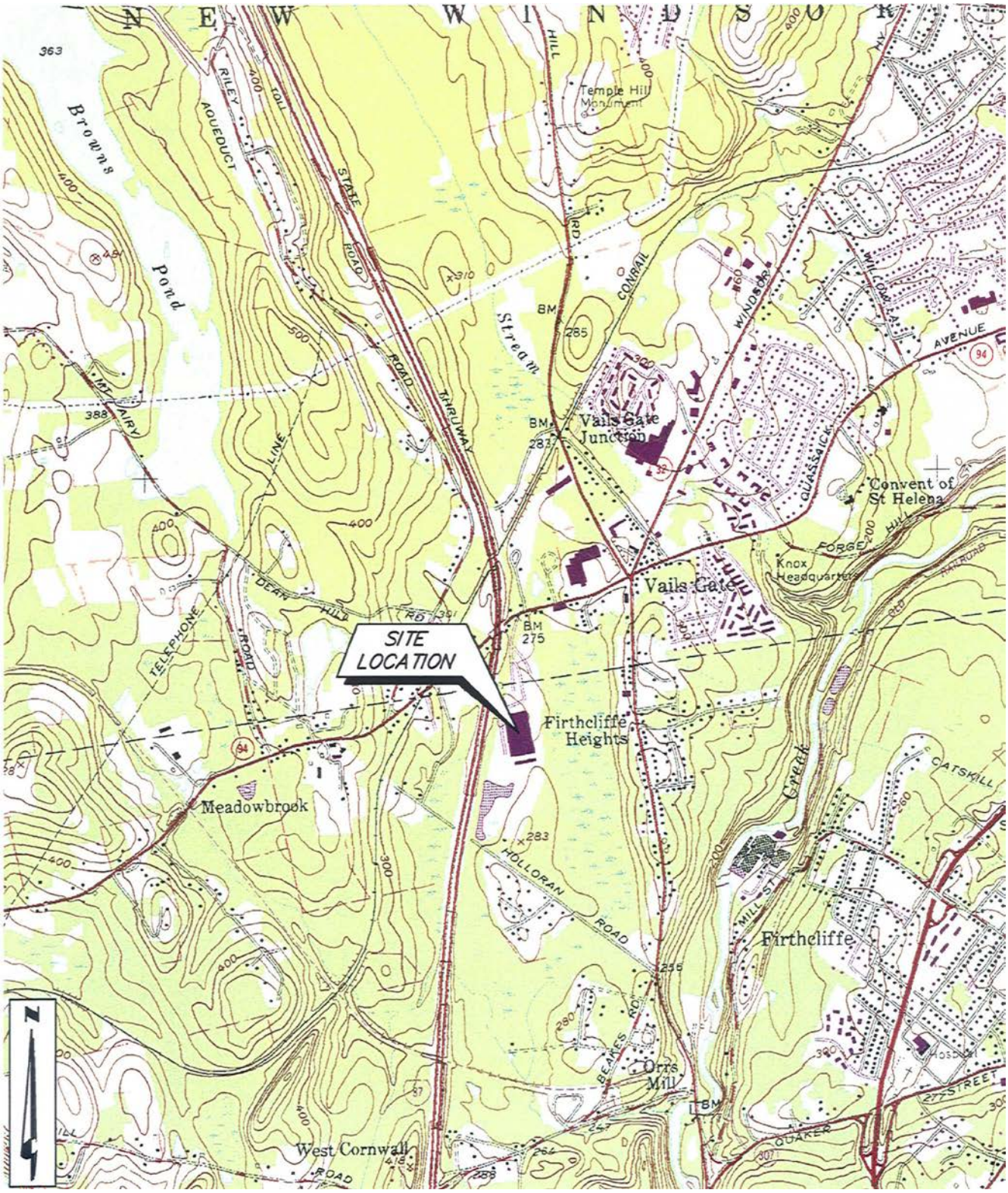
Design Specifications	Quantity	Units
Injection Point Spacing within rows	10	ft. on center
Injection Point Spacing between rows	15	ft. on center
Number of Injection Points	6	----
Treatment Areal Extent	900	$ft.^2$
Top of Treatment Interval	6	ft.
Bottom of Treatment Interval	16	ft.
Vertical Treatment Thickness	10	ft.
Product Quantities	**Quantity**	**Units**
Total 3-D Microemulsion - All Points	800	lbs.
	96	gallons
3-D Microemulsion - Per Point	133	lbs.
	16	gallons
Bio-Dechlor Inoculum Plus - All Points	12	liters
Bio-Dechlor Inoculum Plus –Per Point	2	liters
Field Mixing/Injection Ratios	**Quantity**	**Units**
Dilution Rate (% 3DMe)	10.0	%
Total Mixing Water (all Points)	863	gallons
Mixing Water per Point	144	gallons
Mixing Water per Foot	14	gallons
Total Volume Injected (all Points)	959	gallons
Total Volume Injected per Point	160	gallons
Total Volume Injected per Foot	16	gallons
Total Linear Footage to be Drilled	96	ft.

TABLE 3-1
GROUNDWATER MONITORING SCHEDULE*

Time (months after injection date)	**Groundwater Measurements**	**Redox**	**Laboratory Analysis**
Baseline sampling prior to injection of biotreatment media	X	X	Nitrate, Total and Dissolved Iron and Manganese, Sulfate, TOC, Dissolved gases methane, ethane, and ethene, and VOCs
Months 1-2	----	---	----
Month 3	X	X	Sulfate, TOC, Dissolved Iron and VOCs
Month 4			
Month 5			
Month 6	X	X	Sulfate, TOC, Dissolved Iron and VOCs
Month 7			
Month 8			
Month 9	X	X	Sulfate, TOC, Dissolved Iron and VOCs
Month 10			
Month 11			
Month 12	X	X	Sulfate, TOC, Dissolved Iron and VOCs
Month 13			
Month 14			
Month 15	X	X	Sulfate, TOC, Dissolved Iron and VOCs
Month 16			
Month 17			
Month 18	X	X	Sulfate, TOC, Dissolved Iron and VOCs
Month 19			
Month 20			
Month 21	X	X	Sulfate, TOC, Dissolved Iron and VOCs
Month 22			
Month 23			
Month 24	X	X	Nitrate, Total and Dissolved Iron and Manganese, Sulfate, TOC, Dissolved gases methane, ethane, and ethene, and VOCs

*Note : Based on a two-year quarterly monitoring program.

FIGURES



SOURCE: CHA March 10, 2011 RCRA Facility Investigation – Vapor Intrusion Investigation.

Title: Site Location Map 1073 Route 94, Vails Gate, New York	Leader Consulting Services, Inc. 2813 Wehrle Drive, Suite 1 Williamsville, New York 14221 (716) 565-0963 (716) 565-0964 (fax)	Project: 737.003 Date: 3/2014 Scale: N.T.S.	Drawn: HDK Checked: JAW File Name:	Figure: 1
Prepared For: Damon Morey LLP				

FEDERAL WETLANDS

TRANSFORMER AREA

FORMER SEPTIC SYSTEM

MW-CHA-RFI-1

APPROXIMATE LOCATION OF SEPTIC TANK

CONSOLIDATED RAIL CORPORATION

TILE FIELD

FORMER SETTLING CHAMBER

MW-12

PAVED PARKING

MW-13

MW-B16

AOC 6

PAVED DRIVEWAY

MW-5A/AR

MAINTENANCE

MW-B4

WATER

MW-CHA-RFI-2

FORMER OIL/WATER SEPARATOR AREA

MW-9

PAVED DRIVEWAY

RESEARCH BUILDING

SS-2

SS-3

SS-1

MW-B3

FORMER 20,000gal UNDERGROUND FUEL TANK

JUNCTION VAULT

MW-CHA-RFI-7 (CHA-RFI-B6)

MW-11

MW-16

MW-10

CONCRETE AREA

MW-14

MW-B2

MW-B6

LOADING PLATFORM

MANUFACTURING PLANT

MW-B1

MW-B5

MW-B13

PROPANE TANKS

PAVED PARKING

MW-8

STORAGE BUILDING

MW-CHA-RFI-5

NYSDEC WETLANDS

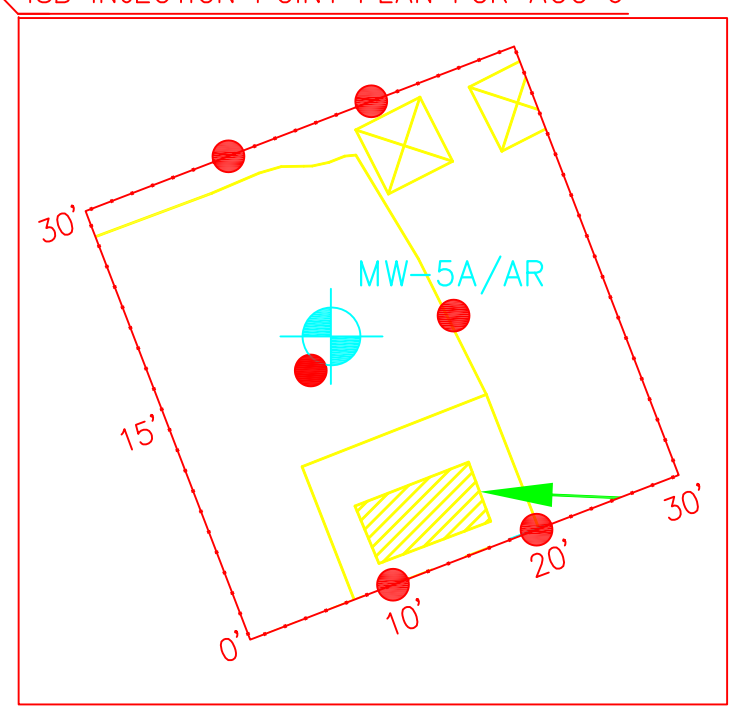
LEGEND

- Phase II RFI 2011 Monitoring Well Installation
- Existing Monitoring Well
- Injection Point

NOTES

1) Base map prepared by CHA
2) Phase II RFI test boring/monitoring well and sampling locations located by Leader based on standard surveying techniques.
3) Drawing considered accurate to the degree implied by the method used.

ALTERNATIVE 3
ISB INJECTION POINT PLAN FOR AOC 6



No.	Submittal / Revision	App'd	By	Date
1	Phase II RFI	KK	HK	9/2011
2	Corrective Measures Study	KK	HK	12/2012
3	Remedial Action Work Plan	KK	HK	3/2014

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Designed By: CHA	Date: 01/12/06
Drawn By: CHA	Date: 01/10/06
Revised by: The Leader Group	Date: 12/11/12

VAILS GATE
MANUFACTURING FACILITY
VAILS GATE, NEW YORK

REMEDIAL ACTION WORK PLAN

IN-SITU BIOREMEDIATION INJECTION POINT PLAN FOR AOC 6

Issue Date: 3/24/14 | Project No.: 737.003 | Scale: NTS

Figure No.
2

APPENDIX A
HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

IN-SITU BIOREMEDIATION AT AREA OF CONCERN 6 OF VAILS GATE MANUFACTURING, LLC.

1073 ROUTE 94

VAILS GATE, NEW YORK

NYSDEC SITE NO. 336065

Prepared For:

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April 2014

Project No.737.003

Table of Contents

APPENDICES

1. INTRODUCTION

Leader Consulting Services Inc. ("Leader") was retained by Damon Morey, LLP, on behalf of Stora Enso, to prepare a Remedial Action Work Plan ("RAWP") to implement the In-situ bioremediation remedial alternative selected for Area of Concern 6 ("AOC 6") at the Vails Gate Manufacturing, LLC site ("the Site") in Vails Gate, New York. In-situ bioremediation was the selected remedial alternative identified in the February 2014 Corrective Measure Study ("CMS") for the Site. The CMS was approved for implementation by the New York State Department of Environmental Conservation ("NYSDEC") on March 7, 2014.

This Health and Safety Plan ("HASP") has been prepared as Appendix A of the RAWP. This HASP has been developed in general accordance with 29 CRF 1910.120 and with the requirements identified in the NYSDEC Program Policy Department of Remediation ("DER") document DER-10/ Technical Guidance for Site Investigation and Remediation, Chapter 1, Section 1.9, as referenced by Chapter 5, Section 5.3(b)(4). This HASP has been developed to address direct push injection ("DPI") biotreatment activities to be completed within AOC 6 at the Site.

This plan is to be implemented by the Leader's project health and safety coordinator ("H&SC"). The H&SC will provide and implement the health and safety procedures for all project employees and any subcontractors ("Team") who may be exposed to hazardous conditions. Prior to field activities, field Team members are required to read and sign this Health and Safety Plan. Appendix A provides the Health and Safety Plan Approval/Sign Off Form. All site contractors will be responsible for their employees' health and safety while on-Site.

The HASP has been developed to provide a mechanism for providing safe working conditions at the Site during DPI activities. The safety organization, procedures, and protective equipment selected for this project have been established based upon a review of potential hazards. Specific hazard control methodologies have been evaluated and selected with the goal of reducing the potential for exposures and accident or injury. The content of this HASP may change based upon additional information made available to health and safety personnel, monitoring results, or changes in the technical scope of work. Such changes will be completed in the form of an addendum.

2. SITE DESCRIPTION

The Site was formerly used for the manufacture of vinyl floor tiles from the mid-1960s to 2005. Numerous environmental investigations have occurred at the Site from the 1990s to the present time. The buildings on the Site now comprise the Vails Gate Manufacturing, LLC business park. The Main Building on the Site consists primarily of fabrication facilities and distribution warehouses. Figure 2 of the RAWP provides the general layout of the Site.

Based on analytical information obtained on past groundwater monitoring well sampling events within AOC 6, it has been determined that 1,1 dichloroethane, 1,1, dichloroethene, 1,1,1 trichloroethane, chloroethane and vinyl chloride are residual groundwater contaminants from a former oil/water separator located within AOC 6.

3. POLICY STATEMENT

Leader developed this site-specific HASP based on the remedial activities proposed at AOC 6. The remedial contractor is responsible for its employee safety regarding all aspects of the project, including the use and maintenance of Site equipment (i.e., Geoprobe DPI equipment, etc.). Individuals associated with the project that are not employees of the contractor (e.g., NYSDEC staff members, business park employees, etc.) will be subject to the requirements identified in this HASP as administered by Leader. Leader's Project Management Team, including the H&SC will be responsible for the administration and implementation of this HASP.

The objective of this HASP is to provide a safe and healthy work environment for employees involved in Site work and excavation activities. No aspect of the operation is of greater importance than prevention of injury and illnesses. The Project Management Team will take reasonable steps to control hazards in order to limit the possibility of injury, illness, or accident. The HASP describes the procedures that must be followed during referenced Site activities. The provisions of this plan are mandatory for all personnel, as well as any visitors/workers assigned to the work area.

This HASP is not intended or represented to be suitable for re-use by the client or others in other work areas or any other project. Any re-use without prior written approval or adaptation by Leader will be at the user's risk and will not present liability and legal exposure to Leader. This HASP is site-specific and cannot be directly applied to other projects.

4. REFERENCES

This HASP generally complies with applicable Occupational Safety and Health Administration ("OSHA") regulations and U.S. Environmental Protection Agency ("USEPA") regulations. This plan generally follows the guideline established in the following:

- Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH, OSHA, USCG, EPA (86-116, October 1995);
- Title 29 of the Code of Federal Regulations, Part 1910.120, HAZWOPER;
- Title 29 of the Code of Federal Regulations, Part 1910.1200, Hazard Communication;
- Title 29 of the Code of Federal Regulations, Part 1910.1000, Air Contaminants;
- Title 29 of the Code of Federal Regulations, Part 1926;
- Pocket Guide to Chemical Hazards, DHHS, PHS, CDC, NIOSH (2001); and
- (NYSDEC) DEC Program Policy DER-10, Technical Guidance for Site Investigation and Remediation, May 3, 2010.

5. HEALTH AND SAFETY ORGANIZATION AND RESPONSIBILITIES

On-site personnel involved in DPI activities, including, but not limited to handling of bioremediation solutions, implementing injection procedures and processes and/or operating injection equipment must adhere to these procedures during the completion of their work. Each person is responsible for completing tasks safely, and reporting any unsafe acts or conditions to his or her immediate supervisor or to the H&SC. No person may work in a manner that conflicts with the safety and environmental procedures expressed herein.

All on-Site personnel involved with the project will be required to have received training in accordance with 29 CFR 1910.120 and be familiar with the requirements and procedures contained in this document prior to the beginning of the project operations. The role of key personnel is outlined in the following sections.

5.1 HEALTH AND SAFETY COORDINATOR

Leader's H&SC is responsible for the coordination of technical health and safety aspects of the project, including review and approval of this HASP. Any changes or addenda to this HASP must be approved by the H&SC.

The H&SC will be responsible for coordinating Site health and safety issues. The H&SC will observe on-Site activities, and will establish and oversee the project air-monitoring program. The H&SC is the Site contact concerning project health and safety. It is the responsibility of the H&SC or the H&SC-designated alternate to:

- Provide technical and practical input to policies and procedures associated with the project;
- Review operations to monitor compliance with this HASP;
- Maintain a daily logbook for recording significant health and safety activities, incidents and air monitoring data;
- Review procedures related to DPI activities;
- Ensure that all on-site personnel have completed the required training;
- Perform a daily review/inspection of all equipment to be used during day;
- Ensure the proper disposal expendable materials and PPE, if necessary;
- Ensure compliance with decontamination procedures;
- Conduct personal air monitoring, including equipment maintenance and calibration;
- Conduct site safety orientation training and daily safety meetings; and
- Maintains required health and safety documents and records on-site.

6. HEALTH AND SAFETY EQUIPMENT AND MAINTENANCE

Health and safety equipment used by project personnel is broken down into two categories: personnel protective equipment and safety equipment. The personnel protective equipment ("PPE") includes any equipment that is usually worn and physically protects workers from environmental hazards. Safety equipment includes any equipment that measures, eliminates, monitors, or provides protection against environmental hazards. Section 7 provides a list of the types of equipment that may be used on this project.

7. SAFETY EQUIPMENT

A Photoionization detection meter will be used to assess the presence of volatile organic compounds ("VOCs") in the breathing zone of project personnel during DPI activities.

8. PERSONAL PROTECTIVE EQUIPMENT

Personnel must wear protective equipment when work activities involve known or suspected chemical and physical hazards. Such hazards may include atmospheric contamination, generation of vapors, gases, or particulates by construction activities or direct contact with harmful substances, splashes, loud noises, sharp objects, etc. Careful selection and use of adequate PPE should protect the respiratory system, skin, eyes, face, hands, feet, head, body and hearing. OSHA requires the use of PPE as required in 29 CFR Part 1910 and USEPA in 40 CFR Part 300.

No single combination of PPE can protect against all hazards; therefore, it should be used in conjunction with other protective methods. PPE can itself create significant hazards, such as heat stress, physical and psychological stress, and impaired vision, mobility, and communication. In general, the greater the level of PPE used, the greater the associated risks. For any given situation, equipment and clothing should be selected to provide maximum protection using minimum equipment. The two main objectives of any PPE program should be to protect the wearer from safety and health hazards, and prevent injury to the wearer from incorrect PPE use and/or malfunction. Equipment that protects the body against contact with known or anticipated toxic chemicals has been divided into four categories according to the degree of protection afforded. It is anticipated that the level of protection required for the DPI pilot study will not exceed a modified Level D. Should the air monitoring results indicate a hazardous work atmosphere, activities will cease in order to adequately evaluate the situation.

8.1 LEVELS OF PROTECTION

Level D Protection

The minimum level of protection that will be required of all site personnel and subcontractors at the site will be Level D, which will be worn as the initial protection level for site operations. The following equipment will be used:

- Work clothing as prescribed by weather;
- Steel toe work boots, meeting ANSI Z41;
- Safety glasses or goggles, meting ANSI Z87;
- Face shield (if necessary);
- Hard hat, meeting ANSI Z89; and
- Hearing protection (in areas where noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at lease 20 dBA must be used).

Modified Level D Protection

This level of protection will be used when VOC concentrations are greater than 5 ppm within the breathing zone, but less than ½ the Permissible Exposure Level ("PEL") and, when site activities are causing an increase potential for skin contact with subsurface liquids and/or solids, or there is an increased potential for exposure to bioremediation solutions. Modified Level D consists of:

- Tyvek coveralls;
- Steel toe work boots;
- Vinyl or latex booties, or PVC overboots;
- Safety glasses or goggles;
- Hard hat;
- Face shield in addition to safety glasses (if necessary);
- Inner/Outer gloves; and
- Hearing protection (if necessary).

Level C Protection

This level of protection will be used when VOC concentrations are greater than ½ the PEL, but less than the PEL and when site activities are causing an increase potential for skin contact with subsurface liquids and/or solids, or there is an increased potential for exposure to bioremediation solutions. Modified Level D consists of:

- Tyvek coveralls;
- Steel toe work boots;
- Vinyl or latex booties, or PVC overboots;
- Safety glasses or goggles;
- Hard hat;
- Face shield in addition to safety glasses (if necessary);
- Inner/Outer gloves;
- Hearing protection (if necessary); and
- Full face or half face Air Purifying Respirator ("APR") and combination gas, vapor, fumes and particulate cartridge filter.

Equipment for personal protection has been selected based on the potential for contact, site conditions, breathing zone air quality, and the judgment of supervising site personnel and H&SC professionals. The PPE used has been chosen to be effective against the compound(s) present on the Site.

9. RESPIRATORY PROTECTION

Respiratory protection is an integral part of employee health and safety at sites with potential airborne contamination. DPI activities and support activities conducted at this site are not expected to exceed a Level D protection category. The remedial contractor's personnel will have the appropriate training equipment and documentation to upgrade to a Level C PPE category if site conditions change, i.e., VOC concentrations are detected within the breathing zone of site personnel within two (2) consecutive 15 minute monitoring periods at greater than 5 parts per million ("ppm")(see Section 14). Site personnel that voluntary choose to don dust masks or respirators prior to detection of VOC concentrations at the prescribed action limits must comply with the OSHA Respiratory Protection Standard (29 CFR Part 1910.134). The Site Respiratory Protection Program includes the following:

- All site personnel who may use respiratory protection will have an assigned respirator;
- All site personnel who may use respiratory protection will have been fit tested and trained in the use of a full-face air-purifying respirator within the past 12 months;
- All site personnel who may use respiratory protection must within the past year have been medically certified as being capable of wearing a respirator. Documentation of the medical certification must be provided to the H&SC, prior to beginning of site work;
- Only cleaned, maintained, NIOSH-approved respirators are to be used on this Site;
- If respirators are used, the respirator cartridge is to be properly disposed of at the end of each work shift, or when load-up or breakthrough occurs;
- Contact lenses are prohibited in the contaminant reduction zone and exclusion zone;
- All site personnel who may use respiratory protection must be clean-shaven;
- Respirators will be inspected daily before each use, and a positive/negative pressure test performed prior to each use; and
- After each use, the respirator will be wiped with a disinfectant, cleansing wipe. When used, the respirator will be thoroughly cleaned at the end of the work shift. The respirator will be stored in a clean plastic bag, away from direct sunlight in a clean, dry location, in a manner that will not distort the face piece.

10. HAZARD ASSESSMENT

There are chemical exposure hazards, physical hazards and excessive noise exposure hazards associated with DPI activities. In addition, potential electrical and explosion or

fire hazards exist as a result of encountering overhead and/or below-ground utilities during DPI activities.

The potential substance exposure hazards at the site include the presence of VOCs released into the personnel breathing zone from site soils and groundwater within the Injection Zones during injection activities. Physical hazards include activities involving the use of mobile geoprobe units, handling pressurized nitrogen cylinders for bioremediation solution applications, handling bulk containers of bioremediation solutions and potential heat stress, particularly if level C dermal and respiratory protection is required. Potential excessive noise exposure is possible during geoprobe operation and injection of pressurized bioremediation solutions into the subsurface.

10.1 CHEMICAL EXPOSURE HAZARDS

Airborne concentrations of VOC contaminants from the soil and groundwater, and eye and skin exposures to concentrated bioremediation solutions are potential chemical substance exposure hazards to be considered.

January 2013 groundwater sampling completed at groundwater monitoring wells MW 5A/AR and MW-14 within AOC 6 identified the following compounds.

Monitoring Well Number	Compound	Concentration (ug/L)
MW 5A/AR	chloroethane	150
MW 5A/AR	1,1,dichloroethane	280
MW 5A/AR	1,1 dichloroethene	11
MW 5A/AR	1,1,1Trichloroethane	210
MW-14	1,1,dichloroethane	53
MW-14	vinyl chloride	2.1 (estimated value)

The potential routes of exposure for these compounds include inhalation, skin absorption, ingestion, and skin/eye contact. The potential for exposure through any one of these routes will depend on the activity conducted. The most likely on-site activity to create a potential exposure to the compounds will be from the DPI activities associated with the geoprobe injection unit.

The bioremediation solutions may pose an exposure as a result of preparing, handling, and mixing the solutions for injection. Level D PPE requires the use of safety glasses. Face shields should be used when the potential for exposures exists due to mixing or processing bioremediation solutions. The Material Safety Data Sheets ("MSDS"), manufacturer technical bulletins, handling and dilution instructions, and storage requirements for the solutions are included in Appendix B.

10.2 PHYSICAL HAZARDS

Working near mobile powered equipment, such as the geoprobe unit, poses a risk for accident or injury to on-site personnel. The geoprobe operator must maintain diligence

during geoprobe injection activities, particularly while moving from one injection point ("IP") to another, and while backing up the unit. The geoprobe unit must be equipped with an audio alarm to provide warning to on-site personnel during back ups.

The Regenisis bioremediation solution BDI Plus is shipped with a pressurized container from 10 to 15 pounds per square inch ("psi"). Pressurized gas cylinders used to dispense the culture must be equipped with the proper regulators to prevent accidental release of the material. They will be secured to a gas cylinder cart, and the valves will remain on the cylinders when not in use. During application, the working pressure of 15 psi must not be exceeded.

Handling bulk containers of bioremediation solutions, equipment and tools pose risks for accident or injury to on-site personnel. Each container or equipment requiring transport should be assessed by site personnel to determine the level of effort necessary to safely transport the item. They should utilize available equipment to assist in the transport of the object to be moved. A drum trolley should be used to move drummed materials/products or waste drums. Site personnel should avoid lifting objects over 35 lbs. without assistance. Level D PPE requires the use of steel-toed boots, thereby minimizing the risk of foot injury from contact with heavy objects.

If the biortreatment remedial activities are implemented in the summer months, the potential for heat stress exists, particularly if Level C PPE is necessary to complete the work. Appropriate rest periods and sufficient hydration can minimize the possibility of heat stress. Appendix C includes Table 2 of the OSHA guidance document entitled *Using the Heat Index: A Guide for Employers*, which provides recommended rest schedules for workers wearing chemical-resistant suits. In addition to the E&HS coordinator, each site employee should be familiar with the signs and symptoms of heat cramps, heat exhaustion and heat stroke, and be able to recognize the symptoms in their fellow employees during on-Site activities. A description of heat related illnesses is included in Appendix D.

10.3 NOISE

Exposure to noise over the OSHA action level of 85 dBA can cause temporary impairment of hearing; prolonged and repeated exposure can cause permanent damage to hearing. The risk and severity of hearing loss increases with the intensity and duration of exposure to noise. In addition to damaging hearing, noise can impair voice communication, thereby increasing the risk of accidents on site. Noise monitoring will not be required during the project. However, hearing protection is mandatory for all employees working with or near the geoprobe unit during DPI activities. As a general rule, sound levels that cause speech interference at normal conversation distance should require the use of hearing protection.

10.4 SUBSURFACE/OVERHEAD UTILITIES

The geoprobe unit will be required to penetrate to 16 feet below ground surface ("bgs") to inject the bioremediation solutions. Subsurface activities will be coordinated with the

Underground Facilities Protection Organization, in accordance with New York State Code Rules and Regulations ("NYCRR") 753 for the purpose of identifying and locating underground utilities in the area. A private utility location service will be retained to identify underground utilities at or near the proposed IP locations. In, addition, AOC 6 will be visually surveyed to identify any above-ground or suspended obstructions or utility lines that have the potential to contact the mast of the geoprobe unit when it is fully extended (i.e., estimated maximum height of 10 feet).

11. SITE CONTROL

The biotreatement activities proposed at the Site are not anticipated to pose a significant risk of exposure of chlorinated compounds to Site workers. A residual amount of subsurface soils may be present on the injection probes when retrieved from the IPs. To minimize the transfer of contaminated soils or groundwater from the work area, contamination control procedures are needed. Two general methods are used: establishing specific site work zones; and establishing a decontamination zone.

The Site must be controlled to reduce the possibility of: 1) contact with any contaminants present; and 2) accidental transfer of contaminants from personnel to equipment upon leaving the Site.

The possibility of exposure or transportation of substances off-Site will be reduced or limited in the following ways:

- Setting up signage and physical barriers (caution tapes) to exclude unnecessary personnel from the general area;
- Establishing work zones within the site;
- Establishing control points to regulate access to work zones;
- Conducting operations in a manner that reduces the exposure of personnel and equipment, and eliminating the potential for airborne dispersion; and
- Implementing appropriate decontamination procedures.

No person will be allowed in the general work area during Site operations without first being given a Site orientation and hazard briefing. The orientation will be presented by the H&SC, and will consist of a review of this HASP. In addition to this meeting, Daily Safety Meetings will be held each day before work begins. All people on the Site, including visitors, must document their attendance to this briefing as well as the Daily Safety Meetings on the forms included with this plan.

12. COMMUNICATION

When on the Site, verbal and visual communication will be used whenever possible. On-Site personnel will have a mobile phone, or another effective means to summon assistance in the event an emergency situation develops.

13. DECONTAMINATION

Contamination Control Zones are maintained to prevent the spread of contamination and to prevent unauthorized people from entering hazardous areas. If work activities only require Level D protection, decontamination procedures will be limited to the equipment used to inject the bioremediation solution into the subsurface. Solid materials (i.e., soils) that adhere to the exterior of the equipment will be manually removed using buckets of water and alconox detergent. The waste water will be contained in a waste drum and transported off-Site for appropriate disposal. The interior surfaces of the equipment will be transported to a secured decontamination ("decon") pad located near AOC 6. The equipment will be cleaned. The remaining solids will be collected and drummed for appropriate disposal. The contained liquid waste water will be transported off-Site for appropriate disposal.

In the event that Level C protection category is determined to be necessary to complete the project, all personnel working in the contaminated zone must undergo personal decontamination prior to entering the support zone. All contaminated clothing and equipment leaving a contaminated area shall be appropriately disposed of or decontaminated. Decontamination procedures will be monitored by the H&SC to determine their effectiveness and appropriate steps will be taken to correct any deficiencies. Decontamination shall be performed in areas that will minimize the exposure of uncontaminated employees or equipment. The personnel decontamination will consist of the stations summarized below.

Project Decontamination Procedures

Station 1 - Personnel leaving the contaminated zone will remove the gross contamination from their outer clothing and boots. Washing or wiping down outer protective clothing may be necessary.

Station 2 - Personnel will remove their outer garment and gloves and deposit them in the lined waste receptacles. Personnel will then decontaminate their hard hats, and boots with an aqueous solution of Alconox or other appropriate cleaning solution.

14. AIR MONITORING

14.1 Personal Exposure Monitoring

Personal exposure monitoring may be necessary to evaluate employee exposures. The monitoring results will dictate work procedures and the selection of PPE. The monitoring device to be used will be a PID. During direct push injection activities, the PID will be used to measure relative VOC concentrations within the breathing zone of employees involved with the activity. Monitoring shall be conducted with the PID equipped with a 10.2 eV lamp or a Photovac Microtip. This instrument is capable of detecting total VOCs to an approximate detection limit of 1 ppm. The rapid response of the instrument allows for quick determination of potential contaminants in the air, and changes in safety procedures, such as an upgrade to level C protection category, can be implemented if needed.

The Permissible Exposure Levels ("PELs") established by OSHA for an eight-hour workday for the contaminants of concern range from 1 part per million ("ppm") for vinyl chloride to 1,000 ppm for chloroethane. Given that the monitoring instrument does not distinguish between the contaminants, the total VOC value detected by the instrument will be used to establish the appropriate action level for PPE measurement. This approach is conservative and limits VOC exposure to on-Site employees.

ATMOSPHERIC HAZARD GUIDELINES

Parameter	Reading	Action
Total Volatile Organic Compounds	>Background to <5ppm	Level D operations; Continue hourly breathing zone monitoring.
Total Volatile Organic Compounds	>5ppm to less than ½ PEL	Level D Modified. Increase monitoring frequency to every 15 minutes.
Total Volatile Organic Compounds	>1/2 PEL to PEL	Stop work; Upgrade to Level C respiratory protection category if relative concentrations of VOCs in the breathing zone remain in this range. Monitor breathing zone every 15 minutes.
Total Volatile Organic Compounds	>PEL	Stop all work. Re-assess appropriate level of respiratory protection and monitoring requirements.

14.2 Community Air Monitoring Plan

A Community Air Monitoring Plan ("CAMP") requires real-time monitoring for VOCs and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-Site receptors including residences and businesses and on-Site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-Site through the air.

Depending upon the nature of known or potential contaminants, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. The Site may involve VOC monitoring, by means of a PID equipped with a 10.2 eV lamp or a Photovac Microtip. Dust monitoring will be accomplished using a TSI 8530 DustTrak II particulate meter.

Continuous monitoring will be required for ground intrusive activities. Ground intrusive activities associated with this RAWP include the advancement of Geoprobe borings near AOC 6 for the purpose of HRC injection.

A) VOC Monitoring, Response Levels, and Actions

VOCs must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a periodic basis. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work will be performed using a PID equipped with a 10.2 eV lamp. The equipment will be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment will be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below:

1) If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds five (5) parts per million (ppm) above background for the fifteen (15) minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below five (5) ppm over background, work activities can resume with continued monitoring;

2) If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of five (5) ppm over background but less than twenty-five (25) ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued.

After these steps, work activities can resume provided that the total organic vapor level two-hundred (200) feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than twenty (20) feet, is below five (5) ppm over background for the fifteen (15) minute average;

3) If the organic vapor level is above twenty-five (25) ppm at the perimeter of the work area, activities must be shutdown; and

4) All fifteen (15) minute readings must be recorded and be available for NYSDEC and NYSDOH personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

B) Particulate Monitoring, Response Levels, and Actions

Particulate concentrations will be monitored, by a Dust Monitor TSI 8530 DustTrak II, at the upwind and downwind perimeters of the exclusion zone. The particulate monitoring will be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of fifteen (15) minutes (or less) for comparison to the airborne particulate action level. The equipment will be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration will be visually assessed during work activities for following items:

1) If the downward PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than the upwind perimeter for the fifteen (15) minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed one hundred fifty (150) mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area;

2) If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than one hundred fifty (150) mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within one hundred fifty (150) mcg/m^3 of the upwind level and in preventing visible dust migration; and

3) All readings will be recorded and be available for NYSDEC and NYSDOH and County Health personnel to review.

15. EMPLOYEE TRAINING

All on-Site personnel must have completed hazardous waste operations-related training, as required by OSHA Regulation 29 CFR 1910.120. New field employees must have a minimum of three days of actual field experience under the direct supervision of a trained, experienced supervisor. Personnel who completed training more than 12 months prior to the start of the project must have completed an 8-hour refresher course within the past 12 months.

15.1 SITE-SPECIFIC TRAINING

Site-specific training will be accomplished through a site briefing and review of this HASP before work begins. In addition, Daily Safety Meetings will cover the work to be accomplished, the hazards anticipated, the protective clothing and procedures required to minimize site hazards, and emergency procedures. No work will be performed before the Daily Safety Meeting has been held. The meeting must also be held prior to new tasks and repeated if new hazards are encountered. A format for documenting this meeting is attached in Appendix F.

16. CONTINGENCY PROCEDURES AND EMERGENCY ACTION PLAN

In the event of an emergency, the H&SC will be notified. In the event of a fire, explosion or medical emergency the notifier will also notify the Orange County 911 center and be prepared to provide the following information:

- Nature of the emergency; and
- Location of the project.

Refer to Appendix F for driving directions to St. Luke's Cornwall Hospital – Cornwall Campus. All project personnel are required to have awareness of this location before beginning Site work.

16.1 SITE-SPECIFIC TRAINING

In case of personal injury at the Site the following procedures will be followed:

1. Workers should start first aid;

2. Dial 911 and send someone to flag down emergency personnel, i.e., Fire Department or Ambulance;
3. Injured person should be transported to St. Luke's Cornwall Hospital or the nearest available emergency room; and
4. H&SC will prepare an Accident Report.

16.2 FIRE/EXPLOSION

1. Workers will use fire extinguisher, if practical, to put out the fire;
2. Assist others in evacuation of the area;
3. Dial 911 and send someone to the street entrance to the site to flag down emergency personnel, i.e., Fire Department; and
4. H&SC will prepare an Incident Report.

16.3 SPILLS

1. Workers should contain spill and begin to address the spill source. Absorbent materials and spill barriers will be available to contain spills;
2. Ensure that individuals not involved in cleanup activities are removed from the area;
3. Notify an emergency response contractor if assistance is needed or contact Fire Department if spill threatens offsite property or has a potential for a fire or explosion;
4. Notify NYSDEC; and
5. H&SC will prepare an Incident Report.

16.4 CHEMICAL EXPOSURE

1. Workers should notify the H&SC and the Project Manager to evaluate the incident and direct responders appropriately to assist the exposed worker;
2. Dial 911 and send someone to the street entrance to the site to flag down emergency personnel, i.e., Fire Department or Ambulance;
3. Notify St. Luke's Cornwall Hospital of a chemically exposed worker being transported to the hospital; and
4. H&SC will prepare an Accident Report.

EMERGENCY CONTACT NUMBERS		
Emergency Medical Facility		
	Location	Telephone
Hospital	St. Luke's Cornwall Hospital – Cornwall Campus 19 Laurel Avenue, Cornwall, NY	845-534-7711
Ambulance Services		
Ambulance		911
Fire Department		
Fire Department		911
Police Department		
Town of Cornwall		911
Poison Control Center		
Poison Control Center		1-800-222-1222
Leader's Health & Safety Coordinator		
Keith Keller	Office	(716) 565-0963
	cell phone	(716) 713-9874
Alternate/Office Safety Supervisor		
Mary Ellen Holvey	Office	(585) 690-3361
	Cell phone	(585) 690-3361

Appendix F provides the written directions and a map indicating the route to St. Luke's Cornwall Hospital.

OTHER SOURCES OF ASSISTANCE	
Chemtrec	1-800-424-9300
National Response Center	1-800-424-8802
NYSDEC Spills Division	1-800-457-7362 or (716) 851-7220
DOT, Regulatory Matters	1-202-426-9280
U.S. Coast Guard	1-800-424-8802

APPENDIX A

HEALTH AND SAFETY PLAN APPROVAL/SIGN OFF FORM

HEALTH AND SAFETY PLAN APPROVAL/SIGN OFF FORM

I have read, understood and agreed with the information set forth in this Health and Safety Plan, and have had the opportunity to discuss its contents with the Health & Safety Coordinator for this project.

Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
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Site Health & Safety Coordinator	Signature	Date

APPENDIX B

BIOREMEDIATION SOLUTION MSDS AND APPLICATION INSTRUCTIONS

3-D MicroEmulsion® FACTORY EMULSIFIED

STAGED RELEASE, pH NEUTRAL, FACTORY EMULSIFIED ELECTRON DONOR

DESCRIPTION

Factory emulsified 3-D Microemulsion is a unique electron donor material that offers an engineered, 3 stage electron donor release profile, pH neutral chemistry and is delivered on-site as a factory emulsified material. This new molecule also exhibits a novel hydrophile-lipophile balance (HLB) which provides maximum subsurface distribution well beyond that of emulsified vegetable oils.

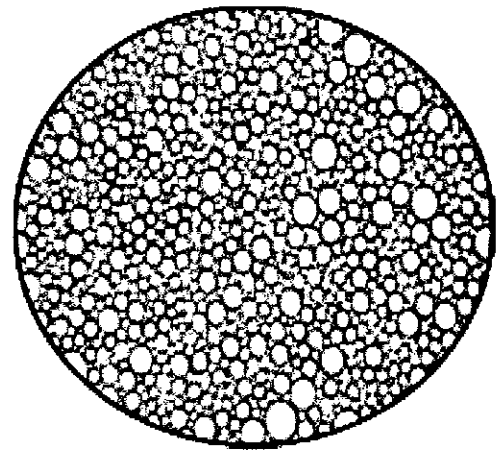

FIGURE 1: Microscopic view of factory emulsified 3-D Microemulsion.

FEATURES & BENEFITS

- **3 Stage Electron Donor Release Profile Avoids Multiple Re-applications Saving Time and Money**

This feature optimizes start to finish timing of the enhanced reductive dechlorination process through an immediate, mid-range and long-term electron donor release. Without a 3 stage release profile, bioremediation efforts are inefficient, causing gaps in electron donor supply and requiring multiple injections. Factory emulsified 3-D Microemulsion offers a 3 stage electron donor release for optimal results (Figure 2).

Stage 1 - Immediately available free lactic acid (lactate) is fermented rapidly

Stage 2 - Controlled-release lactic acid (lactate esters and polylactate esters) are metabolized at a more controlled rate

Stage 3 - Free fatty acids and fatty acid esters are converted to hydrogen over a mid to long-range timeline giving factory emulsified 3-D Microemulsion an exceptionally long electron donor release profile

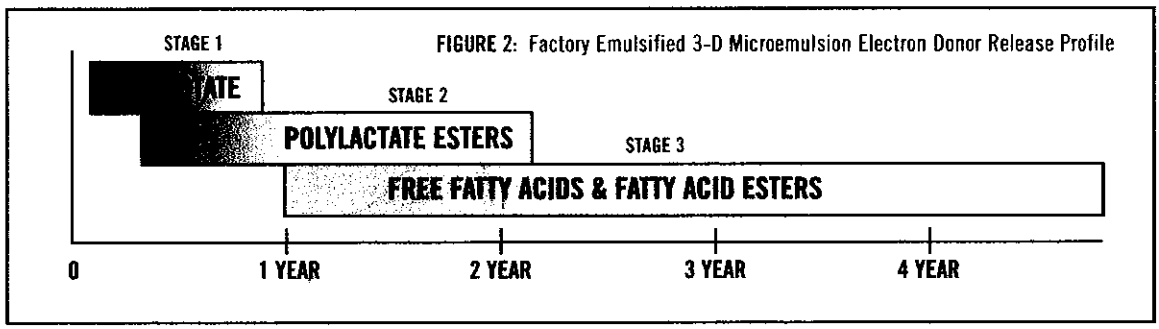

FIGURE 2: Factory Emulsified 3-D Microemulsion Electron Donor Release Profile

WWW.REGENESIS.COM

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Advanced Technologies for Contaminated Site Remediation

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3-D MicroEmulsion® FACTORY EMULSIFIED

STAGED RELEASE, pH NEUTRAL, FACTORY EMULSIFIED ELECTRON DONOR

FEATURES & BENEFITS

- **A Unique Hydrophile/Lipophile Balance (HLB) Enhances Distribution and Limits Reduction in Hydraulic Conductivity**

  The HLB feature allows the product to distribute in the subsurface via micellar movement. During this process, microscopic colloidal aggregates (micelles) continuously propagate from areas of high concentration to those of lower concentration moving the factory emulsified 3-D Microemulsion electron donor material into areas beyond those affected by the initial injection. This enhanced distribution mechanism allows for greater spacing between injection points and less time required for material application. Additionally, due to its unique hydrophile-lipophile balance, applications of factory emulsified 3-D Microemulsion have not resulted in the significant aquifer blockage as seen with the use of emulsified oil products.

FIGURE 3: A 2000 lb. tote of factory emulsified 3-D Microemulsion. The material can be delivered in drums, totes or tanker trucks.

- **Highly Efficient Application Designs**

  When designing an *in situ* remediation project with factory emulsified 3-D Microemulsion, application designs are based on mass balance and stoichiometric demand from the contaminant, competing electron acceptors and a minimum total organic carbon (TOC) loading. This often results in a more efficient dosing requirement compared to design methods employed by other electron donor suppliers.

- **Neutral pH**

  Neutral pH minimizes potentially harmful impacts to beneficial biodegrading microorganisms required to metabolize chlorinated contaminants. This feature can be highly valuable when the microemulsion is used in conjunction with pH-sensitive commercial bioaugmentation cultures

- **Injection-Ready Formulation, Simple and Easy Application**

  3D Microemulsion is delivered on-site as a factory emulsified, injection-ready product. It can be applied as delivered or further diluted and mixed with additional site water to form a higher-volume ready-to-inject microemulsion. This material can be applied through a variety of application techniques including permanent or temporary injection wells and direct-push points.

- **Choose from a Range of Packaging Options**

  Factory emulsified 3-D Microemulsion can be delivered in 400 lb. drums, 2000 lb. totes and large volume tanker trucks making shipping, receiving and application on any site simple and convenient (Figure 3).

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PRODUCT APPLICATION INSTRUCTIONS

3-D Microemulsion® Factory Emulsified

As delivered, the 3-D Microemulsion factory emulsified product is a significant change compared to the physical state of standard 3-D Microemulsion. Whereas the standard 3-D Microemulsion is delivered in a concentrate form that requires an emulsification step prior to application, factory emulsified 3-D Microemulsion is delivered as a ready-to-apply, factory emulsion. It does not require shearing or any another other emulsion making steps. The only pre-application requirement is a quick stir and any required/recommended dilution of the factory emulsified 3-D Microemulsion with an appropriate volume of clear water.

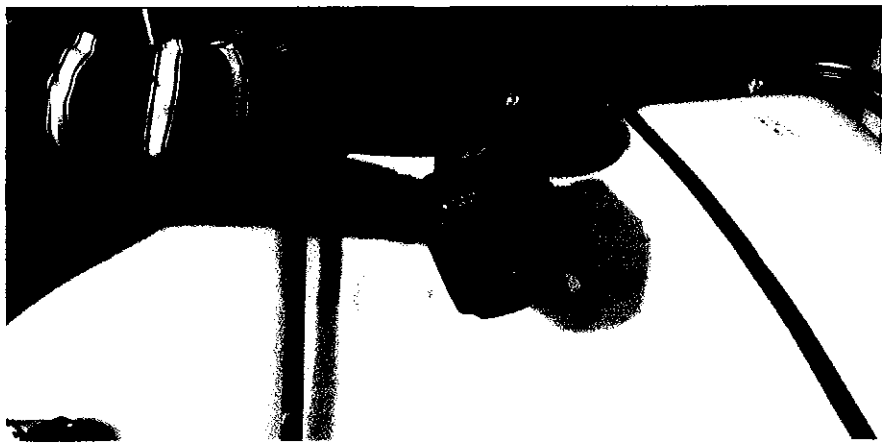
Material Overview Handling and Safety

3-D Microemulsion factory emulsified is shipped and delivered as an emulsion of 2 part water to 3 parts active ingredient. Packaging is available in 275 gallon totes and/or 55 gallon drums.

- Each tote typically has a gross weight of 2,000 pounds
- Each drum has a weight of 400 pounds

At room temperature, 3-D Microemulsion factory emulsified is a liquid material with an appearance and viscosity roughly equivalent to milk. The microemulsion is <u>not</u> temperature sensitive above 50ºF (10ºC). If the user plans to apply the product in cold weather, consideration should be given to warming the material to above 50ºF so that it can be more easily handled. The material should be stored in a warm, dry place. It is common for stored factory emulsified 3-D Microemulsion to settle somewhat in the container while in transit, a quick pre-mix stir using a hand held drill, equipped with paint mixer attachment will rapidly re-homogenize the microemulsion. Factory emulsified 3-D Microemulsion is non-toxic, however field personnel should take precautions while handling and applying the material. Field personnel should use appropriate personal protection equipment (PPE) including eye protection. Gloves should be used as appropriate based on the exposure duration and field conditions. A Material Safety Data Sheet (MSDS) is provided with each shipment. Personnel who operate field equipment during the installation process should have appropriate training, supervision, and experience and should review the MSDS prior to site operations.

PRODUCT APPLICATION INSTRUCTIONS



3-D Microemulsion® Factory Emulsified Field Homogenization using a Cordless Drill Equipped with a Paint Mixing Attachment

Design and Specifications

Designs for 3-D Microemulsion factory emulsified remain unchanged from standard 3-D Microemulsion. An additional application method has been added with the use of a Dosatron® metering system.

Composition and associated physical properties of factory emulsified 3-D Microemulsion are as follows:

Density: is approximately 1 g/cc (8.34 lbs/gallon) at 20°C/68°F
Physical Form: liquid, composed of 2 part water to 3 parts Factory Emulsified 3-D Microemulsion (2:3)

The 3-D Microemulsion factory emulsion can be diluted water a (v/v) volume to volume basis to produce the desired diluted concentration. Most typical concentrations range from 1 to 10% (v:v); more dilute concentrations can be easily produced using the water volumes provided in the table below.

Higher dilution rates are governed by the following technical considerations:

- Factory emulsified 3-D Microemulsion required to treat the estimated contaminant mass
- Target pore volume in which the Factory Emulsified 3-D Microemulsion is applied
- Available application time (aquifer acceptance rate)

PRODUCT APPLICATION INSTRUCTIONS

Although using a more dilute microemulsion will produce a greater volume of the material, it will also lower the delivered concentration. Thus, the benefit of using a higher dilution rate (to affect a greater pore volume of the subsurface aquifer) is offset by the lower factory emulsified 3-D Microemulsion concentration. Another important consideration is the aquifer's capacity to accept the volume of material (i.e., the aquifer's hydraulic conductivity and effective/mobile porosity).

It is important that the user consider the 3-D Microemulsion factory emulsion dilution rate to be employed at a project site. The resulting emulsion volume will dictate the site water requirements and the time required for injection, etc. If the subsurface does not readily accept the volume as designed, the user can simply reduce the amount of water, thereby lowering the volume of subsequent batches. For more information on design and material dilution rates to meet specific site conditions, please contact Regenesis Technical Services.

The following table provides a quick reference to the dilution water necessary for some common application rates:

3-D Microemulsion Factory Emulsified (%)	3-D Microemulsion Factory Emulsified (mg/L)	3-D Microemulsion Factory Emulsified (gal)	Clear Water (gal)	Resulting Volume (gal)
10	100,000	1	9	10
5	50,000	1	19	20
3	30,000	1	32	33
2	20,000	1	49	50
1	10,000	1	99	100

EXAMPLE: Create a 50,000 mg/L factory emulsified 3-D Microemulsion material

- Dilute each gallon of material with 19 gallons of water resulting in a 20 gallon material volume

3-D Microemulsion® Factory Emulsified Dilution

There are two basic approaches for dilution of factory emulsified 3-D Microemulsion. These approaches are referred to as "on demand" and "batched" and are discussed below:

PRODUCT APPLICATION INSTRUCTIONS

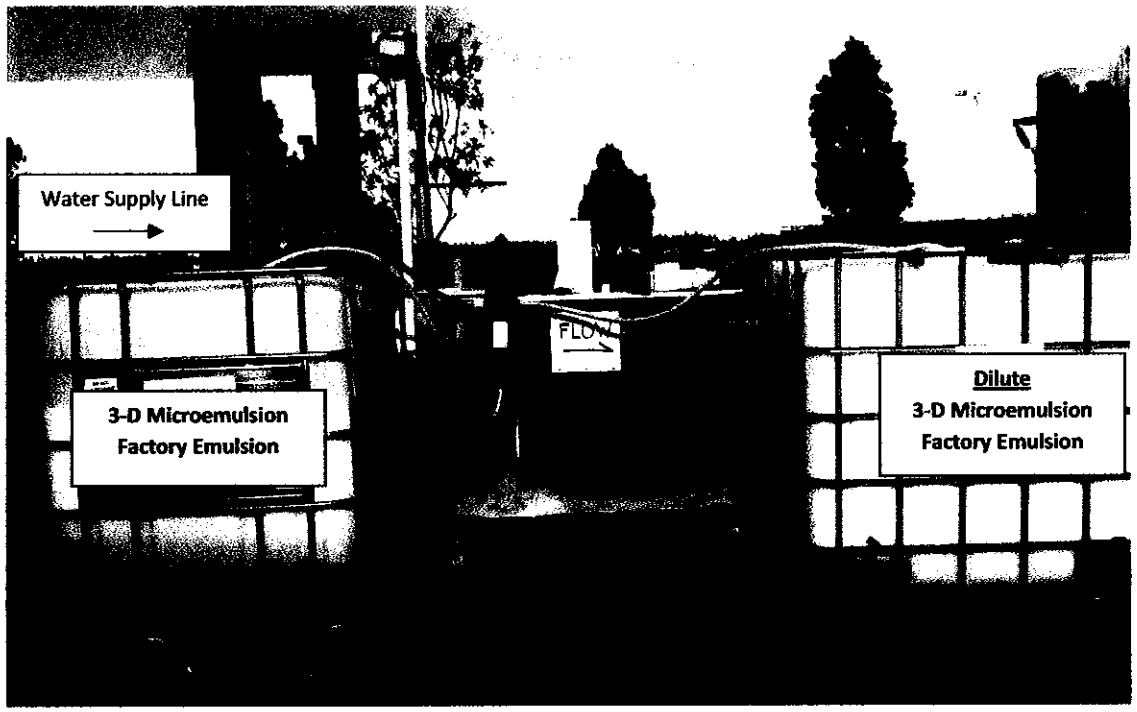
On Demand – Dosatron® Metering System

This method consists of the dilution and application of factory emulsified 3-D Microemulsion in "real time". This is typically accomplished at the well head and is used almost exclusively via dedicated injection well applications. These systems are designed to dilute the material "in-line" and on an "as needed" basis. The most common metering system used for this purpose is the Dosatron® System. This is a volume-based metering system that is positioned at the surface and on individual well heads. These units create a targeted dilution of factory emulsified 3-D Microemulsion in water by metering a set volume of the material into a set volume of clear water passing through and powering the device. Thus, fluctuations in the water flow volume or pressure will not result in a change in the rate of factory emulsified 3-D Microemulsion delivered. This device will maintain consistent water to emulsion ratio regardless of water flow rate or pressure.

NOTE: prior to use, each drum or tote of factory emulsified 3-D Microemulsion should be stirred thoroughly using a paint mixer equipped drill.

In this method, each delivery point is manifold to a central clear water holding tank via a manifold system as shown below. Typically, a single pump is placed between the holding tank and the manifold, this pump is used to pressurize the system and to maintain the flow of clear water through the manifold and to the individual application points. A flow meter/totalizer, pressure gauge and ball check valve should be present between the manifold effluent and each Dosatron unit to allow the applier to regulate and monitor individual application rates. This will aid in determining each application point's optimal acceptance rate. Please refer to the User's Manual for your Dosatron. Additional information and specific set up information is available on the Dosatron® Website at http://www.dosatronusa.com/search-results.aspx?QueryExpr=manuals .

PRODUCT APPLICATION INSTRUCTIONS



Dilution of the Factory Emulsified 3-D Microemulsion® in a Batched Configuration

Batched

This method consists of preparing a pre-determined volume of dilute factory emulsified 3-D Microemulsion and storing it in a batch tank until applied. Delivery of the dilute microemulsion can be to a single delivery point (or well) or multiple delivery points via a manifold system, in either case the injection location must be plumbed to the factory emulsified 3-D Microemulsion holding tank and account for the issues outlined in the Application Methods introduction (below). The delivery of dilute microemulsion is typically via wells or direct push injection points that are connected to the central diluted microemulsion tank via a manifold system and include a dedicated inline flow meter/totalizer, pressure gauge and ball valve for each well or injection point. Often a single pump is placed between the dilute microemulsion tank and the manifold, this pump is used to pressurize the system and maintain flow of the dilute factory emulsified 3-D Microemulsion through the manifold and application points. The flow meter/totalizer and pressure gauge allow the applier to monitor application rates and back pressure for each well or injection point and thus the aquifer's acceptance rate. A simple manifold system with pressure gauges and flow meter/totalizer is shown below. NOTE: upon dilution the material should be stirred on a periodic and regular basis (as shown above).

PRODUCT APPLICATION INSTRUCTIONS

Factory Emulsified 3-D Microemulsion® Application

The application of the dilute factory emulsified 3-D Microemulsion is typically accomplished by injection via direct-push points (DPI) or dedicated injection wells. Regardless of which delivery option is used, dilution of the factory emulsion prior to application is most appropriate. Application can be performed using pressure or gravity feed.

At a minimum the applier should use the following instrumentation to monitor application:

- Pressure gauges
    - psi range should be selected based site specific conditions
        - aquifer conductivity (anticipated aquifer acceptance rate)
        - pump type (e.g. double diaphragm vs. positive displacement pumps)
        - application methods [Direct Push Injection vs. Injection Wells]
        - not-to-exceed pressures
- In-Line Flow Meters
    - range should be selected based on site specific requirements
- Pressure-Relief Valves for prevention of pressure buildup in various segments of the application tooling
    - positioning of pressure relief valves should be considered in the following locations
        - At or along product delivery lines or manifold
        - The injection well head or direct push injection rod → product delivery hose connection

For direct assistance or more information contact us at 1-949-366-8000 or send an e-mail to tech@regenesis.com

3-D Microemulsion® Factory Emulsified
MATERIALS SAFETY DATA SHEET

Last Revised: November 15, 2011

Section 1 – Material Identification

Supplier:

REGENESIS

1011 Calle Sombra
San Clemente, CA 92673

Phone: **949.366.8000**

Fax: **949.366.8090**

E-mail: **info@regenesis.com**

Chemical Name(s):	Glycerides, tall-oil di-, mono [2-[2-[2-(2-hydroxy-1-oxopropoxy)-1-oxopropoxyl]-1-oxopropoxy]propanoates]
Chemical Family:	**Organic Chemical**
Trade Name:	**3-D Microemulsion® Factory Emulsified**
Synonyms:	**HRC Advanced®, HRC-PED (Hydrogen Release Compound – Partitioning Electron Donor)**
Product Use:	**Used to remediate contaminated groundwater (environmental applications)**

Section 2 – Chemical Identification

CAS#	Chemical
823190-10-9	**HRC-PED**
72-17-3	**Sodium Lactate**
7789-20-0	**Water**

Section 3 – Physical Data

Melting Point:	**Not Available (NA)**
Boiling Point:	**100 °C**
Flash Point:	**> 93.3 °C using the Closed Cup method**
Density:	**1.0 -1.2 g/cc**
Solubility:	**Soluble in water.**
Appearance:	**White emulsion.**
Odor:	**Not detectable**
Vapor Pressure:	**None**

Section 4 – Fire and Explosion Hazard Data

Extinguishing Media: **Use water spray, carbon dioxide, dry chemical powder or appropriate foam to extinguish fires.**

Water May be used to keep exposed containers cool.

For large quantities involved in a fire, one should wear full protective clothing and a NIOSH approved self contained breathing apparatus with full face piece operated in the pressure demand or positive pressure mode as for a situation where lack of oxygen and excess heat are present.

Section 5 – Toxicological Information

Acute Effects:	May be harmful by inhalation, ingestion, or skin absorption. May cause irritation.
Sodium Lactate:	Toxicity to Animals: LD50: Not available. LC50: Not available. Chronic Effects on Humans: Not Available. Other Toxic Effects on Humans: Very hazardous in case of skin contact (irritant), ingestion and inhalation.
Soybean Oil:	Health Hazards (Acute and Chronic): Acute: none observed by inhalation. Chronic: none reported.
Inhalation Risks and Symptoms of Exposure:	Excessive inhalation of oil mist may affect the respiratory system. Oil mist is classified as a nuisance particulate by ACGIH.

Skin Absorption Health Risks and Symptoms of Exposure:	Sensitive individuals may experience dermatitis after long exposure of oil on skin.

Section 6 – Health Hazard Data

Handling:	Avoid continued contact with skin. Avoid contact with eyes.

In any case of any human exposure which elicits a reaction, a physician should be consulted immediately.

First Aid Procedures:

Inhalation:	Remove to fresh air. If not breathing give artificial respiration. In case of labored breathing give oxygen. Call a physician.
Ingestion:	No effects expected. Do not give anything to an unconscious person. Call a physician immediately. DO NOT induce vomiting.
Eye Contact:	Wash eyes with plenty of water for at least 15 minutes lifting both upper and lower lids. Call a physician.

Section 7 – Reactivity Data

Conditions to Avoid:	Strong oxidizing agents, bases and acids
Hazardous Polymerization:	Will not occur.
Stability:	Spontaneous combustion can occur.
Further Information:	Hydrolyses in water to form lactic acid and soybean oil.
Hazardous Decomposition Products:	None known.

Section 8 – Spill, Leak or Accident Procedures

After Spillage or Leakage:	Neutralization is not required. The material is very slippery. Spills should be covered with an inert absorbent and then be placed in a container. Wash area thoroughly with water. Repeat these steps if slip hazard remains.
Disposal:	Laws and regulations for disposal vary widely by locality. Observe all applicable regulations and laws. This material may be disposed of in solid waste. Material is readily degradable and hydrolyses in several hours.

No requirement for a reportable quantity (CERCLA) of a spill is known.

Section 9 – Special Protection or Handling

Should be stored in plastic lined steel, plastic, glass, aluminum, stainless steel, or reinforced fiberglass containers.

Protective Gloves:	Vinyl or Rubber
Eyes:	Splash Goggles or Full Face Shield. Area should have approved means of washing eyes.
Ventilation:	General exhaust.
Storage:	Store in cool, dry, ventilated area. Protect from incompatible materials.

Section 10 – Other Information

This material will degrade in the environment by hydrolysis to lactic acid and soybean oil. Materials containing reactive chemicals should be used only by personnel with appropriate chemical training.

This material is a non hazardous material in regards to USDOT shipping criteria.

The information contained in this document is the best available to the supplier as of the time of writing. Some possible hazards have been determined by analogy to similar classes of material. No separate tests have been performed on the toxicity of this material. The items in this document are subject to change and clarification as more information becomes available.

REGENESIS

Advanced Technologies for Groundwater Resources

Bio-Dechlor INOCULUM PLUS (BDI PLUS™)

Application Instructions

(Direct-Push Injection)

General Information

Bio-Dechlor INOCULUM PLUS (BDI PLUS™) is an enriched natural microbial consortium containing species of *Dehalococcoides*. This microbial consortium has since been enriched to increase its ability to rapidly dechlorinate contaminants during *in situ* bioremediation processes. BDI PLUS has been shown to stimulate the rapid and complete dechlorination of compounds such as tetrachloroethene (PCE), trichloroethene (TCE), dichloroethene (DCE), and vinyl chloride (VC). BDI PLUS also contains microorganisms capable of degrading chloromethanes (carbon tetrachloride and chloroform) as well as chloroethanes like trichloroethane (TCA).

Recent trends in engineered bioremediation indicate that the treatment of chlorinated solvent contamination sometimes results in slow or incomplete degradation of the intermediate compounds. When faced with this circumstance, bioaugmentation with a microbial consortium such as BDI PLUS offers a solution to accelerate or simply make possible the complete dechlorination of these otherwise recalcitrant compounds.

Regenesis believes that the best approach to install BDI PLUS into the subsurface is by direct-push methods. This allows for the BDI PLUS solution to be applied directly into the aquifer material and provides greater coverage/treatment over the life of the project. As a minimum, the following equipment will be needed to perform this type of installation:

- Direct-push drilling unit
- Grout pump (e.g. Geoprobe GS 2000)
- Appropriate hose assembly including a fitting that links a hose from the grout pump to the direct-push rods (provided by Regenesis with shipment)
- One or more 55+ gallon water drums, fitted with an appropriate lid that has at least one bung hole (number of drums depends on size of application)
- Rotary transfer pump (or equivalent) with appropriate amount of hose to connect from 55-gal drum to hopper of grout pump (similar to Grainger No. 1P893, Fill-Rite model #FR112GR))
- Compressed Nitrogen gas tank with appropriate regulator **(0 to 15 pounds per square inch (psi)).** A 300-ft^3 tank should be sufficient for discharge of concentrated or non-concentrated kegs and for nitrogen sparging to deoxygenate batch water.
- Pressure washer (or equivalent) for cleaning

Material Packaging and Safety

BDI PLUS is a mixture of living bacteria including members of the *Dehalococcoides* genus that are capable of anaerobically degrading chlorinated contaminants. The culture has been tested to ensure that it is free of the most common pathogenic bacteria, but like all living cultures it should be handled with due care to prevent contamination of work surfaces or field personnel.

During installation activities, Regenesis recommends that field personnel use at least level "D" personal protection equipment (PPE). A Materials Safety Data Sheet (MSDS) is sent with each shipment and should be reviewed before proceeding with installation activities.

WARNING

- The BDI PLUS container is pressurized to 10 to 15 psi with Nitrogen before shipping.
- Wear suitable eye protection, gloves, respirator and protective clothing.
- Gas cylinders used to dispense culture MUST be equipped with a proper pressure regulator.
- During operation DO NOT exceed the containers maximum working pressure of 15 psi.

UNPACKING

1. Carefully remove the container from shipping cooler and stand upright. DO NOT use the plastic sight tube as a handle.
2. Carefully check the container, connectors, valves and tubing for any damage or defects. If defects or damage is observed, do not use. Report any damage to Regenesis at 949-366-8000. A back up set of quick connects is provided in the packaging material.
3. Check and ensure that all valves are in the CLOSED position.

Culture Keg in Cooler

CULTURE CONTAINER SET-UP

1. Ensure that the VALVE attached to the GREY quick connect is tightly closed.

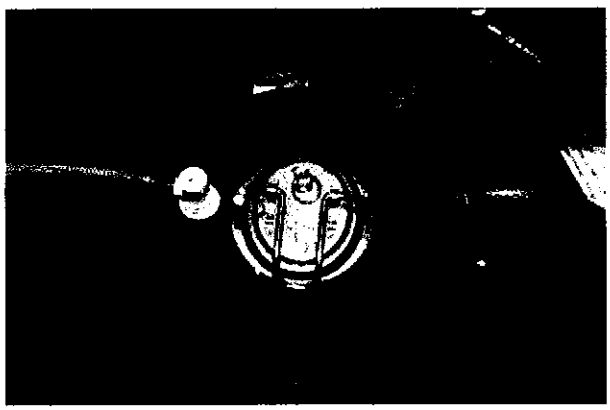
2. Using an appropriate length of reinforced ¼" ID tubing, connect the GREY quick connect fitting assembly to the gas tank regulator.

3. The GREY connector is designed only for use with the " Gas In" line.

4. Ensure that the VALVE attached to the BLACK quick connect is tightly closed.

5. Using an appropriate length of reinforced ¼" ID tubing, connect the BLACK quick connect fitting assembly to the desired injection point

6. The BLACK connector is designed only for use with the "Liquid Out" line.



Culture Keg with Quick Connects Attached

STORAGE

If the schedule of bacteria application requires adding the bacteria over a period of more than one day, the keg(s) should be stored at a temperature 2-4 °C, but freezing must be avoided. This can normally be achieved by storing the kegs under ice in the provided coolers. Keg should be pressurized with Nitrogen to pressure 10- 15 psi. before storing to ensure a tight seal on the keg cap.

SHIPPING

After completion of operation, please, ship cooler with keg and all attachments back to the following address:
Shaw Environmental, Inc.
17 Princess Road, Lawrenceville, NJ 08648

CUTURE CONTAINER DISCHARGING

1. Set up the gas pressure on the delivery gas (Nitrogen or Argon) tank regulator at 10 to 15 psi.

2. Place the container on a scale or use sight tube to control and monitor culture delivery

3. Attach the GREY connector to the ball-lock fitting on the keg marked "IN" by pulling up the barrel of connector and pushing it all the way down onto the ball lock fitting of the keg. Release the barrel of the quick connect. A Click sound indicates that connector was properly attached to the keg fitting.

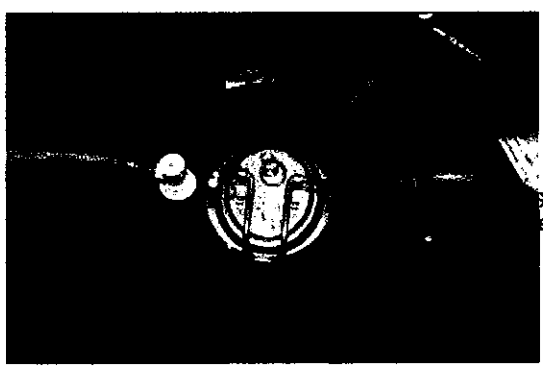
4. Attach the BLACK quick connect assembly to the fitting on the keg marked "OUT" the same way as grey connector.

5. Slowly open the valve on "Gas in" line. This action will pressurized the container with delivery gas.

6. Gradually open the valve on the "Liquid Out" line to provide the desired flow of bacterial suspension. Delivery of the culture can be monitored by watching the liquid level in the sight window, or by using an installed flow meter (not supplied)

7. After delivery of the desired volume of culture, close the valves on the 'Liquid Out" line and the "Gas In" line.

8. Disconnect the connectors from container by pulling up on the barrel of the quick connects.



Specific Installation Procedures

1. The BDI PLUS must be added to the previously prepared "oxygen-free" water before it is installed in the subsurface. The desired amount of BDI PLUS should be carefully discharged into the 55-gal drum containing the appropriate amount of "oxygen free" water. The tables provided below indicates the amount of water that a given amount of BDI PLUS should be mixed with.

   The BDI PLUS must be added to "oxygen-free" water before it is installed in the subsurface. To ensure that the water has reached the desired anoxic state prior to mixing with BDI PLUS an appropriate amount of nitrogen sparging into the 55-gal drum containing a given amount of water at least **one hour** prior to adding the BDI PLUS. To ensure that a sufficient quantity of "oxygen free" water is available throughout the day, a large trough of "nitrogen sparged" water can be prepared and additional 55-gal drums can be filled from this trough. The water in the trough can be transferred to the 55-gal drums where the BDI is mixed with the water using a primed transfer pump.

   Nitrogen sparging is accomplished by a gas sparging device equivalent to a fish tank aerator. Adjust the 300ft^3 nitrogen tank pressure regulator to 3-5 psi and immerse the gas sparger to the bottom of the drum or trough. By internal convection and oxygen stripping processes, the oxygen levels should diminish within an hour. Be careful to not consume too much gas and not have nitrogen to empty the kegs. Keeping an eye on tank pressure loss will indicate when one can trim down on the sparge pressure and conserve the nitrogen.

Volume of BDI PLUS™	**Volume of water**
5 liters	50 gal
1 liter	10 gal

Volume of BDI PLUS™ **concentrate**	**Volume of water**
0.5 liters	50 gal
0.1 liter	10 gal

BDI PLUS Dilution Chart

2. The drive rod assembly should be fitted with a disposable tip on the first drive rod and pushed down to the desired depth. This process should be done in accordance with the manufacturer's standard operating procedure (SOP).
3. A sub-assembly connecting the delivery hose to the drive rods and pump should be used. The sub-assembly should be constructed in a manner that allows for the drive rods to be withdrawn while the material is being pumped.
4. Prior to connecting the hose to the sub-assembly a volume check should be completed to determine the volume and weight of product displaced with each pump stroke.
5. After the drive rods have been pushed to the desired depth, the rod assembly should be withdrawn three to six inches so that the disposable tip has room to be dropped.
    a. If an injection tool is used instead of an expendable tip, the application of material can take place without any preliminary withdrawal of the rods.
6. Fill the annular space of the drive rods with water. This will minimize the amount of air introduced to the system.

7. Insert the telescoping suction pipe on the rotary transfer pump into a bung hole on the lid of the 55-gal drum and make sure that the pipe reaches the bottom of the drum. If possible, attach the suction pipe to the bung hole with the 2" bung adapter to ensure that the pump remains securely in place while pumping the Bio-Dechlor INOCULUM mixture from the drum to the pump hopper.
8. Attach the hose to the outlet of the rotary transfer pump making sure that the opposite end of the hose reaches the pump hopper. Open the opposite bung hole on the drum lid to prevent a vacuum then pump the desired amount of BDI PLUS solution into the hopper of the pump.
9. Connect the hose from the grout pump to the drive rod assembly.
10. Start pumping the BDI PLUS product solution.

11. The initial volume of BDI PLUS solution pumped should only be enough to displace the water within the drive rods. Once this is done the actual injection can start.
12. Begin withdrawing the drive rods, in accordance with the manufacturer's SOP, and start pumping the BDI PLUS solution simultaneously. The dosage should be 0.1 liter per vertical foot or 1 gallon per vertical foot if prepared using the BDI dilution chart. The withdrawal rate should be such that it allows the appropriate quantity of material to be injected into each vertical foot of aquifer being treated. The withdrawal rate should be slow to avoid creating a vacuum. This vacuum can potentially pull a small volume of material to the surface if the drive rods are withdrawn too quickly.
13. In less permeable soils such as clays and silts, there may be difficulty accepting the volume of estimated material. In this case Regenesis recommends using a "step-wise" application approach. For this approach we suggest withdrawing the drive rods in one-foot increments and then injecting the quantity of material required per vertical foot.
14. Look for any indications of aquifer refusal such as:
    - Excessive pump noise or application pressure spikes (e.g. squealing)
    - Surfacing of material through the injection point ("blow-by")

    If acceptance appears to be an issue it is critical that the aquifer is given enough time to equilibrate before breaking down the drive rods and/or removing the hose. The failure to do this can lead to excessive back flow of the BDI PLUS material on personnel, equipment, and the ground surface.
15. If BDI PLUS solution continues to "surface" after the drive rods have been completely removed from the borehole a plug may be necessary. Large diameter disposable tips or wood stakes have been used successfully for this purpose.
16. Drive rods should be disconnected after one rod (typically 4 feet in length) has been withdrawn. The drive rods should be placed in a bucket (or equivalent) after they have been disconnected.
17. Complete the installation of the BDI PLUS solution at the designated application rate across the entire targeted vertical interval.
18. After the injection is completed, an appropriate seal should be installed above the vertical interval where the BDI PLUS solution has been placed to prevent contaminant migration. Typically, bentonite powder or chips are used to create this seal. However, consultants should review local regulations before beginning field installation activities to confirm that this approach can be used.
19. Complete the borehole at the surface as appropriate using concrete or asphalt.
20. Repeat steps 7 through 19 until the entire application has been completed. If additional drums of de-oxygenated water are required, prepare as suggested in Step 1.
21. Prior to the installation of BDI PLUS, all surface and overhead impediments should be identified as well as the location(s) of any underground structure(s). Underground structures include but are not limited to: utility lines (gas, electrical, sewer, etc), drain piping, and landscape irrigation systems.

22. The planned injection locations should be adjusted in the field to account for impediments and obstacles.
23. The actual injection locations should be marked prior to the start of installation activities to facilitate the application process.
24. Using an appropriate pump to install the BDI PLUS product is very critical to the success of the application as well as the overall success of the project. Based on our experience in the field, Regenesis strongly recommends using a pump that has a pressure rating of at least 1,000 psi and a delivery rate of at least 3 gallons per minute.

    If the application involves both HRC and BDI PLUS, two separate pumps may be required to facilitate the process. The pump used to deliver HRC to the subsurface should be in accordance with the specifications outlined in the General Guidelines section of the HRC Installation Instructions.

Additional Information

The internal workings of the grout pump can be cleaned easily by recirculating a solution of hot water and a biodegradable cleaner (e.g. Simple Green) through the pump and delivery hose(s). If additional cleaning and decontamination is required it should be conducted in accordance with the manufacturer's SOP and local regulatory requirements.

Note: Regenesis assumes that all of the material (microorganisms) sent to a site for installation purposes will be used for that particular project and that no material (microorganisms) will be left over at the conclusion of the installation activities.

REGENESIS

Advanced Technologies for Groundwater Resources

1011 Calle Sombra
San Clemente, CA 92673
949-366-8000

REGENESIS

Advanced Technologies for Groundwater Resources

Material Safety Data Sheet (MSDS)

Bio-Dechlor INOCULUM PLUS (BDI PLUS™)

SECTION 1 - MATERIAL IDENTIFICATION AND INFORMATION

Material Name: DHC microbial consortium (SDC-9) MSDS #: ENV 1033

Date Prepared: 1/05/2006 CAS #: N/A (Not Applicable)

Prepared By: Simon Vainberg Formula #: N/A

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

SECTION 2 - INGREDIENTS

Components	%	OSHA PEL	ACGIH TLV	OTHER LIMITS
Non-Hazardous Ingredients	100	N/A	N/A	N/A

SECTION 3 - PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point: 100°C (water) Specific Gravity (H_2O = 1): 0.9 - 1.1

Vapor Pressure @ 25°C: 24 mm Hg (water) Melting Point: 0°C (water)

Vapor Density: N/A Evaporation Rate (H_2O = 1): 0.9 - 1.1

Solubility in Water: Soluble Water Reactive: No

pH: 6.0 - 8.0

Appearance and Odor: Murky, yellow to grey water. Musty odor.

Skin Contact: May cause skin irritation. Hypersensitive individuals may experience allergic reactions to enzymes.

Eye Contact: May cause eye irritation.

FIRST AID

Ingestion: Get medical attention if allergic symptoms develop (observe for 48 hours). Never give anything by mouth to an unconscious or convulsing person.

Inhalation: Get medical attention if allergic symptoms develop.

Skin Absorption: N/A

Skin Contact: Wash affected area with soap and water. Get medical attention if allergic symptoms develop.

Eye Contact: Flush eyes with plenty of water for at least 15 minutes using an eyewash fountain, if available. Get medical attention if irritation occurs.

NOTE TO PHYSICIANS: All treatments should be based on observed signs and symptoms of distress in the patient. Consideration should be given to the possibility that overexposure to materials other than this material may have occurred.

SECTION 7 - SPILL AND LEAK PROCEDURES

Reportable quantities (in lbs of EPA Hazardous Substances): N/A

Steps to be taken in case of spill or release: No emergency results from spillage. However, spills should be cleaned up promptly. All personnel involved in the cleanup must wear protective clothing and avoid skin contact. Absorb spilled material or vacuum into a container. After clean-up, disinfect all cleaning materials and storage containers that come in contact with the spilled liquid.

Waste Disposal Method: No special disposal methods are required. The material may be sewered, and is compatible with all known biological treatment methods. To reduce odors and permanently inactivate microorganisms, mix 100 parts (by volume) of SDC-9 consortium with 1 part (by volume) of bleach. Dispose of in accordance with local, state and federal regulations.

SECTION 8 - HANDLING AND STORAGE

Hand Protection: Rubber gloves.

Eye Protection: Safety goggles with side splash shields.

Protective Clothing: Use adequate clothing to prevent skin contact.

Respiratory Protection: Surgical mask.

Ventilation: Provide adequate ventilation to remove odors.

Storage & Handling:
Material may be stored for up to 3 weeks at 2-4°C without aeration.

Other Precautions: An eyewash station in the work area is recommended.

Hydrogen Release Compound Primer (HRC Primer™)
MATERIAL SAFETY DATA SHEET (MSDS)

Last Revised: August 17, 2005

Section 1 - Material Identification

Supplier:

REGENESIS
1011 Calle Sombra
San Clemente, CA 92673
Phone: 949.366.8000
Fax: 949.366.8090
E-mail: info@regenesis.com

Chemical Name:	**Propanoic acid, 2-[2-[2-(2-hydroxy-1-oxopropoxy)-1-oxopropoxy]-1-oxopropoxy]-1,2,3-propanetriyl ester**
Chemical Family:	**Organic Chemical**
Trade Name:	**HRC, Glycerol Polylactate Primer**

Section 2 – Chemical Identification

CAS#	Chemical
201167-72-8	Glycerol Polylactate
50-21-5	Lactic Acid

Section 3 - Physical Data

Melting Point:	**NA**
Boiling Point:	**ND**
Flash Point:	**ND**
Density:	**1.10 g/cc**
Solubility:	**Water, Acetone and DMSO**
Appearance:	**Yellow Liquid**
Odor:	**Not detectable**

Section 4 - Fire and Explosion Hazard Data

Extinguishing Media: **Carbon Dioxide, Dry Chemical Powder or Appropriate Foam.**

Water may be used to keep exposed containers cool.

For large quantities involved in a fire, one should wear full protective clothing and a NIOSH approved self contained breathing apparatus with full face piece operated in the pressure demand or positive pressure mode as for a situation where lack of oxygen and excess heat are present.

Section 5 - Toxicological Information

Acute Effects: **May be harmful by inhalation, ingestion, or skin absorption. May cause irritation. To the best of our knowledge, the chemical, physical, and toxicological properties of the glycerol tripolylactate have not been investigated. Listed below are the toxicological information for glycerol and lactic acid.**

RTECS#: **MA8050000**
Glycerol

Irritation data:

SKN-RBT 500 MG/24H MLD	BIOFX* 9-4/1970
85JCAE-,207,1986	85JCAE-,207,1986
EYE-RBT 126 MG MLD	
EYE-RBT 500 MG/24H MLD	

Toxicity data:

ORL-MUS LD50:4090 MG/KG	
FRZKAP (6),56,1977	
SCU-RBT LD50:100 MG/KG	NIIRDN 6,215,1982
ORL-RAT LD50:12600 MG/KG	FEPRA7 4,142,1945
IHL-RATLC50:>570MG/M3/1HBIOFX*9-4/1970 IPR-RAT LD50: 4420 MG/KG	RCOCB8 56,125,1987
IVN-RAT LD50:5566 MG/KG	ARZNAD 26,1581,1976
IPR-MUS LD50: 8700 MG/KG	ARZNAD 26,1579,1978
SCU-MUS LD50: 91 MG/KG	NIIRDN 6,215,1982
IVN-MUS LD50: 4250 MG/KG	JAPMA8 39,583,1950
ORL-RBT LD50: 27 GM/KG	DMDJAP 31,276,1959
SKN-RBT LD50:>10GM/KG	BIOFX* 9-4/1970
IVN-RBT LD50: 53 GM/KG	NIIRDN 6,215,1982
	JIHTAB 23,259,1941
ORL-GPG LD50: 7750 MG/KG	

Section 5 - Toxicological Information (cont)

Target Organ data:	**Behavioral (headache), gastrointestinal (nausea or vomiting), Paternal effects (spermatogenesis, testes, epididymis, sperm duct), effects of fertility (male fertility index, post-implantation mortality).**
Acute Effects:	**May be harmful by inhalation, ingestion, or skin absorption. May cause irritation. To the best of our knowledge, the chemical, physical, and toxicological properties of the glycerol tripolylactate have not been investigated. Listed below are the toxicological information for glycerol and lactic acid.**
RTECS#:	**OD2800000** **Lactic acid**
Irritation data:	**SKN-RBT 5MG/24H SEV** **85JCAE -,656,86** **EYE-RBT 750 UG SEV** **AJOPAA 29,1363,46**
Toxicity data:	**ORL-RAT LD50:3543 MG/KG** **FMCHA2-,C252,91** **SKN-RBT LD50:>2 GM/KG** **FMCHA2-,C252,91** **ORL-MUS LD50: 4875 MG/KG** **FAONAU 40,144,67** **JIHTAB 23,259,41** **ORL-GPG LD50: 1810 MG/KG** **FMCHA2-,C252,91** **ORL-QAL LD50: >2250 MG/KG**

Only selected registry of toxic effects of chemical substances (RTECS) data is presented here. See actual entry in RTECS for complete information on lactic acid and glycerol.

Section 6 - Health Hazard Data

Handling: **Avoid continued contact with skin. Avoid contact with eyes.**

In any case of any exposure which elicits a response, a physician should be consulted immediately.

First Aid Procedures

Inhalation:	**Remove to fresh air. If not breathing give artificial respiration. In case of labored breathing give oxygen. Call a physician.**
Ingestion:	**No effects expected. Do not give anything to an unconscious person. Call a physician immediately.**

Section 6 - Health Hazard Data (cont)

Skin Contact:	**Flush with plenty of water. Contaminated clothing may be washed or dry cleaned normally.**
Eye contact:	**Wash eyes with plenty of water for at least 15 minutes lifting both upper and lower lids. Call a physician.**

Section 7 - Reactivity Data

Conditions to Avoid:	**Strong oxidizing agents, bases and acids**
Hazardous Polymerization:	**None known**
Further Information:	**Hydrolyses in water to form Lactic Acid and Glycerol.**

Section 8 - Spill, Leak or Accident Procedures

After Spillage or Leakage:	**Neutralization is not required. This combustible material may be burned in a chemical incinerator equipped with an afterburner and scrubber.**
Disposal:	**Laws and regulations for disposal vary widely by locality. Observe all applicable regulations and laws. This material, may be disposed of in solid waste. Material is readily degradable and hydrolyses in several hours.**

No requirement for a reportable quantity (CERCLA) of a spill is known.

Section 9 - Special Protection or Handling

Should be stored in plastic lined steel, plastic, glass, aluminum, stainless steel, or reinforced fiberglass containers.

Protective Gloves:	**Vinyl or Rubber**
Eyes:	**Splash Goggles or Full Face Shield** **Area should have approved means of washing eyes.**
Ventilation:	**General exhaust.**
Storage:	**Store in cool, dry, ventilated area. Protect from imcompatible materials.**

Section 10 - Other Information

This material will degrade in the environment by hydrolysis to lactic acid and glycerol. Materials containing reactive chemicals should be used only by personnel with appropriate chemical training.

The information contained in this document is the best available to the supplier as of the time of writing. Some possible hazards have been determined by analogy to similar classes of material. No separate tests have been performed on the toxicity of this material. The items in this document are subject to change and clarification as more information becomes available.

APPENDIX C

OSHA HEAT INDEX TABLE

TABLE 2. APPROACH FOR SETTING WORK/REST SCHEDULES FOR WORKERS WEARING CHEMICAL-RESISTANT SUITS[1]

Air Temperature	Work/Rest Schedules								
	--Light Work--			--Moderate Work--			--Heavy Work--		
	Full Sun	Partly Cloudy	No Sun[2]	Full Sun	Partly Cloudy	No Sun[2]	Full Sun	Partly Cloudy	No Sun[2]
75°F	Normal Schedule	Normal Schedule	Normal Schedule	Normal Schedule	Normal Schedule	Normal Schedule	35/25[3]	Normal Schedule	Normal Schedule
80°F	30/30	Normal Schedule	Normal Schedule	20/40	Normal Schedule	Normal Schedule	10/50	40/20	Normal Schedule
85°F	15/45	40/20	Normal Schedule	10/50	25/35	Normal Schedule	Caution[4]	15/45	40/20
90°F	Caution[4]	15/45	40/20	Caution[4]	Caution[4]	25/35	Stop Work	Caution[4]	15/45
95°F	Stop Work	Stop Work	15/45	Stop Work	Stop Work	Stop Work	Stop Work	Stop Work	Stop Work

NOTES:

1. This table is based on values for heat-acclimatized adult workers under the age of 40 who are physically fit, well-rested, and fully hydrated; with the assumptions of Tyvek coveralls, gloves, boots, and a respirator being worn; adequate water intake; and air temperature readings taken in the shade. Cooling vests may enable workers to work for longer periods. Adjustments must be made when additional protective gear is worn.
2. No shadows are visible or work is in the shade or at night.
3. 35/25 = 35 minutes work and 25 minutes rest each hour.
4. Indicates very high levels of heat stress. Consider rescheduling activities for a time when the risk of heat illness is lower.

SOURCE: Adapted from: U.S. EPA/OSHA. 1993. A guide to heat stress in agriculture. EPA-750-b-92-001

Other resources with approaches and tips for setting work/rest periods include:

- OSHA's Technical Manual Table III: 4-2 offers a simple chart showing several example WBGT meter readings and the appropriate work/rest schedules for light, moderate or heavy work.
- The American Conference of Governmental Industrial Hygienists (ACGIH) describes a detailed method of determining work/rest schedules based on numerous factors including WBGT meter readings. The schedule can be adjusted for work demands and clothing type. This work/rest schedule method is published as: Heat Stress and Strain, in TLVs and BEIs, American Conference of Industrial Hygienists, Cincinnati, OH.

APPENDIX D

HEAT RELATED ILLNESS DESCRIPTIONS

SAFETY AND HEALTH TOPICS

Occupational Heat Exposure

Heat-related Illnesses and First Aid

Heat stroke, the most serious form of heat-related illness, happens when the body becomes unable to regulate its core temperature. Sweating stops and the body can no longer rid itself of excess heat. Signs include confusion, loss of consciousness, and seizures. **"Heat stroke is a medical emergency that may result in death!** Call 911 immediately.

Heat exhaustion is the body's response to loss of water and salt from heavy sweating. Signs include headache, nausea, dizziness, weakness, irritability, thirst, and heavy sweating.

Heat cramps are caused by the loss of body salts and fluid during sweating. Low salt levels in muscles cause painful cramps. Tired muscles—those used for performing the work—are usually the ones most affected by cramps. Cramps may occur during or after working hours.

Heat rash, also known as prickly heat, is skin irritation caused by sweat that does not evaporate from the skin. Heat rash is the most common problem in hot work environments.

The chart below shows **symptoms** and **first aid measures** to take if a worker shows signs of a heat-related illness.

Illness	Symptoms	First Aid*
Heat stroke	▪ Confusion ▪ Fainting ▪ Seizures ▪ Excessive sweating or red, hot, dry skin ▪ Very high body temperature	▪ Call 911 While waiting for help: ▪ Place worker in shady, cool area ▪ Loosen clothing, remove outer clothing ▪ Fan air on worker; cold packs in armpits ▪ Wet worker with cool water; apply ice packs, cool compresses, or ▪ Provide fluids (preferably water) as soon as possible ▪ Stay with worker until help arrives

Heat exhaustion	▪ Cool, moist skin ▪ Heavy sweating ▪ Headache ▪ Nausea or vomiting ▪ Dizziness ▪ Light headedness ▪ Weakness ▪ Thirst ▪ Irritability ▪ Fast heart beat	▪ Have worker sit or lie down in a cool, shady area ▪ Give worker plenty of water or other cool beverages to drink ▪ Cool worker with cold compresses/ice packs ▪ Take to clinic or emergency room for medical evaluation or treatm symptoms worsen or do not improve within 60 minutes. ▪ Do not return to work that day
Heat cramps	▪ Muscle spasms ▪ Pain ▪ Usually in abdomen, arms, or legs	▪ Have worker rest in shady, cool area ▪ Worker should drink water or other cool beverages ▪ Wait a few hours before allowing worker to return to strenuous w ▪ Have worker seek medical attention if cramps don't go away
Heat rash	▪ Clusters of red bumps on skin ▪ Often appears on neck, upper chest, folds of skin	▪ Try to work in a cooler, less humid environment when possible ▪ Keep the affected area dry

* Remember, if you are not a medical professional, use this information as a guide only to help workers in need.

For more information about heat-related illnesses:

- OSHA *Campaign to Prevent Heat Illness in Outdoor Workers* **materials**:
  - Illustrated, low-literacy fact sheets for workers (PDF*). OSHA, (2011). A Spanish version (PDF*) is also available.**
  - Worksites poster for employers that illustrate heat illness (PDF*). OSHA, (2011). A Spanish version (PDF*) is also available
  - Community posters that list heat prevention tips and provide OSHA contact information (PDF*). A Spanish version (PDF) is
  - OSHA Heat Illness Prevention Training Guide (PDF*). OSHA, (2011). A Spanish version (PDF*) is also available.
  - Use OSHA's Heat Smartphone App. Check the heat index for your worksite and see reminders about the protective measu risk level.
- OSHA Technical Manual (OTM). OSHA Directive TED 01-00-015 [TED 1-0.15A], (1999, January 20). Includes a chapter on Hea sections on the signs and symptoms of heat stress, sampling methods, control suggestions, and guidelines for investigating he workplace.
- Protecting Workers from the Effects of Heat (PDF*). OSHA Fact Sheet, (2011, April).
- Protecting Workers from Heat Stress (PDF*). OSHA Quick Card, (2010).
- Protecting Workers from Heat Illness (PDF*). OSHA-NIOSH Info Sheet, (2011).
- Working in Hot Environments . National Institute for Occupational Safety and Health (NIOSH) Publication No. 86-112, (1986, health hazards and preventive measures for working in hot environments.
- Heat Stress . National Institute for Occupational Safety and Health (NIOSH) Workplace Safety and Health Topic Page.
- Frequently Asked Questions (FAQ) about Extreme Heat . Centers for Disease Control and Prevention (CDC).
- Heat Illness . National Institutes of Health, Medline Plus. Includes information in multiple languages.
- Heat: A Major Killer . National Oceanic and Atmospheric Administration (NOAA), National Weather Service. Links to landing p index description and chart.
- *Heat Stress and Strain: TLV® Physical Agents 7th Edition Documentation.* Summarizes the scientific data used by the America Government Industrial Hygienists (ACGIH) used to derive its threshold limit value (TLV) for heat exposure.
- Cal/OSHA Webpage: California Campaign to Protect Outdoor Workers From Heat Illness **
- Cal/OSHA Heat Illness Prevention eTool and Action Kit ***

***California and Washington state have their own heat illness prevention standards; these materials reflect the requirements in those

*Accessibility Assistance: Contact OSHA's Directorate of Technical Support and Emergency Management at (202) 639-2300 for assistance accessing P

All other documents, that are not PDF materials or formatted for the web, are available as Microsoft Office® formats and videos and are noted according is needed with reading, reviewing or accessing these documents or any figures and illustrations, please also contact OSHA's Directorate of Technical Supp Management at (202) 639-2300.

**eBooks - EPUB is the most common format for e-Books. If you use a Sony Reader, a Nook, or an iPad you can download the EPUB file format. If you us download the MOBI file format.

APPENDIX E

DAILY SAFETY MEETING LOG

DAILY SAFETY MEETING LOG

DATE: _____

TIME: _____

I. ITEMS DISCUSSED

_____

_____

_____

_____

_____

_____

_____

_____

_____

II. SIGNATURES OF ATTENDEES

APPENDIX F

DRIVING DIRECTIONS AND ROUTE TO ST. LUKE'S CORNWALL HOSPITAL – CORNWALL CAMPUS

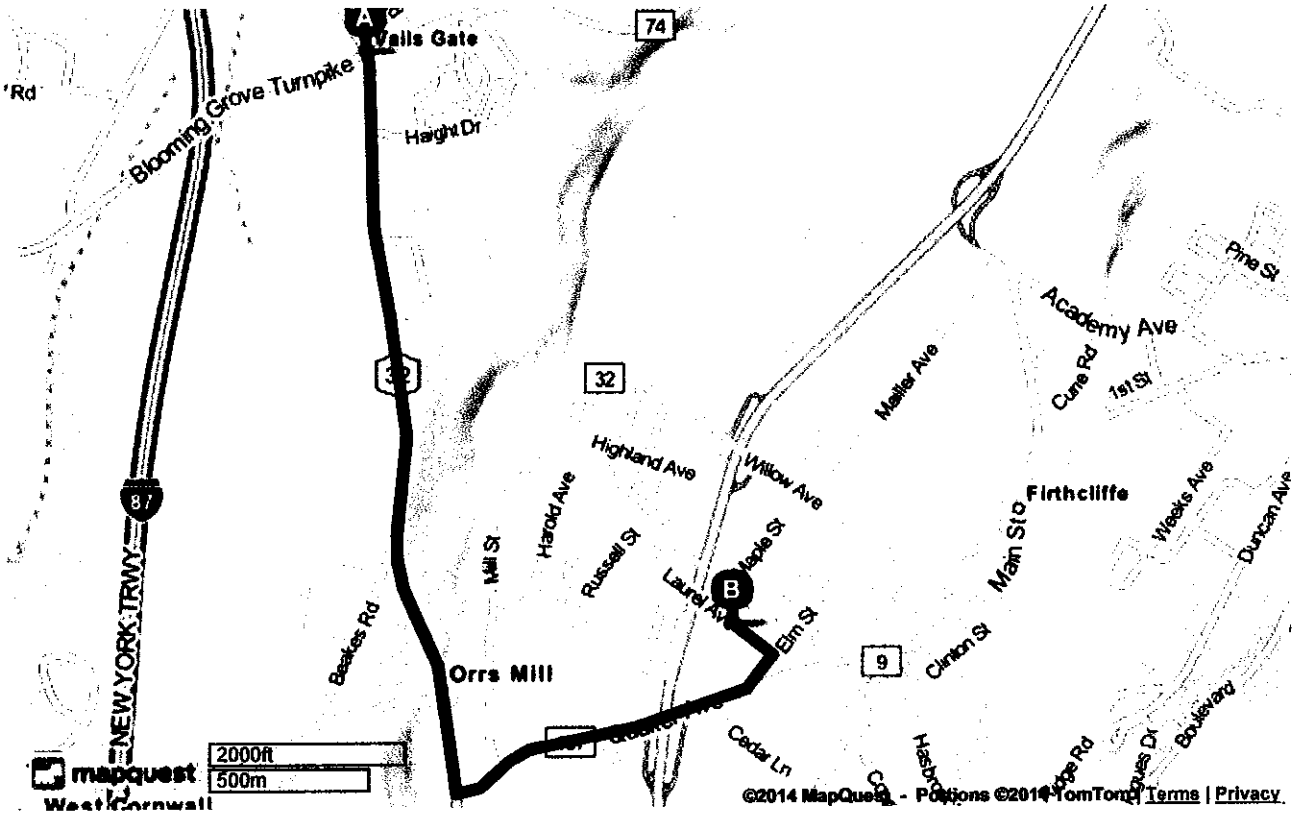
Notes

mapquest

Trip to:
19 Laurel Ave
Cornwall, NY 12518-1403
2.56 miles / 5 minutes

A	**Vails Gate, NY**	Download Free App
●	1. Start out going **south** on **State Route 32 / NY-32** toward **Haight Dr**. Map	**1.7 Mi**
↰	2. Turn **left** onto **Quaker Ave / County Hwy-107**. Continue to follow **Quaker Ave**. Map	**0.7 Mi**
↖	3. Turn **slight left** onto **Elm St**. Map	**0.09 Mi**
↰	4. Take the 1st **left** onto **Laurel Ave**. Map	**0.1 Mi**
■	5. **19 LAUREL AVE** is on the **left**. Map	
B	**19 Laurel Ave**, Cornwall, NY 12518-1403	

Total Travel Estimate: **2.56 miles - about 5 minutes**



APPENDIX B
AGREEMENT WITH SITE OWNER
(Pending)