



NEW MEXICO ENVIRONMENT  
DEPARTMENT GROUND WATER QUALITY  
BUREAU



UNDERGROUND INJECTION CONTROL  
GENERAL DISCHARGE PERMIT

**Certified Mail- Return Receipt Requested**

**Facility Name:** College Plaza South Site  
**Facility Location:** 2400 Cerrillos Road, Santa Fe, New Mexico  
Section 34, T 17 N, R 9 E  
VRP Site #53161011

**Legally Responsible Party:** B & LV College Plaza, LP  
330 Garfield Street  
Santa Fe, New Mexico 87501  
505-992-5121

**Remediation Oversight Agency Contact:** New Mexico Environment Department  
Groundwater Quality Bureau – Voluntary  
Remediation Program  
Jennifer Muus (Project Manager)  
505-827-2242

**Remediation or Injection Plan Identification:** “Groundwater Remediation Workplan for the  
College Plaza South Site”

**Permitting Action:** New

**PPS Contact** Tim Haller – Haller & Associates, Inc.  
505-281-9333 [timhaller@vcimail.com](mailto:timhaller@vcimail.com)

**EFFECTIVE DATE:** **TERM ENDS:**

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**Justin Ball**  
**Acting Chief, Ground Water Quality Bureau**

[Subsection H of 20.6.2.3109 NMAC, NMSA 1978, § 74-6-5.I]

## I. UIC GENERAL DISCHARGE PERMIT

The New Mexico Environment Department (NMED) Ground Water Quality Bureau (GWQB) issues this Underground Injection Control General Discharge Permit (UIC Permit) for the subsurface emplacement of additive fluids through a Class V UIC injection well for the purpose of facilitating vadose zone or groundwater remediation. The GWQB issues this UIC Permit to [B & LV College Plaza, LP] (Permittee) pursuant to the New Mexico Water Quality Act (WQA), NMSA 1978 §§74-6-1 through 74-6-17, and the New Mexico Water Quality Control Commission (WQCC) Ground and Surface Water Protection Regulations, 20.6.2 NMAC.

In issuing this UIC Permit, the GWQB has determined that the requirements of Subsection C of 20.6.2.3109 NMAC have been met. The activities authorized by this UIC Permit are principally governed by [Groundwater Remediation Workplan for the College Plaza South Site] (Injection Plan), under the authority of [NMAC 20.6.3 – Environmental Protection, Water Quality, Voluntary Remediation], with oversight by the [Groundwater Quality Bureau – Voluntary Remediation Program]. Compliance with this UIC Permit requires compliance with the terms, requirements, and conditions of the Injection Plan. The term of this UIC Permit shall be no longer than five years from the effective date of this UIC Permit.

The injection activities, the location of the injection site, the type of injection and quantities of additives being used are briefly described as follows:

### **Injection Activities (summary: including injection well type, number of wells, and injection frequency)**

Copy of the Injection Plan Attached (required): ☒

The objective of this permit is to facilitate remediation of dissolved PCE via reductive dechlorination processes. The attached workplan provides methods for mixing and injection of Regenesis treatment solutions into 18 injection wells. 3DME® and CRS® mixed with water will be injected, immediately followed by the injection of BDI Plus® anaerobic bacteria. One injection event is anticipated; however, subsequent hotspot treatment may be performed if necessary.

### **Injection Site Information**

Depth to groundwater: Approx. 101 ft (west portion of plume) to 104 ft (east portion of plume)

Existing concentration of total dissolved solids (TDS) in groundwater: 540 mg/L (average from five monitor wells, converted from field-measured specific conductance)

Location: Rear parking lot of the College Plaza South shopping center. The east portion of the dissolved PCE plume is located behind Units 2404 and 2406. The west portion of the plume is behind Units 2408 through 2412.

County: Santa Fe

Latitude: 35.393339

Longitude: -105.585004

Map Showing Area of Injection Sites Attached (required) -: ☒ (Figure 2)

**Additives Being Used (including volumes, manufacturer, and mixing ratios)**

3DME® by Regenesis (oleic acids, lactates and polylactates)  
CRS® by Regenesis (ferrous iron solution)  
1,150 gallons of 3DME®, 457 gallons of CRS® and 13,229 gallons of clean potable water  
14,836 gallons total  
824 gallons per injection well  
Mixed onsite in 500 to 1,000-gallon batches  
Ratio of 3DME® to water is approximately 8.7 gallons per 100 gallons  
Ratio of CRS® to water is approximately 3.5 gallons per 100 gallons  
Injection into the shallow aquifer by pumping into 18 injection wells  
Depth to groundwater is approximately 101 feet (east portion) and 104 feet (west portion)

BDI Plus® by Regenesis (anaerobic bacteria and enzymes)  
24.3 gallons of BDI Plus® and 920 gallons of de-oxygenated clean potable water  
Mixed onsite in 50-gallon batches  
Ratio of BDI Plus® to water is approximately 1.3 gallons per 50 gallons  
Injection into the shallow aquifer by pumping into 18 injection wells  
Depth to groundwater is ranges from 101 to 104 feet

**Anticipated Precipitation, Dissolution, Adsorption, and Desorption Products**

Anticipated Increases: Dissolved Fe and Mn, TOC, BOD, COD, alkalinity, metabolic acids (Figure 4)

Anticipated Decreases: Chlorinated VOCs, DO, ORP, sulfate, nitrate and pH (Figure 4).

The objective of 3DME® and CRS® injection is to alter groundwater chemistry to an anaerobic state while providing sufficient electron donors and electron receptors to support anaerobic bacteria. BDI Plus® injection provides anaerobic microbes that are shown to dechlorinate PCE and daughter products.

The injected solutions are expected to have efficacy for 18 to 24 months during which time groundwater monitoring and reporting will be performed.

**Public Notice Posting Locations**

2 inch by 3 inch Newspaper Ad required for Renewal applications.  
**Newspaper:** Not Applicable – New Application

3 inch by 4 inch Newspaper Ad required for New, Modification, and Renewal/Modification applications.  
**Newspaper:** The Santa Fe New Mexican

2 feet by 3 feet sign posted for 30 days in a location conspicuous to the public at or near the facility required for New, Modification, and Renewal/Modification applications.  
**Sign Location:** Installed in parking lot on land scaping median, in front of suites 2404 & 2406

8.5 inch by 11 inch or larger posted off-site location conspicuous to the public (e.g. public library). Required for New, Modification, and Renewal/Modification applications.  
**Flyer Location:** Santa Fe Public Library – La Farge Branch (1730 Llano St)

This UIC Permit consists of the complete and accurate completion of this UIC Permit form as determined by the GWQB.

Issuance of this UIC Permit does not relieve the Permittee of the responsibility to comply with the WQA, WQCC Regulations, and any other applicable federal, state and/or local laws and regulations, such as zoning requirements and nuisance ordinances.

**Signatures**

Signature must be that of the person listed as the legally responsible party on this application.

*I, the applicant, attest under penalty of law to the truth of the information and supporting documentation contained in this application for an Underground Injection Control General Discharge Permit.*

**Applicant's Signature**

**B&LV College Plaza Limited Partnership, a Delaware limited partnership**

**By: Rosemont College Plaza LLC, a New Mexico limited liability company, its general partner**



**By: \_\_\_\_\_**

**By: Paul S. Gerwin**

**Its: Manager, Executive Vice President and Secretary**

**Date: March 5, 2021**

## **II. FINDINGS**

In issuing this UIC Permit, GWQB finds:

1. The Permittee is injecting fluids so that such injections will move directly or indirectly into groundwater within the meaning of Section 20.6.2.3104 NMAC.
2. The Permittee is injecting fluids so that such fluids will move into groundwater of the State of New Mexico which has an existing concentration of 10,000 mg/L or less of TDS within the meaning of Subsection A of 20.6.2.3101 NMAC.
3. The Permittee is using a Class V UIC well as described in 20.6.2.5002(B)(5)(d)(ii) NMAC for in situ groundwater remediation by injecting a fluid that facilitates vadose zone or groundwater remediation.
4. The Permittee is injecting fluids into groundwater in order to achieve the remediation goals identified in the Injection Plan.

## **III. AUTHORIZATION TO DISCHARGE**

The Permittee is authorized to inject chemical additives into groundwater in accordance with this UIC Permit and the Injection Plan under the oversight of [GROUNDWATER QUALITY BUREAU – VOLUNTARY REMEDIATION PROGRAM].

[20.6.2.3104 NMAC, Subsection C of 20.6.2.3106 NMAC, Subsection C of 20.6.2.3109 NMAC]

#### **IV. CONDITIONS**

The conditions of this UIC Permit shall be complied with by the Permittee and are enforceable by GWQB.

1. The Permittee shall perform remediation activities in accordance with the Injection Plan and shall notify GWQB of any changes prior to making them.  
[20.6.2.3107 NMAC]
2. The Permittee shall monitor the injection activities and their effects on groundwater quality as required by the Injection Plan and shall provide GWQB with electronic copies of the required reporting and any pertinent documentation of activities at the site.  
[20.6.2.3107.A NMAC, 20.6.2.3109.A NMAC]
3. If GWQB or the Permittee identifies any failure of the Injection Plan or this UIC Permit to comply with 20.6.2 NMAC not specifically noted herein, GWQB may require the Permittee to submit a corrective action plan and schedule for completion of corrective actions to address the failure. Additionally, the GWQB may require the Permittee to submit a proposed modification to the Injection Plan, this UIC Permit, or both.  
[20.6.2.3107.A NMAC, 20.6.2.3109.E NMAC]
4. **ADDITIONAL MONITORING REQUIREMENTS – (RESERVED)**
5. **TERMINATION** – Within 30 days of completion of activities authorized by this UIC Permit the Permittee shall submit a closure report and a request to terminate the UIC Permit to the GWQB for its approval. The closure report shall identify how the injection well(s) was (were) closed in accordance with the Injection Plan. The Permittee shall provide [GROUNDWATER QUALITY BUREAU - VOLUNTARY REMEDIATION PROGRAM] with a copy of this closure report.  
[20.6.2.5005 NMAC, 19.27.4 NMAC]
6. **INSPECTION and ENTRY** – The Permittee shall allow a representative of the NMED to inspect the facility and its operations subject to this UIC Permit and the WQCC regulations. The GWQB representative may, upon presentation of proper credentials, enter at reasonable times upon or through any premises in which a water contaminant source is located or in which are located any records required to be maintained by regulations of the federal government or the WQCC. The Permittee shall allow the GWQB representative to have access to, and reproduce for their use, any copy of the records, and to perform assessments, sampling or monitoring during an inspection for the purpose of evaluating compliance with this UIC Permit and the WQCC regulations.

Nothing in this UIC Permit shall be construed as limiting in any way the inspection and entry authority of GWQB under the WQA, the WQCC Regulations, or any other local, state, or federal regulations.

[20.6.2.3107.D NMAC, NMSA 1978, §§ 74-6-9.B and 74-6-9.E]

7. MODIFICATIONS and/or AMENDMENTS – In the event the Permittee proposes a change to the injection plan that would result in a change in the volume injected; the location of the injections; or the concentration of the additives being injected by the facility, the Permittee shall notify GWQB prior to implementing such changes. The Permittee shall obtain approval (which may require modification of this UIC Permit) by GWQB prior to implementing such changes.

[20.6.2.3107.C NMAC, 20.6.2.3109.E and G NMAC]

8. COMPLIANCE with OTHER LAWS – Nothing in this UIC Permit shall be construed in any way as relieving the Permittee of the obligation to comply with all applicable federal, state, and local laws, regulations, permits, or orders.

[NMSA 1978, § 74-6-5.L]

9. PERMIT FEES – Payment of permit fees is due at the time of UIC Permit approval. Permit fees shall be paid in a single payment remitted to GWQB no later than 30 days after the UIC Permit effective date.

Permit fees are associated with issuance of this UIC Permit. Nothing in this UIC Permit shall be construed as relieving the Permittee of the obligation to pay all permit fees assessed by GWQB. A Permittee that ceases injecting or does not commence injecting during the term of the UIC Permit shall pay all permit fees assessed by GWQB. An approved UIC Permit shall be suspended or terminated if the facility fails to remit a payment by its due date.

[20.6.2.3114.F NMAC, NMSA 1978, § 74-6-5.K]

## **FIGURES**



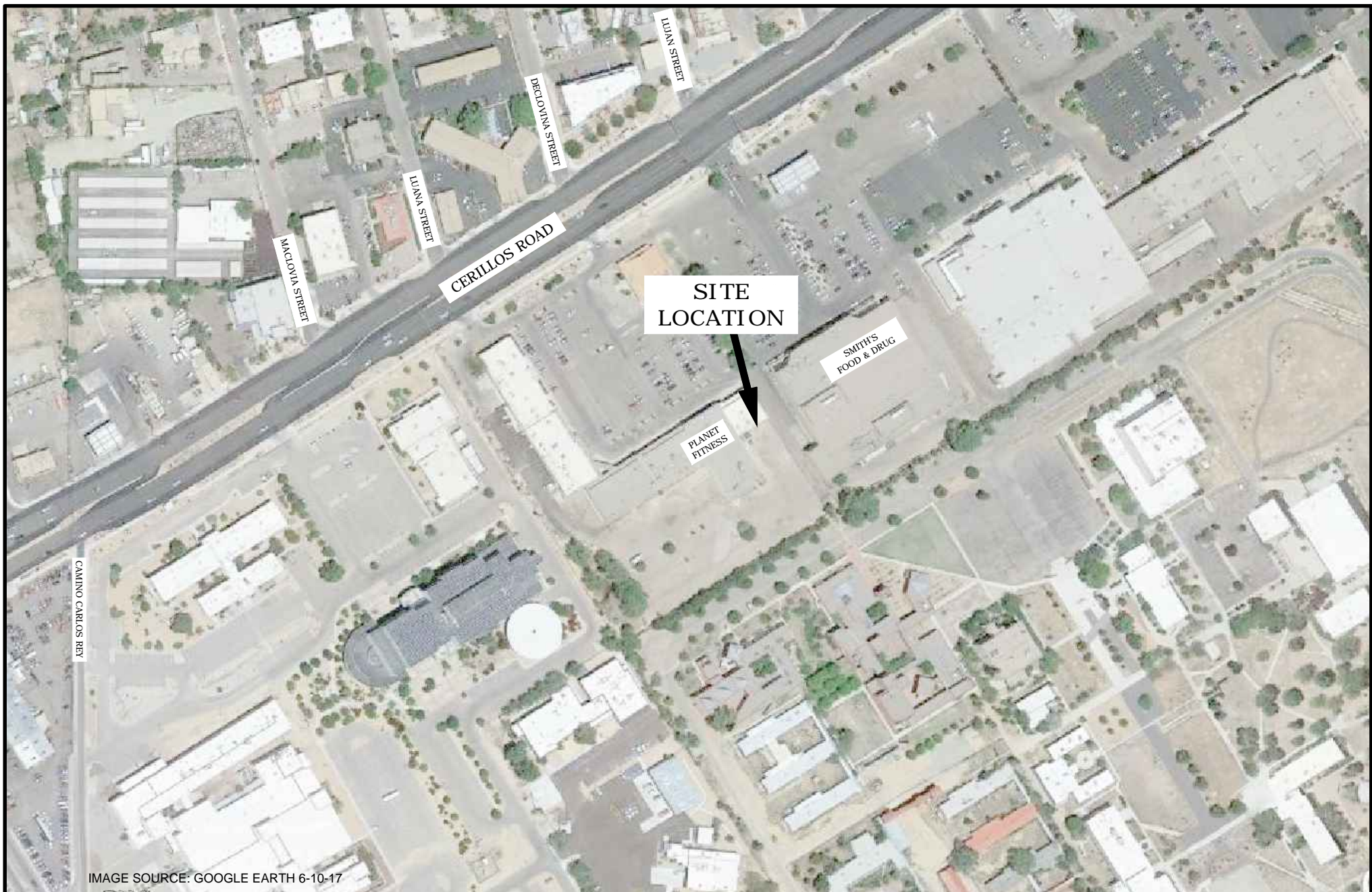


IMAGE SOURCE: GOOGLE EARTH 6-10-17



P.O. BOX 1667, 12220 N. HWY 14, SUITE C  
CEDAR CREST, NEW MEXICO 87008

## SITE LOCATION MAP

COLLEGE PLAZA SOUTH  
2400 CERILLOS ROAD  
SANTA FE, NEW MEXICO

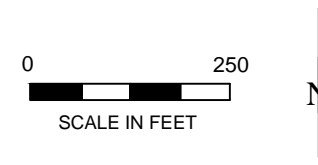


FIGURE  
**1**



LEGEND

- VB-1

BORING WITH VAPOR IMPLANTS AT 10', 30', 50' AND 70'

MW-1

MONITOR WELL OR PIEZOMETER

MW-3  
A/B

NESTED SVE WELL  
(A=SHALLOW, B=DEEP)

PROPOSED INJECTION WELL LOCATION

390

PCE CONCENTRATION

PCE ISOCONCENTRATION CONTOUR  
(DASHED WHERE INFERRED)
- PCE - TETRACHLOROETHENE

  - MOST RECENT PCE DATA ARE SHOWN. REFER TO TABLE 2.
  - CONCENTRATIONS EXPRESSED IN MICROGRAMS PER LITER
  - WELLS SHOWN IN MAGENTA ARE CONNECTED TO SVE SYSTEM

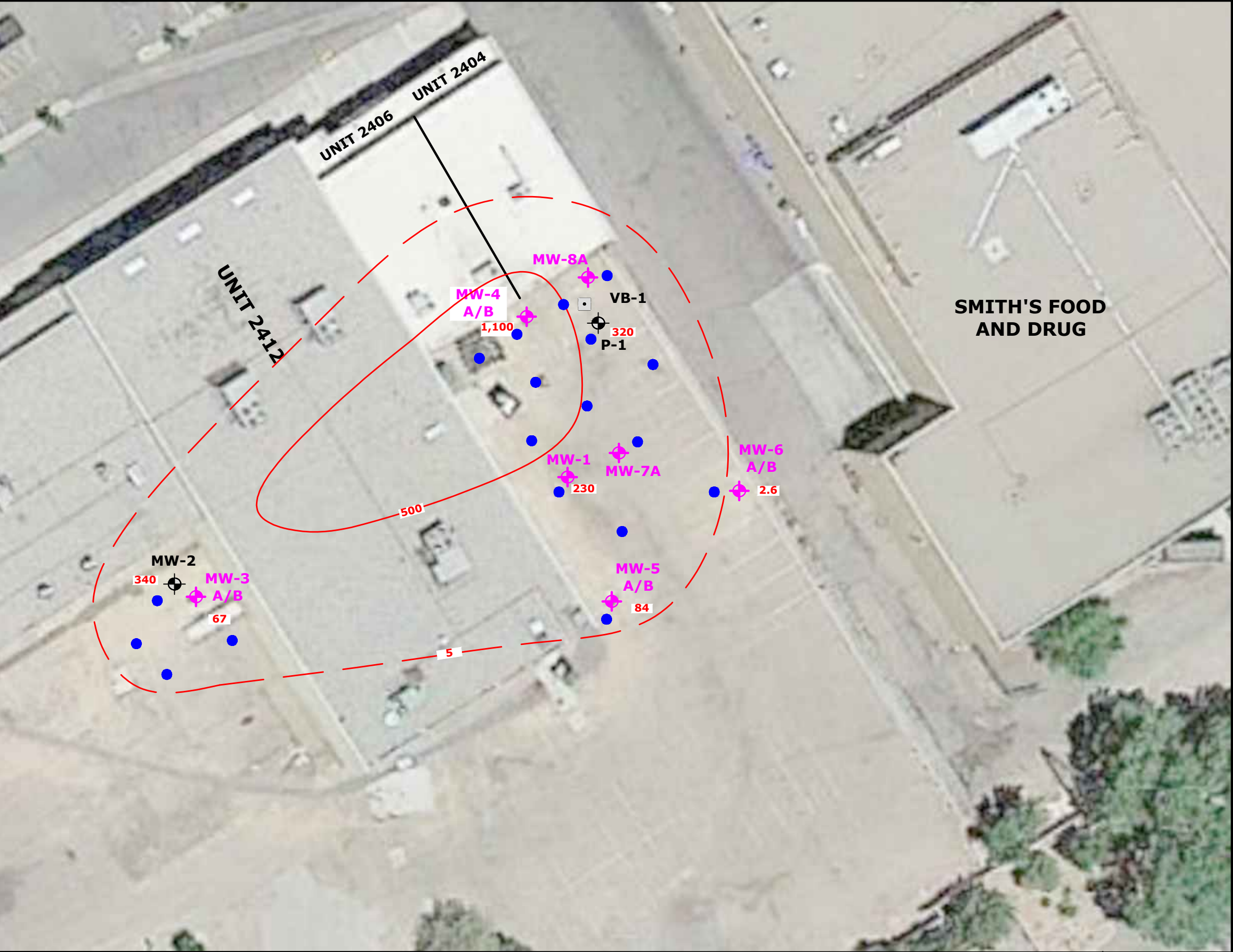
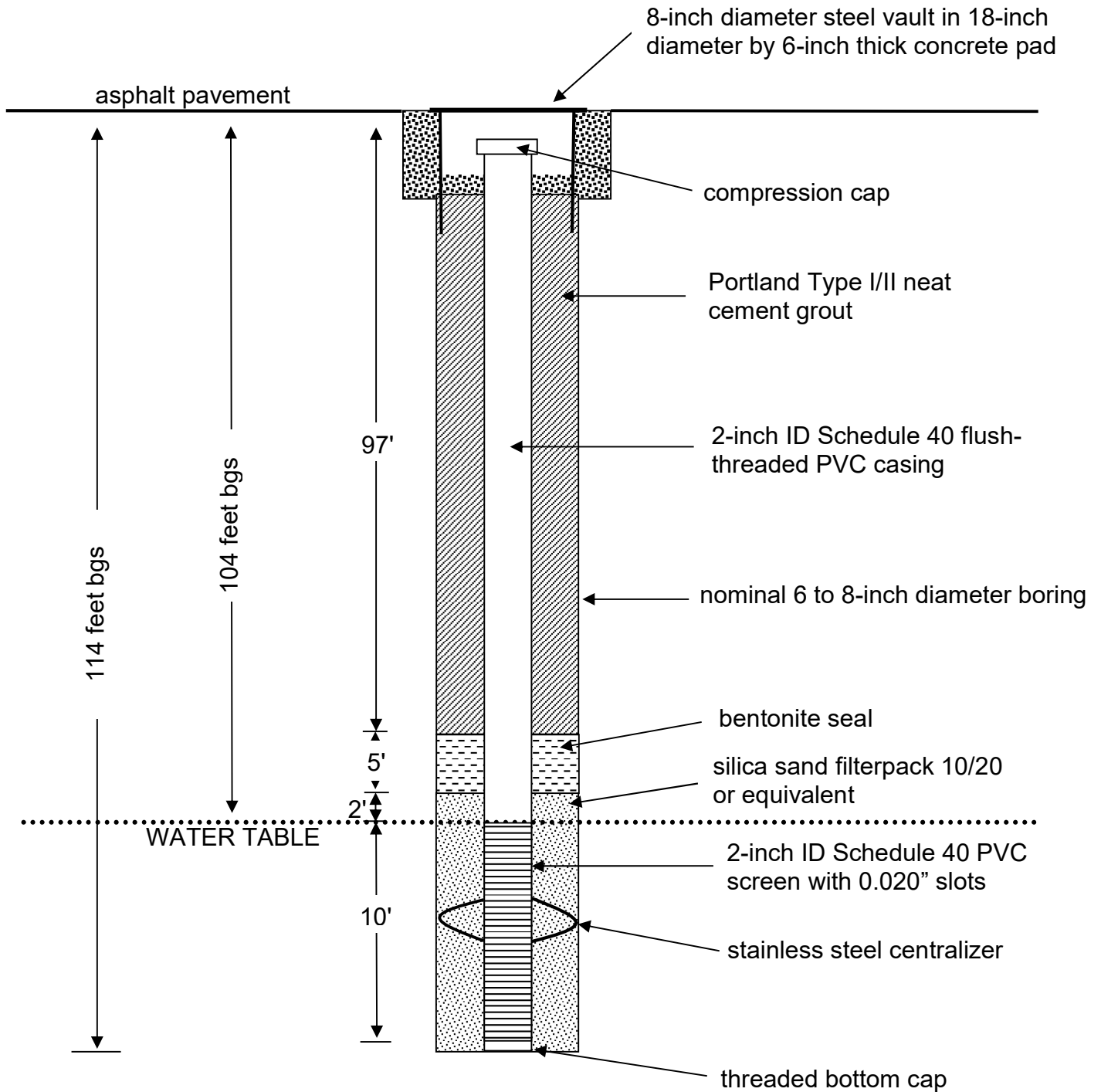


IMAGE SOURCE: GOOGLE EARTH 6-10-17



**Figure 3. Conceptual Injection Well Profile**  
**College Plaza South, Santa Fe, New Mexico**



- Proposed injection well depths are based on most recent groundwater data. Actual well construction depths will be determined by actual depth to groundwater at the time of drilling.
- Drawing is not to scale.

## **APPENDIX A**

### **GROUNDWATER REMEDIATION WORKPLAN FOR THE COLLEGE PLAZA SOUTH SITE**

December 11, 2019

Ms. Jennifer Muus  
New Mexico Environment Department  
Groundwater Quality Bureau  
Voluntary Remediation Program  
1190 St. Francis Drive, Suite N-2200  
Santa Fe, NM 87502

**RE:** Groundwater Remediation Workplan  
College Plaza South, 2400 Cerrillos Road, Santa Fe, New Mexico  
VRP #53161011

Dear Ms. Muus:

Haller & Associates, Inc. (HAI) is pleased to submit this workplan to address the dissolved-phase contaminant plume at College Plaza South in Santa Fe, New Mexico. This workplan was prepared on behalf of B & LV College Plaza, LP, in response to a workplan request from the New Mexico Environment Department - Groundwater Quality Bureau - Voluntary Remediation Program.

If you have questions or comments, please call me at (505) 281-9333.

Sincerely,

**HALLER & ASSOCIATES, INC.**



Timothy M. Haller, CPG  
VP / Hydrogeologist

Attachments: College Plaza GW Remediation Workplan

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## **GROUNDWATER REMEDIATION WORKPLAN**

### **COLLEGE PLAZA SOUTH 2400 CERRILLOS ROAD SANTA FE, NEW MEXICO**

#### **1.0 INTRODUCTION**

A dry cleaner formerly occupied Unit 2404 of College Plaza South in the 1980s and 1990s. A release of tetrachloroethene or perchloroethylene (PCE) occurred, resulting in subsurface vapor-phase and dissolved-phase PCE contamination. The site location is shown on Figure 1. Site features and monitor well locations are shown on Figure 2.

A sub-slab soil vapor extraction (SVE) system has operated in Units 2404 and 2406 since November 29, 2017. The sub-slab system utilizes 7 five-foot deep SVE wells completed beneath the concrete floor to mitigate potential indoor vapor intrusion. The sub-slab SVE system removed approximately 2.4 pounds of PCE as of August 23, 2019. The system remains operational, pending approval of a workplan for post-SVE vapor monitoring.

A subsurface SVE system has operated in the parking lot behind the building since November 30, 2019. The sub-surface system utilizes 11 SVE wells to remove vapor-phase PCE that extends to the water table. The system removed a total of approximately 131 pounds of PCE as of August 23, 2019 when the system was temporarily turned off.

During the most recent groundwater monitoring event, dissolved PCE concentrations ranged from 2.6 to 1,100 micrograms per liter ( $\mu\text{g/L}$ ). Historically, the highest PCE concentrations have been detected in well MW-4B, located near the back of Unit 2404. Actionable dissolved trichloroethene (TCE) has not been detected at the site. Distribution of dissolved PCE as of August 23, 2019 is shown on Figure 3.

The proposed strategy to remediate the dissolved PCE plume consists of injection of the following products by Regenesi Bioremediation Products (Regenesis) to induce and support anaerobic dechlorination processes:

- 3-D Microemulsion (3DME®) which is comprised of a patented molecular structure containing oleic acids and lactates/polylactates to support a reduced aquifer environment;
- Chemical Reducing Solution (CRS®) food grade ferrous iron to support in situ chemical reduction of chlorinated compounds; and
- Bio-Dechlor INOCULUM Plus (BDI PLUS®) an enriched natural consortium containing species of Dehalococoides sp (DHC) which has been shown to facilitate complete dechlorination of PCE, TCE, dichloroethene (DCE) and vinyl chloride (VC) to non-toxic end products.



The scope of this workplan consists of the following tasks:

- Prepare general discharge permit application for in-situ biological treatment
- Install and develop injection well field
- Inject solution of combined 3DME® and CRS®
- Inject solution of BDI Plus®
- Intermittent or pulsed operation of subsurface SVE system
- Quarterly and annual groundwater monitoring
- Preparation of associated reports

## 2.0 SITE HYDROGEOLOGY

Depth to unconfined groundwater in the monitor wells and deep SVE wells ranges from approximately 101 to 104 feet below ground surface (bgs). Since March 2017, groundwater flow direction has varied from east to northeast. The overall hydraulic gradient across the site has ranged from 0.005 to 0.01 foot per foot (ft/ft). The gradient is steeper in the west portion of the plume near MW-2 and MW-3B. The gradient flattens in the east portion of the plume at MW-1, MW-4B, MW-5B and MW-6B (Figure 4).

Based on soil samples collected during drilling of the monitor wells and SVE wells, the generalized subsurface stratigraphy at the site consists of the following:

- 0-10 feet: reddish-brown silty, sandy clay and clayey sand with cobbles at bottom.
- 10-30 feet: light reddish-brown gravelly sand, clayey gravel and clayey sand; fine to coarse-grained with cobbles; sub-angular to sub-round, lithology is granite and quartzite.
- 30-60 feet: light reddish-brown gravelly sand; fine to coarse grained; clay lenses at 35 to 40 feet; lithology is decomposed granite with no quartzite below 30 feet.
- 60 to 80 feet: dark brown and yellow-brown sandy silt and silty sand; fine to coarse grained, poorly sorted, granitic.
- 80 to 100 feet: variegated red and brown gravelly sand; fine to coarse-grained, angular to sub-round, poorly sorted, lithology is decomposed granite.
- 100 to >115 feet: unconsolidated dark brown silty sand with clayey silt; fine to medium grained, slightly cohesive in thin silt layers; groundwater at 101 to 104 feet.

The hydraulic conductivity of the aquifer matrix is estimated at 2.0 feet per day (ft/day) or 7.06E-04 centimeters per second (cm/sec), based on grain size, sorting, lithology and observations of monitor well yields during sampling.

### **3.0 GROUNDWATER FIELD PARAMETERS**

Groundwater pH at the site generally ranges from 7.0 to 7.5. Specific conductivity (SC) ranges from 600 to 1,100 micromhos per centimeter. Dissolved oxygen (DO) concentrations range from 5 to 7 milligrams per liter (mg/L). Oxidation-reduction potential ranges from 180 to 250 millivolts (mV).

Field parameter data, particularly pH, DO and ORP, indicate groundwater is in an oxidative or aerobic state. The absence of PCE primary degradation products (TCE, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene and VC) indicate that anaerobic dechlorination processes are largely absent and are not supported by background groundwater chemistry.

#### **3.1 Pre-Injection Inorganics Sampling and Analysis**

Prior to remedial implementation, HAI will sample MW-2 and MW-3B and submit a letter report presenting results of the following laboratory analyses:

- Total and dissolved iron and manganese (Fe / Mn) – EPA Method 6010B
- Nitrate and sulfate – EPA Method 300.0

The purpose of these analyses is to determine background concentrations prior to inducing anaerobic conditions. After anaerobic conditions have been established, nitrate and sulfate concentrations are expected to decrease. Iron and manganese concentrations are expected to increase during anaerobic conditions, and return to background levels as the aquifer returns to its current oxidative state.

### **4.0 DISCHARGE PERMIT AND WELL PERMITS**

#### **4.1 GWQB General Discharge Permit Application**

HAI will prepare an application for an Underground Injection Control (UIC) General Discharge Permit in accordance with 20.6.2.5006 NMAC. The application will be prepared using forms issued by the NMED Ground Water Quality Bureau (GWQB) Pollution Prevention Section. The permit application will include this injection plan and groundwater monitoring plan. The permit application will be submitted with payment of a \$100.00 application fee and a \$600.00 general permit fee.

Three forms of public notice of the permit application will be completed:

- Publish a 3-inch by 4-inch display ad in the Santa Fe New Mexico newspaper
- Post a 2-foot by 3-foot laminated sign for 30 days in a conspicuous location at the site
- Mail 8.5" x 11" flyers to site owner and owners of property within 1/3-mile of the site

## **4.2 NMOSE Well Permit Application**

HAI will prepare a permit application for 18 non-consumptive use wells. The application will be submitted to the New Mexico Office of the State Engineer (NMOSE) with the permit application fee of \$5.00/well. Drilling will not begin until after permit approval.

## **5.0 INJECTION WELLFIELD**

Eighteen (18) injection wells will be installed to apply Regenesis solutions to the actionable PCE plume, approximately 16,000 square feet (SF) total. Approximately 7,200 SF underlies Unit 2412 and is not accessible. Approximately 2,000 SF is accessible on the west side of Unit 2412. Approximately 6,700 SF is accessible behind Unit 2404. Regenesis has specified 18 injection wells to apply amending solutions and anaerobic bacteria to the PCE plume. The proposed layout is shown on Figure 5.

### **5.1 Drilling and Well Construction**

Each injection well will be drilled with 6-inch diameter air-rotary or 8-inch diameter hollow-stem augers, or a combination of both. Drill cuttings logged with respect to lithology during drilling. Drill cuttings will be contained in a roll-off box for subsequent waste profile sampling and disposal, consistent with previous well installations at the site.

Each injection well will be completed with 2-inch inner diameter Schedule 40 PVC flush-thread casing and 10 feet of 0.020-inch screen. The top of each screen will be placed at the water table. The bottom of the screen will extend 10 feet below the water table.

In the west portion of the plume, depth to groundwater is approximately 101 feet bgs. The injection wells in this area will be screened at 101 to 111 feet bgs. In the east portion of the plume, depth to groundwater is approximately 104 feet bgs. The injection wells in this area will be screened at 104 to 114 feet bgs. A centralizer will be placed in the middle of each injection well screen. A conceptual well profile is shown on Figure 6.

Annular filterpack consisting of 10/20 silica sand will be placed around the screen and extend no more than 2 feet above the screen. A minimum of 5 feet of bentonite pellets will be placed above the filterpack and hydrated with at least 10 gallons of clean water. The bentonite will be allowed to hydrate and expand for a minimum of 1 hour prior to grout placement. Neat cement grout will extend from the top of the bentonite seal to within 1 foot below ground surface. Each well will be completed at ground surface with 8-inch diameter flush-mount monitor well vaults set in 6-inch thick concrete pads. Watertight compression caps (J-plugs) will be placed on each well casing.

Each injection well will be vigorously developed using a combination of surging, bailing, pumping and/or air-lift pumping. Development will be performed until turbidity and suspended sediment are reduced the maximum extent practicable. The sole objective of injection well development is to maximize the capacity of each well to inject and distribute amending solutions throughout the actionable PCE plume.

## **5.2 Injection Well Installation and Development Report**

HAI will prepare a report of injection well installation. The report will include well logs with well completion diagrams, a site map showing injection well locations, well development logs, photographs and the driller's well completion records.

## **6.0 3DME AND CRS PREPARATION AND INJECTION**

Regenesis has designed a PCE remediation approach using a mixture of their 3DME® and CRS® products. The purpose of the solutions is to alter groundwater chemistry to an anaerobic state with sufficient electron donors (lactates and polylactates) and electron acceptors (ferrous iron) to support anaerobic bacteria for 3 years or more after injection.

### **6.1 3DME and CRS Solution Preparation**

A total of 14,836 gallons of 3DME and CRS solution will be mixed on-site and injected. The total volume of solution will consist of 1,150 gallons of 3DME, 457 gallons of CRS and 13,229 gallons of water.

The solution will be mixed on-site in batches of 500 to 1,000 gallons each, depending on size and availability of locally available rental tanks with centrifugal pumps. Water will be obtained from an on-site high capacity water line or hydrant. 3DME and CRS will be added to the water in the tank. The products and water will be mixed in the tank with the centrifugal pump. Instructions for mixing 3DME and CRS are presented in Appendix C.

### **6.2 3DME and CRS Injection**

Approximately 824 gallons of solution will be pumped into each injection well. Injection volume will be monitored with a totalizing flow meter. Surrounding injection wells and monitor wells will be observed for groundwater mounding. The allotted 824 gallons of solution may be injected into each injection well incrementally to minimize vertical mounding. To further minimize mounding, injection will alternate between injection wells that are not adjacent to each other. The objective is to achieve maximum horizontal distribution of solution while minimizing mounding to the maximum extent practicable. Batch mixing of solution and injection of each batch will be performed until the total prescribed volume of solution has been applied to the shallow aquifer.

## **7.0 BDI PLUS PREPARATION AND INJECTION**

BDI Plus will be prepared and injected immediately after completion of 3DME and CRS injection. The purpose of the BDI Plus solution is to provide the shallow aquifer with non-hazardous, naturally-occurring, non-altered anaerobic microbes which are shown to dechlorinate PCE and daughter products. The microbes will be supported in the anaerobic environment induced by the 3DME and CRS solution.

### **7.1 BDI Plus Solution Preparation**

A total of approximately 944 gallons of BDI Plus solution will be injected. The total volume will consist of 24.3 gallons (92 liters) of BDI Plus and 920 gallons of water.

The solution will be batch-mixed on-site using de-oxygenated water. The mix water will be de-oxygenated by sparging with nitrogen for approximately one hour, or using sodium bisulfite additive. DO will be field-tested and confirmed to be less than 1 mg/L prior to adding BDI Plus to the de-oxygenated water. Instructions are presented in Appendix C.

### **7.2 BDI Plus Injection**

Approximately 52 gallons of BDI Plus solution will be pumped into each injection well. Injection volume will be determined either using 55-gallon drums or a totalizing flow meter. Surrounding injection wells and monitor wells will be observed for groundwater mounding. BDI Plus solution will be continuously pumped into each injection well until the allotted 52 gallons has been injected. To minimize mounding, injection will alternate between injection wells that are not adjacent to each other.

Regenesis Remediation Services (RRS) will send an experienced injection technician to the site to assist HAI with field implementation of the injection plan. The RRS technician will provide on-site support for 3DME and CRS mixing, water de-oxygenation and BDI Plus mixing, injection of solutions and field monitoring during injection.

## **8.0 INJECTION REPORT**

HAI will prepare a report summarizing the injection of 3DME/CRS amending solution and BDI Plus anaerobic bacteria solution. The report will include descriptions of field methods and equipment, injection volumes, injection rates and pressures, hydraulic response data and any workplan deviations, if applicable. The injection report appendices will include data tables, field notes, photographs, and documentation of purchase and delivery of Regenesis products.

## **9.0 QUARTERLY GROUNDWATER MONITORING**

Quarterly groundwater monitoring will be performed to evaluate dissolved PCE concentrations and trends, PCE degradation product concentrations and trends and anaerobic indicator trends. The first quarter event will be performed at least 3 months after completion of injection work. The proposed quarterly groundwater monitoring regimen is summarized in Table 3.

### **9.1 Static Water Level Measurements**

Static groundwater levels and total depths will be gauged to the nearest 0.01-foot using an electronic water level indicator. The water level indicator tape and probe will be decontaminated between wells to minimize potential cross-contamination. Wells will be gauged in order of “clean to dirty” based on historical analytical data.

### **9.2 Groundwater Sample Collection**

Wells scheduled for sampling will be purged of a minimum of 3 well volumes prior to sampling. Purging will be performed using a Grundfos RediFlo2 stainless steel submersible pump and disposable polyethylene tubing. Field parameters of pH, specific conductivity (SC), temperature (T), oxidation-reduction potential (ORP) and dissolved oxygen (DO) will be measured and recorded at each well volume.

The pump discharge rate will be reduced to approximately 100 milliliters per minute after the targeted purge volume has been removed. Groundwater samples will be decanted from the tubing at a slow, non-turbulent rate into clean, method-specific containers provided by the laboratory with method-specific preservatives.

Sample containers will be labeled with respect to well ID, site name, time and date of collection, requested analyses, preservative and sampler’s initials. The samples will be placed in a cooler with ice and cooled to less than 6 degrees Centigrade until delivered to the laboratory with complete chain-of-custody records.

VOCs will be analyzed quarterly. Nitrate, sulfate and total and dissolved iron and manganese will be analyzed at MW-2 and MW-4B quarterly. The quarterly groundwater monitoring regimen, with well sampling schedule and specific laboratory analyses is summarized in Table 3. Sample analytical quality control requirements are summarized in Table 4.

### 9.3 Quarterly Groundwater Monitoring Reports

This task includes preparation of quarterly reports summarizing groundwater monitoring data and SVE system O&M. The reports will include the following elements, as applicable:

- Summary of activities performed and sampling protocols
- Field data and laboratory analytical data
- Dissolved contaminant concentration trends and groundwater elevation trends
- Anaerobic indicator trends
- Vapor-phase mass removal rates
- Conclusions and recommendations
- Figures:
  - Site location map
  - Site map
  - Groundwater elevation map
  - Analytical results maps
  - Distribution of dissolved organic contaminants
  - Distribution of DO and ORP
- Tables:
  - Groundwater levels
  - Groundwater analytical data and vapor analytical data
  - SVE operational data
- Calculations:
  - Hydraulic gradient
  - Mass removal rates by SVE
- Appendices:
  - Groundwater Sampling Field Forms
  - O&M Field Forms
  - Analytical Laboratory Reports

## **10.0 SVE SYSTEM OPERATION & MAINTENANCE**

### **10.1 Pulsed or Intermittent System Operation**

PCE soil vapor concentrations substantially decreased in response to SVE system operation. During the last several months of operation, vapor concentrations and removal rates were largely limited by PCE desorption rates and decreased contaminant mass remaining in the vadose zone. HAI proposes to resume operation of the subsurface SVE system on an intermittent basis. The system will be operated during the second month of each quarter.

### **10.2 Regularly Scheduled O&M**

Bi-weekly and monthly O&M events will be conducted during system operation. The remediation system operational parameters will be recorded on the field data forms presented in Appendix B.

#### 10.2.1 Visual Inspection, Security, and Identification of Problems

This task includes visual inspection of the remediation system components, general site cleanup, assessment of site security, and identification and recording of issues and/or problems. Issues or problems will be communicated to the NMED and Responsible Party within 48 hours of discovery.

#### 10.2.2 Equipment Monitoring and Maintenance

This task includes maintenance of the remediation equipment components. Prior to maintenance, the equipment will be de-energized as per manufacturer shut-down procedures; then the manual controls at the control panel will be switched off. Electrical power will be deactivated at the main disconnect panel. After completing maintenance, the equipment will be restarted using manufacturer startup procedures. The operational manuals are currently maintained at the site and are available to field personnel.

The SVE module includes the SVE manifold, moisture separator and SVE blower/motor.

- Recording of operating parameters and hour meter readings
- The SVE blower bearings and motor bearings will be greased monthly using a grease gun with Sutorbilt AEON synthetic grease NLGI # 2 or equivalent.
- The SVE blower oil will be changed quarterly using Sutorbilt AEON synthetic oil ISO VG 220 or equivalent. The used oil will be delivered to an authorized used oil recycler. New oil will be filled to the specified level in the blower.
- Blower and motor surfaces will be cleaned with rags to prevent parts overheating.



### 10.2.3 Gauging of Field Vacuum

This task will be performed to assess applied vacuum at the SVE wells and degree and extent of vacuum at the surrounding monitor wells, including the following:

- Measurement of applied vacuum at the SVE wells using wellhead sample ports to facilitate vacuum measurements with a portable digital manometer.
- Measurement of vacuum response at the monitor wells using wellhead sample ports to facilitate vacuum measurements with a portable digital manometer.

### 10.2.4 Collection of SVE System Performance Samples

An SVE header vapor sample will be collected at the beginning of the month when the SVE system is started. An SVE header vapor sample will be collected at the end of the month when the SVE system is turned off.

The SVE vapor samples will be analyzed for VOCs by EPA Method TO-15. The samples will be collected under vacuum using 1-liter stainless steel Summa canisters provided by the laboratory. The SVE header vapor samples will be shipped via Fedex to Eurofins Air Toxics, Ltd. (Table 4).

### 10.2.5 Monthly Status Reports

This task includes preparation of monthly O&M status reports. The report will be prepared in a comb-bound letter format and will include the following elements:

- Summary of activities performed
- Discussion of system performance and recommendations
- Tabulated summary of system operating parameters
- Calculations and graphs of vapor-phase PCE removal rates and total mass removed
- Field forms and notes
- SVE header vapor analytical laboratory reports

## 11.0 SEQUENCE OF EVENTS

The conceptual sequence of events will follow a monthly and quarterly schedule dictated by remediation system operation and quarterly groundwater monitoring. The proposed sequence of events is summarized below:

1. **Discharge Permit Application and Public Notice** – The general discharge permit application will be submitted to GWQB approximately 4 weeks after workplan approval. Proof of completion of public notice will be submitted approximately 10 weeks after workplan approval.
2. **Well Permit Application** – The injection wells permit application will be submitted to NMOSE approximately 4 weeks after workplan approval.
3. **Injection Well Drilling and Development** – This phase of work will begin approximately 2 to 4 weeks after approval of both permits and completion of public notice. Drilling and development are anticipated to require 3 weeks in the field.
4. **Injection Event** – This phase of work will be completed approximately 4 weeks after injection well development. Injection activities will require approximately 2 weeks in the field.
5. **Quarterly Monitoring and Reports** – Fieldwork for the 1<sup>st</sup> quarterly monitoring event will be performed 3 to 4 months after completion of injection work. Quarterly reports will be submitted to GWQB approximately 4 weeks after receipt of quarterly analytical laboratory reports.
6. **SVE System Operation** – The SVE system will be operated during the 2<sup>nd</sup> month of each quarter. The status reports of SVE system operation will be submitted to GWQB within 30 days after each month of operation.

This conceptual schedule is subject to change based on the following:

- Time between workplan submittal and workplan approval
- Time between submittal of permit applications and agency approval of permit applications
- Weather conditions and subcontractor scheduling availability

## **TABLES**

**Table 1. Groundwater Elevation Data  
College Plaza South, Santa Fe, New Mexico**

Well ID	Date	Casing Elevation (ft MSL)	Depth to Water (ft below TOC)	Groundwater Elevation (ft MSL)
MW-1	10-23-16	6770.25	104.65	6665.60
	03-09-17		104.61	6665.64
	11-30-17	6769.86	102.74	6667.12
	02-28-18		101.96	6667.90
	05-16-18		101.95	6667.91
	08-20-18		103.91	6665.95
	11-19-18		103.99	6665.87
	02-25-19		103.92	6665.94
	05-29-19		103.78	6666.08
	08-26-19		103.74	6666.12
MW-2	10-23-16	6769.08	102.59	6666.49
	03-09-17		102.60	6666.48
	02-28-18	6769.03	101.12	6667.91
	05-16-18		101.81	6667.22
	08-20-18		101.48	6667.55
	11-19-18		101.41	6667.62
	02-25-19		101.36	6667.67
	05-29-19		100.90	6668.13
	08-26-19		101.13	6667.90
MW-3B	03-09-17	6768.77	102.20	6666.57
	11-30-17		102.10	6666.99
	02-28-18	6769.09	101.05	6668.04
	05-16-18		101.20	6667.89
	08-20-18		101.55	6667.54
	11-19-18		101.48	6667.61
	02-25-19		101.44	6667.65
	05-29-19		100.97	6668.12
	08-26-19		101.19	6667.90
MW-4B	03-09-17	6770.55	104.82	6665.73
	11-30-17		103.29	6667.26
	02-28-18		103.53	6667.02
	05-16-18		103.67	6666.88
	08-20-18		104.62	6665.93
	11-19-18		104.68	6665.87
	02-25-19		104.59	6665.96
	05-29-19		104.48	6666.07
	08-26-19		104.40	6666.15

ft        feet  
MSL     mean sea level  
TOC     top of casing

**Table 1. Groundwater Elevation Data**  
**College Plaza South, Santa Fe, New Mexico**

Well ID	Date	Casing Elevation (ft MSL)	Depth to Water (ft below TOC)	Groundwater Elevation (ft MSL)
<b>MW-5B</b>	03-09-17	6770.16	104.59	6665.57
	11-30-17		102.21	6667.58
	02-28-18		102.83	6666.96
	05-16-18		102.86	6666.93
	08-20-18	6769.79	103.88	6665.91
	11-19-18		103.96	6665.83
	02-25-19		103.88	6665.91
	05-29-19		103.74	6666.05
	08-26-19		103.69	6666.10
<b>MW-6B</b>	03-09-17	6771.15	105.61	6665.54
	11-30-17		103.20	6667.81
	02-28-18		102.88	6668.13
	05-16-18		103.39	6667.62
	08-20-18	6771.01	105.03	6665.98
	11-19-18		105.11	6665.90
	02-25-19		105.01	6666.00
	05-29-19		104.96	6666.05
	08-26-19		104.83	6666.18
<b>P-1</b>	06-29-16		105.13	6,665.85
	08-02-16		105.26	6,665.72
	10-23-16		105.35	6,665.63
	03-09-17		105.40	6,665.58
	11-30-17		105.58	6665.40
	02-28-18	6,770.98	104.90	6666.08
	05-16-18		105.26	6665.72
	08-20-18		105.00	6665.98
	11-19-18		105.07	6665.91
	02-25-19		105.00	6665.98
	05-29-19		104.91	6666.07
	08-26-19		Access Blocked: Well Not Gauged	

ft        feet  
MSL      mean sea level  
TOC      top of casing

**Table 2. Groundwater Analytical Data  
College Plaza South, Santa Fe, New Mexico**

Sample Location	Sample Date	Tetrachloroethene (PCE) (µg/L)	Trichloroethene (TCE) (µg/L)
MW-1	10-23-16	43	<1.0
	02-28-18	390	<1.0
	05-16-18	310	<2.0
	08-20-18	330	<2.0
	11-19-18	91	<1.0
	02-25-19	170	<2.0
	05-29-19	230	<2.0
MW-2	10-23-16	120	<1.0
	02-28-18	300	<2.0
	11-19-18	260	<1.0
	02-25-19	330	<2.0
	06-25-19	340	<2.0
MW-3B	03-07-17	24	<1.0
	05-16-18	340	3.7
	08-20-18	260	<1.0
	11-19-18	210	<2.0
	05-29-19	3.1	<2.0
	08-23-19	67	<1.0
MW-4B	03-03-17	260	<1.0
	02-28-18	1,600	4.2
	05-16-18	1,200	<2.0
	08-20-18	1,100	<2.0
	11-19-18	1,700	3.2
	02-25-19	1,600	<10
	05-29-19	1,500	2.9
	08-23-19	1,100	<5.0
MW-5B	03-03-17	35	<1.0
	05-16-18	110	<1.0
	08-20-18	99	<2.0
	11-19-18	70	<1.0
	05-29-19	81	<1.0
	08-23-19	84	<1.0
MW-6B	03-07-17	22	<1.0
	02-28-18	3.1	<1.0
	11-19-18	2.1	<1.0
	08-23-19	2.6	<1.0
P-1	06-29-16	3.0	<2.0
	08-02-16	110	<1.0
	11-19-18	360	<1.0
	02-25-19	320	<2.0
<b>NMWQCC Standard</b>		<b>5</b>	<b>5</b>

**TABLE 3. GROUNDWATER MONITORING REGIMEN  
COLLEGE PLAZA SOUTH, SANTA FE, NEW MEXICO**

Well Number	Gauging Regimen	Sampling Regimen				Analytical Regimen			
	Every Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	VOCs	Fe Mn	Nitrate Sulfate	Field Parameters
MW-1	X	X			X	X			X
MW-2	X	X	X	X	X	X	X	X	X
MW-3B	X	X			X	X			X
MW-4B	X	X	X	X	X	X	X	X	X
MW-5B	X	X			X	X			X
MW-6B	X	X			X	X			X
P-1	X	X	X	X	X	X			X
TOTALS	7	7	3	3	7	7	2	2	7
NOTES: VOCs = Volatile organic compounds by EPA Method 8260B Fe / Mn = Total and dissolved iron and manganese by EPA Method 6010B Nitrate and sulfate analysis by EPA Method 300.0 Field Parameters = pH, temperature, specific conductance, oxidation-reduction potential and dissolved oxygen X = Scheduled to be sampled									

**TABLE 4. SAMPLE ANALYTICAL AND QUALITY CONTROL REQUIREMENTS  
COLLEGE PLAZA SOUTH, SANTA FE, NEW MEXICO**

Target Analytes	Matrix	Analytical Method	Sample Container	Sample Preparation	Preservative	Holding Time
VOCs	Water	8260B	3 x 40 mL glass vials	sample vials filled with no bubbles/headspace	Mercuric Chloride	14 Days
Dissolved Fe / Mn	Water	6010B	1 x 125 mL poly bottle	field-filter first, and then fill to shoulder of bottle	Nitric Acid	6 Months
Total Fe / Mn	Water	6010B	1 x 125 mL poly bottle	fillt to shoulder of bottle	Nitric Acid	6 Months
Sulfate / Nitrate	Water	300.0	1X x 250-mL poly bottle	fill to shoulder of bottle	None	48 Hours*
VOCs	Vapor	TO-15	1-liter Summa canister	fill canister to approximately 5" Hg	None	14 Days
NOTES: Fe / Mn = Iron and manganese VOCs = Volatile organic compounds 5" Hg = vacuum of 5 inches of mercury *Nitrate hold time is 48 hours; sulfate hold time is 28 days						



## **FIGURES**



IMAGE SOURCE: GOOGLE EARTH 6-10-17



P.O. BOX 1667, 12220 N. HWY 14, SUITE C  
CEDAR CREST, NEW MEXICO 87008

## SITE LOCATION MAP

COLLEGE PLAZA SOUTH  
2400 CERILLOS ROAD  
SANTA FE, NEW MEXICO

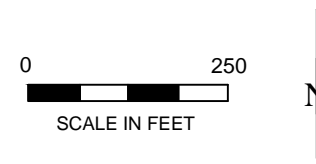


FIGURE  
1



LEGEND

- VB-1 BORING WITH VAPOR IMPLANTS AT 10', 30', 50' AND 70'
- MW-1 MONITOR WELL OR PIEZOMETER
- VP-1 SUB-SLAB VAPOR PIN
- MW-3 A/B NESTED SVE WELL (A=SHALLOW, B=DEEP)

WELLS SHOWN IN MAGENTA ARE CONNECTED TO SVE SYSTEM





LEGEND

- VB-1

■

BORING WITH VAPOR IMPLANTS AT  
10', 30', 50' AND 70'
- MW-1

⊕
- MONITOR WELL OR PIEZOMETER
- MW-3  
A/B

✦
- NESTED SVE WELL  
(A=SHALLOW, B=DEEP)
- 
- PROPOSED INJECTION WELL LOCATION
- 390
- PCE CONCENTRATION
- 
- PCE ISOCONCENTRATION CONTOUR  
(DASHED WHERE INFERRED)

PCE - TETRACHLOROETHENE  
-MOST RECENT PCE DATA ARE SHOWN. REFER TO TABLE 2.  
-CONCENTRATIONS EXPRESSED IN MICROGRAMS PER LITER  
-WELLS SHOWN IN MAGENTA ARE CONNECTED TO SVE SYSTEM

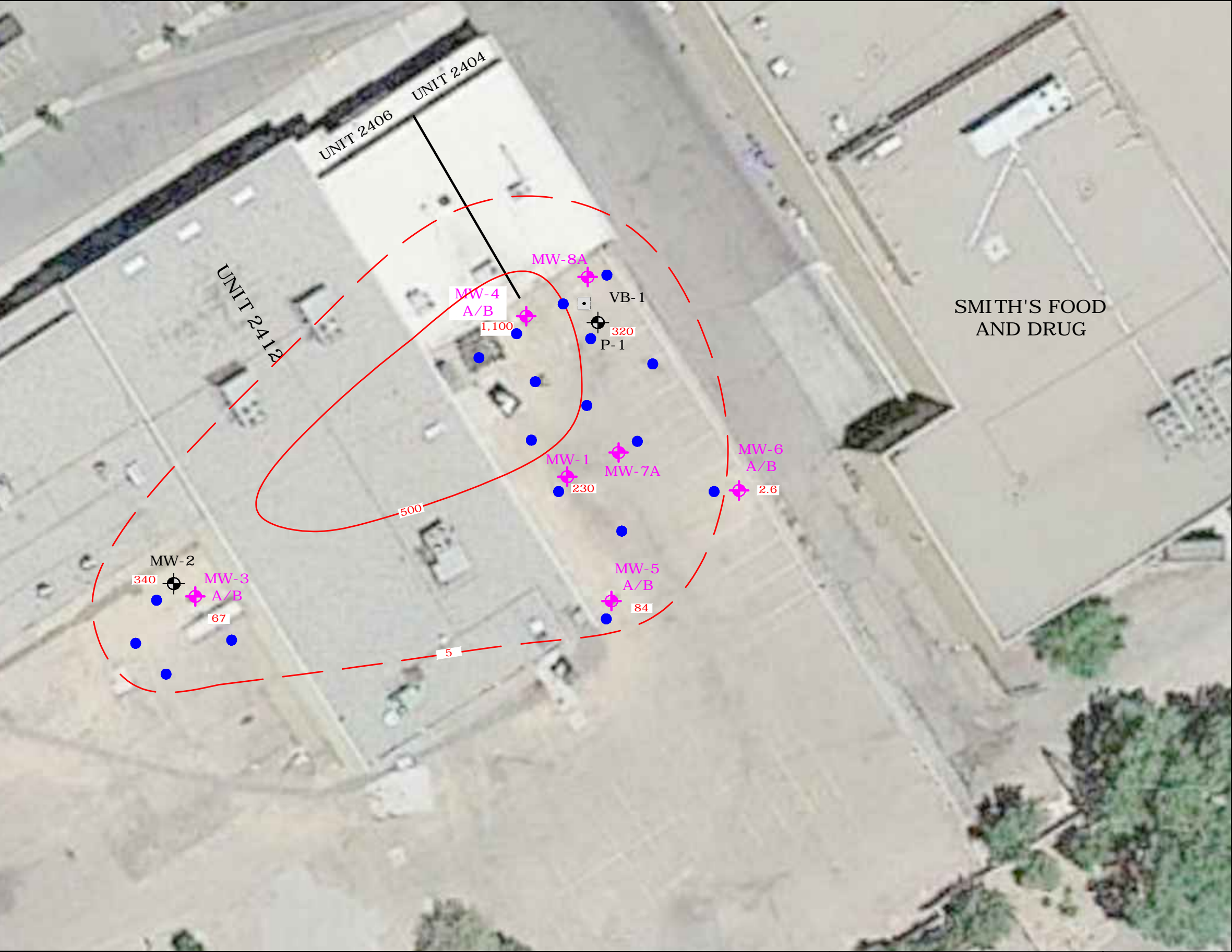








IMAGE SOURCE: GOOGLE EARTH 6-10-17





## LEGEND

- |   |             |  |
|---|-------------|--|
|  | VB-1        | BORING WITH VAPOR IMPLANTS AT<br>10', 30', 50' AND 70' |
|  | MW-1        | MONITOR WELL OR PIEZOMETER                             |
|  | VP-1        | SUB-SLAB VAPOR PIN                                     |
|  | MW-3<br>A/B | NESTED SVE WELL<br>(A=SHALLOW, B=DEEP)                 |
|  | 6,665.71    | GROUNDWATER ELEVATION (FT MSL)                         |
|  |             | GROUNDWATER FLOW DIRECTION                             |

FT MSL FEET ABOVE MEAN SEA LEVEL  
-WELLS SHOWN IN MAGENTA ARE CONNECTED TO SVE SYSTEM



**Haller & Associates, Inc.**  
Environmental Services & Geoscience

P.O. BOX 1667, 12220 N. HWY 14, SUITE C  
CEDAR CREST, NEW MEXICO 87008



## COLLEGE PLAZA SOUTH

2400 CERILLOS ROAD  
SANTA FE, NEW MEXICO

# WATER TABLE MAP

AUGUST 23, 2019

FIGURE

4



LEGEND

- VB-1

BORING WITH VAPOR IMPLANTS AT  
10', 30', 50' AND 70'

MW-1

MONITOR WELL OR PIEZOMETER

MW-3  
A/B

NESTED SVE WELL  
(A=SHALLOW, B=DEEP)

PROPOSED INJECTION WELL LOCATION

390

PCE CONCENTRATION

PCE ISOCONCENTRATION CONTOUR  
(DASHED WHERE INFERRED)
- PCE - TETRACHLOROETHENE  
-MOST RECENT PCE DATA ARE SHOWN. REFER TO TABLE 2.  
-CONCENTRATIONS EXPRESSED IN MICROGRAMS PER LITER  
-WELLS SHOWN IN MAGENTA ARE CONNECTED TO SVE SYSTEM
- UNIT 2406

UNIT 2404

UNIT 2412

MW-8A

MW-4 A/B

1,100

VB-1

340

P-1

MW-1

230

MW-7A

MW-6 A/B

2.6

MW-5 A/B

84

5

500

MW-3 A/B

67

MW-2

340

SMITH'S FOOD AND DRUG

COLLEGE PLAZA SOUTH

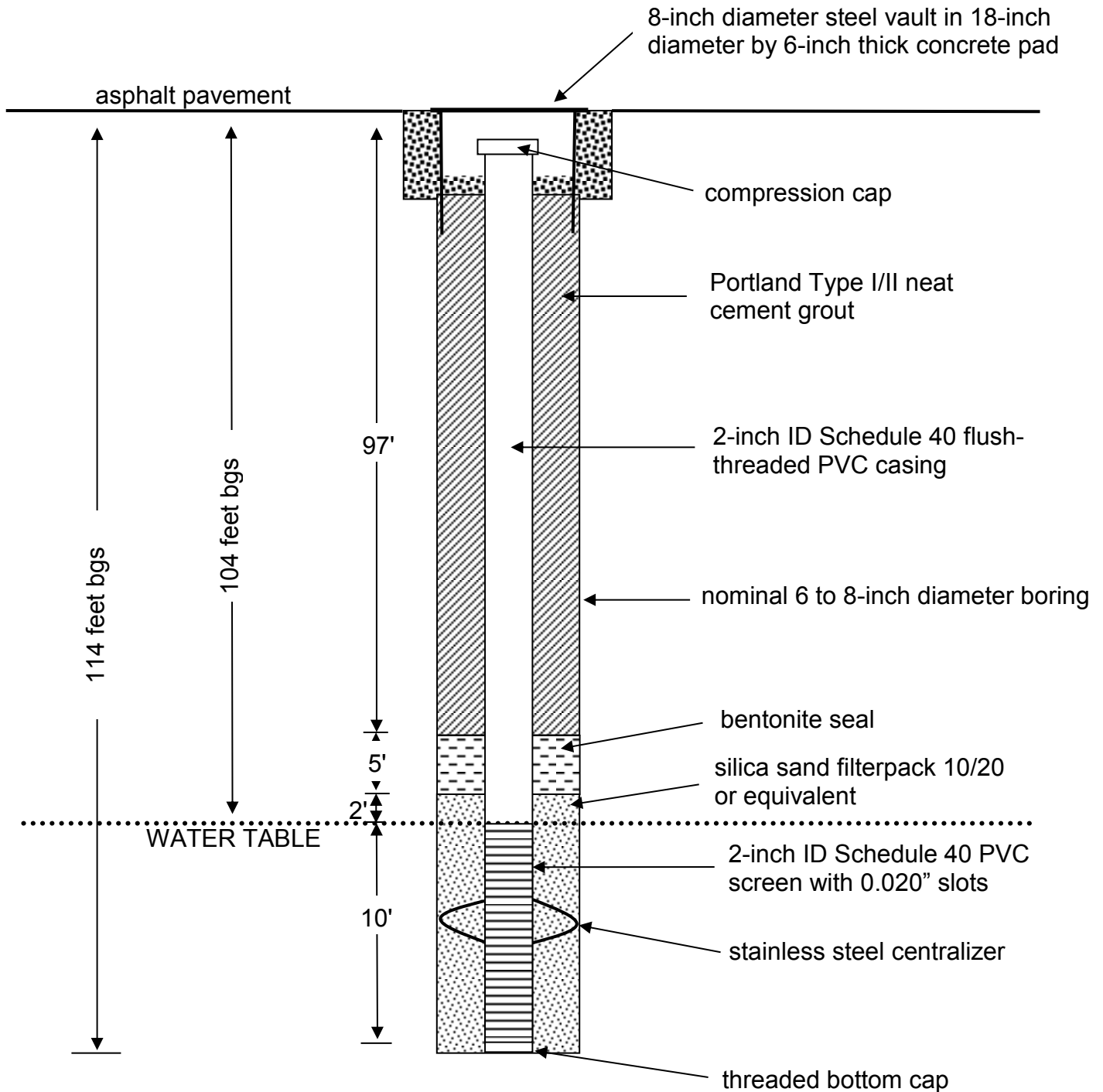
2400 CERILLOS ROAD

SANTA FE, NEW MEXICO

IMAGE SOURCE: GOOGLE EARTH 6-10-17
- Haller & Associates, Inc.**  
Environmental Services & Geoscience

P.O. BOX 1667, 12220 N. HWY 14, SUITE C  
CEDAR CREST, NEW MEXICO 87008
- 0 30  
SCALE IN FEET
- 
- PROPOSED  
INJECTION  
WELLFIELD LAYOUT
- FIGURE  
5

**Figure 6. Conceptual Injection Well Profile**  
**College Plaza South, Santa Fe, New Mexico**



- Proposed injection well depths are based on most recent groundwater data. Actual well construction depths will be determined by actual depth to groundwater at the time of drilling.
- Drawing is not to scale.

## **APPENDIX A**

### **Regenesis Application Design Summary**











3-D Microemulsion®, BDI® Plus, CRS® Application Design Summary		
College Plaza South		
Plume		Field App. Instructions
<b>Application Method</b>	<b>Injection Wells</b>	<b>Input special application instructions here as needed.</b>
Spacing Within Rows (ft)	see map	
Spacing Between Rows (ft)	see map	
<b>Application Points</b>	<b>18</b>	
Areal Extent (square ft)	16,200	
Top Application Depth (ft bgs)	104	<b>Field Mixing Ratios</b>
Bottom Application Depth (ft bgs)	114	3DME Concentrate per Pt (lbs)
<b>3DME to be Applied (lbs)</b>	<b>9,600</b>	533
3DME to be Applied (gals)	1,150	Mix Water per Pt (gals)
3DME Mix %	8%	735
<b>Volume Water (gals)</b>	<b>13,229</b>	3DME Mix Volume per Pt (gals)
3DME Mix Volume (gals)	14,380	799
<b>CRS to be Applied (lbs)</b>	<b>4,000</b>	CRS Volume per Pt (gals)
CRS Volume (gals)	457	25
<b>BDI Plus to be Applied (L)</b>	<b>92</b>	BDI Volume per Pt (L)
BDI Mix Water Volume (gals)	920	5.1
<b>HRC Primer to be Applied (lbs)</b>	<b>0</b>	HRC Primer per Pt (lbs)
HRC Primer Volume (gals)	0	0
<b>Total Application Volume (gals)</b>	<b>15,781</b>	Volume per pt (gals)
		877
		Volume per vertical ft (gals)
		88
Technical Notes/Discussion		
Assumptions/Qualifications		
<p>In generating this preliminary estimate, Regenesi relied upon professional judgment and site specific information provided by others. Using this information as input, we performed calculations based upon known chemical and geologic relationships to generate an estimate of the mass of product and subsurface placement required to affect remediation of the site.</p> <p>REGENESIS developed this Scope of Work in reliance upon the data and professional judgments provided by those whom completed the earlier environmental site assessment(s). The fees and charges associated with the Scope of Work were generated through REGENESIS' proprietary formulas and thus may not conform to billing guidelines, constraints or other limits on fees. REGENESIS does not seek reimbursement directly from any government agency or any governmental reimbursement fund (the "Government"). In any circumstance where REGENESIS may serve as a supplier or subcontractor to an entity which seeks reimbursement from the Government for all or part of the services performed or products provided by REGENESIS, it is the sole responsibility of the entity seeking reimbursement to ensure the Scope of Work and associated charges are in compliance with and acceptable to the Government prior to submission. When serving as a supplier or subcontractor to an entity which seeks reimbursement from the Government, REGENESIS does not knowingly present or cause to be presented any claim for payment to the Government.</p>		



Purchasing Information		
College Plaza South	--	
3-D Microemulsion Required	lbs	9,600
CRS Required	lbs	4,000
BDI Plus Required	liters	92
HRC Primer Required	lbs	0
3-D Microemulsion Cost	\$	\$36,960
CRS Cost	\$	\$11,800
BDI Plus Cost	\$	\$16,100
Subtotal Product Cost	\$	\$64,860

## LEGEND

- |   |             |  |
|---|-------------|--|
|  | VB-1        | BORING WITH VAPOR IMPLANTS AT<br>10', 30', 50' AND 70' |
|  | MW-1        | MONITOR WELL OR PIEZOMETER                             |
|  | VP-1        | SUB-SLAB VAPOR PIN                                     |
|  | MW-3<br>A/B | NESTED SVE WELL<br>(A=SHALLOW, B=DEEP)                 |
|  | 390         | PCE CONCENTRATION                                      |
|  | < 1.0       | TCE CONCENTRATION                                      |

PCE - TETRACHLOROETHENE  
TCE - TRICHLOROETHENE  
-CONCENTRATIONS EXPRESSED IN MICROGRAMS LITER  
-WELLS SHOWN IN MAGENTA ARE CONNECTED TO SVE SYSTEM

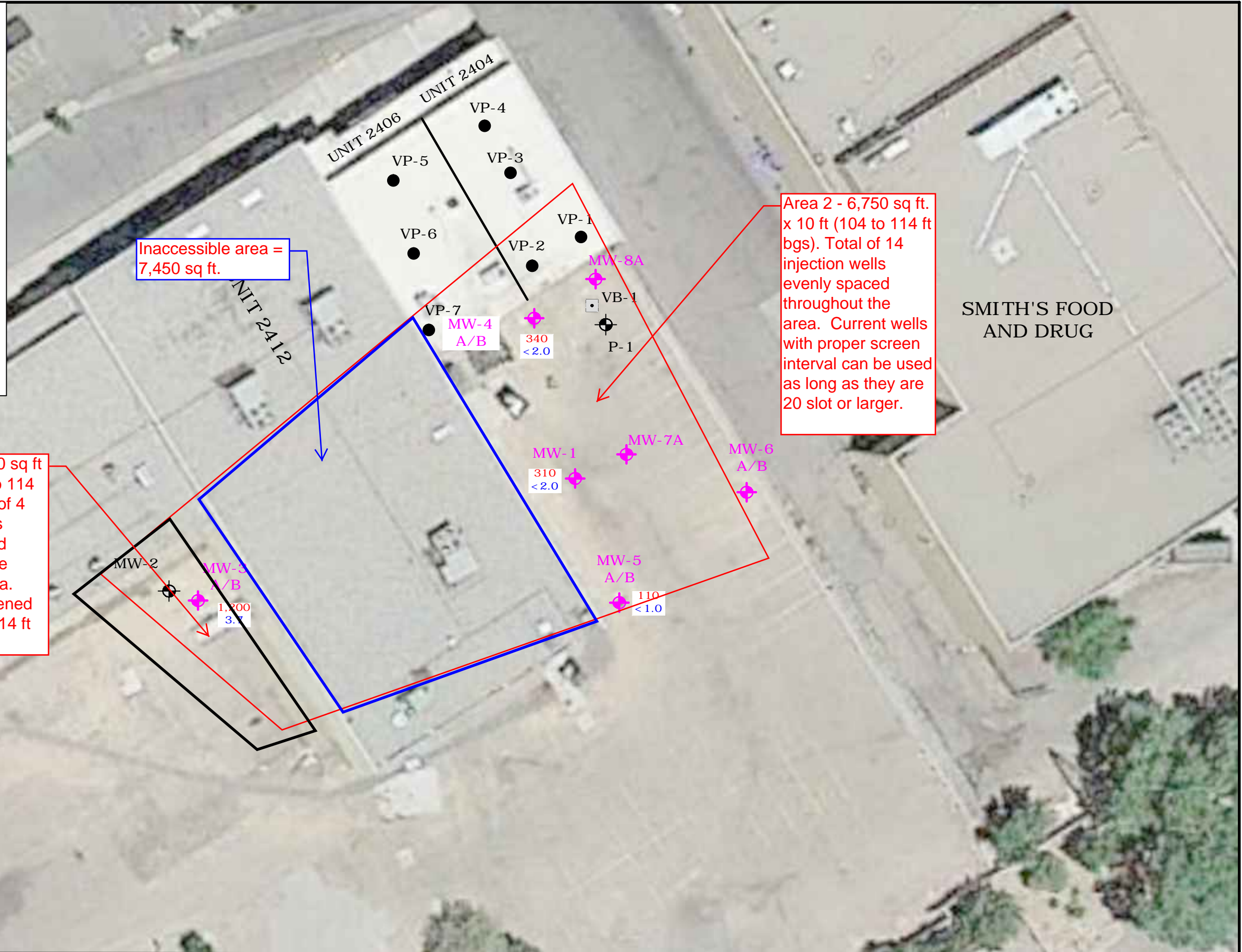
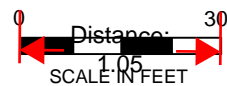


IMAGE SOURCE: GOOGLE EARTH 6-10-17



P.O. BOX 1667, 12220 N. HWY 14, SUITE C  
CEDAR CREST, NEW MEXICO 87008



COLLEGE PLAZA SOUTH  
2400 CERILLOS ROAD  
SANTA FE, NEW MEXICO

# GROUNDWATER PCE & TCE CONCENTRATIONS

MAY 17, 2018

FIGURE  
10



1011 Calle Sombra  
San Clemente, CA 92673-6244  
Tel: 949.366.8000 • Fax: 949.366.8090

## Terms and Conditions Products and Services

**1. PAYMENT TERMS.** Net 30 Days. Accounts outstanding after 30 days will be assessed 1.5% monthly interest. Volume discount pricing will be rescinded on all accounts outstanding over 90 days. An early payment discount of 1.5% Net 10 is available for cash or check payments only. We accept Master Card, Visa and American Express.

**2. RETURN POLICY.** A 15% re-stocking fee will be charged for all returned goods. All requests to return product must be pre-approved by seller. Returned product must be in original condition and no product will be accepted for return after a period of 90 days.

**3 FORCE MAJEURE.** Seller shall not be liable for delays in delivery or services or failure to manufacture or deliver due to causes beyond its reasonable control, including but not limited to acts of God, acts of buyer, acts of military or civil authorities, fires, strikes, flood, epidemic, war, riot, delays in transportation or car shortages, or inability to obtain necessary labor, materials, components or services through seller's usual and regular sources at usual and regular prices. In any such event Seller may, without notice to buyer, at any time and from time to time, postpone the delivery or service dates under this contract or make partial delivery or performance or cancel all or any portion of this and any other contract with buyer without further liability to buyer. Cancellation of any part of this order shall not affect Seller's right to payment for any product delivered or service performed hereunder.

**4. LIMITED WARRANTY.** Seller warrants the product(s) sold and services provided as specified on face of invoice, solely to buyer. Seller makes no other warranty of any kind respecting the product and services, and expressly DISCLAIMS ALL OTHER WARRANTIES OF WHATEVER KIND RESPECTING THE PRODUCT AND SERVICES, INCLUDING ALL WARRANTIES OF MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE AND NON-INFRINGEMENT.

**5. DISCLAIMER.** Where warranties to a person other than buyer may not be disclaimed under law, seller extends to such a person the same warranty seller makes to buyer as set forth herein, subject to all disclaimers, exclusions and limitations of warranties, all limitations of liability and all other provisions set forth in the Terms and Conditions herein. Buyer agrees to transmit a copy of the Terms and Conditions set forth herein to any and all persons to whom buyer sells, or otherwise furnishes the products and/or services provided buyer by seller and buyer agrees to indemnify seller for any liability, loss, costs and attorneys' fees which seller may incur by reason, in whole or in part, of failure by buyer to transmit the Terms and Conditions as provided herein.

**6. LIMITATION OF SELLER'S LIABILITY AND LIMITATION OF BUYER'S REMEDY.** Seller's liability on any claim of any kind, including negligence, for any loss or damage arising out of, connected with, or resulting from the manufacture, sale, delivery, resale, repair or use of any goods or performance of any services covered by or furnished hereunder, shall in no case exceed the lesser of (1) the cost of repairing or replacing goods and repeating the services failing to conform to the forgoing warranty or the price of the goods and/or services or part thereof which gives rise to the claim. IN NO EVENT SHALL SELLER BE LIABLE FOR SPECIAL INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING LOST PROFITS, OR FOR DAMAGES IN THE NATURE OF PENALTIES.

**7. INDEMNIFICATION.** Buyer agrees to defend and indemnify seller of and from any and all claims or liabilities asserted against seller in connection with the manufacture, sale, delivery, resale or repair or use of any goods, and performance of any services, covered by or furnished hereunder arising in whole or in part out of or by reason of the failure of buyer, its agents, servants, employees or customers to follow instructions, warnings or recommendations furnished by seller in connection with such goods and services, by reason of the failure of buyer, its agents, servants, employees or customers to comply with all federal, state and local laws applicable to such goods and services, or the use thereof, including the Occupational Safety and Health Act of 1970, or by reason of the negligence or misconduct of buyer, its agents, servants, employees or customers.

**8. EXPENSES OF ENFORCEMENT.** In the event seller undertakes any action to collect amounts due from buyer, or otherwise enforce its rights hereunder, Buyer agrees to pay and reimburse Seller for all such expenses, including, without limitation, all attorneys and collection fees.

**9. TAXES.** Liability for all taxes and import or export duties, imposed by any city, state, federal or other governmental authority, shall be assumed and paid by buyer. Buyer further agrees to defend and indemnify seller against any and all liabilities for such taxes or duties and legal fees or costs incurred by seller in connection therewith.

**10. ASSISTANCE AND ADVICE.** Upon request, seller in its discretion will furnish as an accommodation to buyer such technical advice or assistance as is available in reference to the goods and services. Seller assumes no obligation or liability for the advice or assistance given or results obtained, all such advice or assistance being given and accepted at buyer's risk.

**11. SITE SAFETY.** Buyer shall provide a safe working environment at the site of services and shall comply with all applicable provisions of federal, state, provincial and municipal safety laws, building codes, and safety regulations to prevent accidents or injuries to persons on, about or adjacent to the site.

**12. INDEPENDENT CONTRACTOR.** Seller and Buyer are independent contractors and nothing shall be construed to place them in the relationship of partners, principal and agent, employer/employee or joint ventures. Neither party will have the power or right to bind or obligate the other party except as may be expressly agreed and delegated by other party, nor will it hold itself out as having such authority.

**13. REIMBURSEMENT.** Seller shall provide the products and services in reliance upon the data and professional judgments provided by or on behalf of buyer. The fees and charges associated with the products and services thus may not conform to billing guidelines, constraints or other limits on fees. Seller does not seek reimbursement directly from any government agency or any governmental reimbursement fund (the "Government"). In any circumstance where seller may serve as a supplier or subcontractor to an entity which seeks reimbursement from the Government for all or part of the services performed or products provided by seller, it is the sole responsibility of the buyer or other entity seeking reimbursement to ensure the products and services and associated charges are in compliance with and acceptable to the Government prior to submission. When serving as a supplier or subcontractor to an entity which seeks reimbursement from the Government, seller does not knowingly present or cause to be presented any claim for payment to the Government.

**14. APPLICABLE LAW/JURISDICTION AND VENUE.** The rights and duties of the parties shall be governed by, construed, and enforced in accordance with the laws of the State of California (excluding its conflict of laws rules which would refer to and apply the substantive laws of another jurisdiction). Any suit or proceeding hereunder shall be brought exclusively in state or federal courts located in Orange County, California. Each party consents to the personal jurisdiction of said state and federal courts and waives any objection that such courts are an inconvenient forum.

**15. ENTIRE AGREEMENT.** This agreement constitutes the entire contract between buyer and seller relating to the goods or services identified herein. No modifications hereof shall be binding upon the seller unless in writing and signed by seller's duly authorized representative, and no modification shall be effected by seller's acknowledgment or acceptance of buyer's purchase order forms containing different provisions. Trade usage shall neither be applicable nor relevant to this agreement, nor be used in any manner whatsoever to explain, qualify or supplement any of the provisions hereof. No waiver by either party of default shall be deemed a waiver of any subsequent default.





## Remedial Design Assumptions and Qualifications

**Cost Estimate Disclaimer:** The cost listed assumes conditions set forth within the proposed scope of work and assumptions and qualifications. Changes to either could impact the final cost of the project. This may include final shipping arrangements, sales tax or application related tasks such as product storage and handling, access to water, etc. If items listed need to be modified, please contact RegenesiS for further evaluation.

**Shipping Estimates:** Shipping estimates are valid for 30 days. All shipping charges are estimates and actual freight charges are calculated at the time of invoice. Additional freight charges may be assessed for any accessorials requested at the time of delivery. The estimate included within assumes standard shipping.

Standard delivery is between 8am -5pm Monday –Friday. \*accessorial – can include, but not limited to lift gate and pallet jack at delivery, inside delivery, time definite deliveries, and delivery appointments.

Please communicate any requirements for delivery with the customer service department at the time the order is placed.

**Return Policy:** To initiate a return please contact your local sales manager for an RMA. A 15% re-stocking fee will be charged for all returned goods. Return freight must be prepaid. All requests to return product must be in original condition and no product will be accepted for return after 90 days from date of delivery.

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

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

## **APPENDIX B**

**Regenesis Spec Sheets and Material Safety Data Sheets**  
**(See APPENDIX B of UIC Discharge Permit)**

## **APPENDIX C**

### **Regenesis Products Instructions**



## **3-D Microemulsion (3DMe)™**

### **INSTALLATION INSTRUCTIONS**

#### ***High-Volume, Wide-Area, Micro-Emulsion Application***

### **Introduction**

3-D Microemulsion (3DMe)™, a form of HRC Advanced®, should ONLY be applied as a high-volume, micro-emulsion. In this form it offers greater physical distribution of the 3DMe material across a larger potential radius from a single injection point. The production of a 3DMe emulsion involves the on-site, volumetric mixing of 10 parts water with 1 part delivered 3DMe concentrate to form the injection-ready 3DMe micro-emulsion. This micro-emulsion suspension can then be injected directly or further diluted to a predetermined ratio of 3DMe to water. The following instructions provide details in the production and installation of the 3DMe micro-emulsion.

### **Material Overview Handling and Safety**

3DMe concentrate is shipped and delivered in 4.25-gallon buckets. Each bucket has a gross weight of approximately 32 pounds. Each bucket contains 30 pounds of 3DMe concentrate (net weight) and a nominal volume of 3.7 gallons. At room temperature, 3DMe concentrate is a liquid material with a viscosity of approximately 500 centipoise, roughly the equivalent of pancake syrup. The viscosity of 3DMe is not temperature sensitive above 50 °F (10 °C). However, below 50 °F the viscosity may increase significantly. If the user plans to apply the product in cold weather, consideration should be given to heating the material to above 60 °F so that it can be easily handled. 3DMe concentrate should be stored in a warm, dry place that is protected from direct sunlight. It is common for stored 3DMe concentrate to settle somewhat in the bucket, a quick pre-mix stir by a hand held drill with a paint or “jiffy mixer” attachment will rapidly re-homogenize the material. 3DMe concentrate 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 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.

## Micro-Emulsion Production 3DMe to Water Ratio

3DMe concentrate should be mixed with water on a volume to volume (v/v) basis to produce a micro-emulsion starting at 10 parts water: 1 part 3DMe. Although micro-emulsions can be easily produced using greater water volumes than 10 parts, e.g. 20 to 50 parts water to 1 part 3DMe, the initial micro-emulsion should never be produced below a ratio of less than 10 parts water: 1 part 3DMe v/v. **WARNING: Do not attempt to produce a micro-emulsion at less than 10 parts water to 1 part 3DMe ratio v/v. This will produce an undesirable and unstable solution.**

The field production of 3DMe micro-emulsion is a very simple procedure; however, it is critical that the user follow the mixing directions outlined below. Never attempt to add water to the 3DMe as this will produce an undesirable and unstable large emulsion. Always add the 3DMe to a large volume of water.

As indicated previously the 10:1 ratio of water to 3DMe v/v is the minimum water ratio that can be used, a greater ratio (more dilute solution ) can easily be achieved and is governed by: A) the volume of 3DMe required to treat the estimated contaminant mass, B) the pore volume in which the material is applied, C) the time available for installation (gallons/pump rate), and C) the estimated volume of 3DMe micro-emulsion that the target zone will accept over the time period allocated for installation.

Conceptually, although a higher volume of water to volume of 3DMe will produce a larger volume of the suspension, it will lower the concentration of 3DMe per gallon of solution. Thus, the benefit of using a high water/3DMe v/v ratio in order to affect a greater pore volume of the subsurface aquifer is offset by the dilution of the 3DMe per unit volume of suspension as well as by the limitations of the subsurface hydraulic conductivity and effective porosity (capacity of the aquifer to accept the volume of 3DMe micro-emulsion).

It is important that the user plan in advance the v/v 3DMe/water ratio to be employed at a project site. The resulting volume of solution will dictate the site water requirements and the time required for injection, etc. If upon injection of greater than 10:1 3DMe micro-emulsion, the subsurface does not readily accept the volume of solution as designed, the user can adjust downward the v/v water to 3DMe ratio until a more concentrated suspension is produced (this solution should never drop below the required 10 parts water:1 part 3DMe v/v production ratio). For more information on designing a 3DMe/water ratios to meet specific site conditions, please contact Regenesys Technical Services.

## Direct Push Application Requirements

One of the best methods to deliver the 3DMe micro-emulsion into the subsurface is to pressure inject the solution through direct-push rods using hydraulic equipment, or to pressure inject/gravity feed the micro-emulsion into the dedicated injection wells. The use of low cost push points or temporary injection points allows the applicator to more cost effectively distribute the 3DMe material across shallow sites by employing multiple points per site. In the case of treating deep aquifer sites, the use of the micro-emulsion applied via dedicated injection wells is likely to be the most cost effective remediation approach. Please note that this set of instructions

## 3DMe MICRO-EMULSION APPLICATION INSTRUCTIONS (cont)

is specific to direct-push equipment. Please contact Regenesi Technical Services to assist you with dedicated injection well applications.

In general, Regenesi strongly recommends application of the 3DMe micro-emulsion using an injection pump with a minimum delivery rate of three gallons per minute (gpm) and a pressure rating of between 150 to 200 pounds per square inch (psi). **Note: the injection pump requirements are different than the requirements of the mixing pump (see Mixing to Generate 3DMe Micro-emulsion).** High pressure, positive displacement pumps and progressive cavity pumps are appropriate for injecting 3DMe. For low permeability lithologies (clay, silt) higher pressure pumps (800-1600 psi) may be necessary, while for more permeable lithologies (gravel, sand) a lower pressure pump may be adequate. Examples of appropriate pumps are: Rupe Models 6-2200, 9-1500 and 9-1600 (positive displacement), Geoprobe® GS-2000 (positive displacement) and DP-800 (progressive cavity), Yamada (air diaphragm), Moyno (progressive cavity), and Wilden (air diaphragm). Delivery rate is a critical factor in managing installation time and costs. Generally, higher delivery rates (>6 gpm) are more cost effective for these types of applications but pump selection should be on a site specific basis and account for the volume of 3DMe solution and specific aquifer conditions present at the site.

The installation of the 3DMe micro-emulsion should span the entire vertical contaminated saturated thickness. If the vertical extent of the application is confined to a limited interval, then the micro-emulsion should be placed across a vertical zone extending a minimum of one-foot above and one-foot below the screened interval of monitoring wells that are being used to evaluate the performance of the project.

### Producing the 3DMe Micro-Emulsion

The application of 3DMe requires the creation of a micro-emulsion. Technically the optimal suspension is an 3DMe-in-water suspension containing micro-emulsions. Before beginning the mixing procedure the user should have in mind the desired water to 3DMe ratio v/v desired.

**It is critical that the micro-emulsion be produced using a high-shear apparatus such as a high speed centrifugal pump.** The shearing provided by the vanes in these types of pumps is sufficient to form and maintain a homogeneous milky emulsion. **This pump will be a different pump than that used to inject the 3DMe micro-emulsion into the subsurface.** If the user is uncertain as to requirements for the pump or the applicability of a certain pump, please contact Regenesi Technical Services. Regenesi typically suggests using a water trailer/pump apparatus commonly found at equipment rental facilities. Regenesi recommends using a Magnum Products LLC model MWT500 or equivalent water trailer (fitted with centrifugal recirculation pump). This “trash pump” or transfer pump is an ideal high shear pump and the water tank (400 gallons) serves as an excellent mixing tank.

To ensure that proper micro-emulsion suspension is generated Regenesi suggests a two-step process that simply requires mixing at least 10 parts water to 1 part 3DMe concentrate using water at a temperature  $\geq 60^{\circ}\text{F}$ .

### **3DMe MICRO-EMULSION APPLICATION INSTRUCTIONS (cont)**

Step 1) Regenesis recommends that the 3DMe concentrate in each bucket be re-homogenized using a drill equipped with a paint or “jiffy” mixer attachment as minor settling may have occurred during shipment.

Step 2) to calculate the volume of water necessary to produce a 10:1 v/v micro-emulsion, each bucket of 3DMe concentrate containing 3.7 gallons of material should be mixed with 37 gallons of water.

Example: 6 buckets x 3.7 gallons 3DMe concentrate/bucket yields a total of 22.2 gallons of 3DMe concentrate. Thus, a 10:1 v/v solution will require 222 gallons of water (22.2 gallons 3DMe concentrate x 10 gallons water yields 222 gallons of water). A nominal total volume micro-emulsion would result from the summation of the 3DMe concentrate volume (22.2 gallons) and the water volume (222 gallons). This yields a total fluids delivery volume of approximately 244 gallons.

The previously calculated water volume (222 gallons) should be transferred into an appropriately sized mixing tank. The water should be circulated by the high shear centrifugal pump and each of the six 3DMe buckets slowly poured into the tank. Each bucket of 3DMe concentrate should be poured at a slow rate (approx. 1 minute per bucket) and the contents of the tank continually recirculated using the high shear centrifugal pump. A period of 1-2 minutes should be allowed between addition of each subsequent bucket of 3DMe concentrate to allow the centrifugal pump to continue to shear and mix the water/3DMe concentrate. Upon addition of the entire volume of 3DMe concentrate the pump should remain on to allow the solution mixture to recirculate. The recirculation of the 3DMe micro-emulsion should continue until the material is injected to maintain micro-emulsion consistency.

### **Application of Micro-Emulsion Using Direct-Push Methods**

- 1) Prior to the installation of the micro-emulsion, any surface or overhead impediments should be identified as well as the location of all underground structures. Underground structures include but are not limited to: utility lines, tanks, distribution piping, sewers, drains, and landscape irrigation systems.
- 2) The planned installation locations should be adjusted to account for all impediments and obstacles.
- 3) Pre-mark the installation locations, noting any points that may have different vertical application requirements or total depth.
- 4) Set up the direct-push unit over each specific point and follow the manufacturer’s standard operating procedures (SOP). Care should be taken to assure that probe holes remain vertical.
- 5) For most applications, Regenesis suggests using drive rods with an O.D. of at least 1.25-inches and an I.D. of at least 0.625-inches I.D (Geoprobe or equivalent). However, the lithologic conditions at some sites may warrant the use of larger 2.125-inch O.D./1.5-inch I.D. drive rods.

### 3DMe MICRO-EMULSION APPLICATION INSTRUCTIONS (cont)

- 6) The most typical type of sub-assembly currently being used is designed for 1.25-inch direct-push rods and is manufactured by Geoprobe. Other brands of drive rods can also be used but require the fabrication of a sub-assembly that allows for a connection between the pump and drive rod.
- 7) For mixing large volumes of the micro-emulsion, Regenesis recommends using a Magnum Products LLC model MWT500 water trailer (fitted with centrifugal recirculation pump) or equivalent unit. However, single large volume poly tanks are adequate. We suggest filling the tank with an appropriate quantity (e.g. from the example above 222 gallons) of water before start of mixing operations. The tank should be configured so that both a hose and a fire hydrant or larger water tank can be connected to it simultaneously and filled with water quickly and easily. This will dramatically reduce the time needed to fill the tank with mixing water.
- 8) Regenesis highly recommends preparing the micro-emulsion before pushing any drive rods into the subsurface. NOTE: it is best if the micro-emulsion is produced a single day application volumes.
- 9) After the micro-emulsion mixing/shearing step has been completed as described above, the micro-emulsion is ready to be applied. Check to see if a hose has already been attached to the inlet side of the centrifugal pump. If this has not been done, do so now.
- 10) If a non-water trailer tank is being used for mixing the micro-emulsion a stand alone centrifugal pump and hose system should be used for the shearing and mixing operations.
- 11) Advance drive rods through the ground surface, as necessary, following SOP.
- 12) Push the drive rod assembly with an expendable tip to the desired maximum depth. Regenesis suggests pre-counting the number of drive rods needed to reach depth prior to starting injection activities to avoid any miscalculations.
- 13) After the drive rods have been pushed to the desired depth, the rod assembly should be withdrawn three to six inches. The expendable tip can be dropped from the drive rods, following SOP.
- 14) If an injection tool is used instead of a direct-push rod with an expendable tip, the application of material can take place without any preliminary withdrawal of the rods.
- 15) In some cases, introduction of a large column of air may be problematic. This is particularly the case in deep injections (>50 ft) with large diameter rods (>1.5-inch O.D.). To prevent the injection of air into the aquifer during the application, fill the drive rods with 3DMe emulsion after they have been pushed to the desired depth and before the disposable tip has been dropped or before the injection tip is operational.

### **3DMe MICRO-EMULSION APPLICATION INSTRUCTIONS (cont)**

- 16) Transfer the appropriate quantity of the micro-emulsion from the water trailer to the working/application pump hopper or associated holding tank.
- 17) A volume check should be performed prior to the injection of the micro-emulsion. Determining the volume discharged per unit time/stroke using a graduated bucket and stopwatch or stroke counter.
- 18) Start the pump and use the graduated bucket to determine how many gallons of micro-emulsion are delivered each minute or stroke per unit volume.
- 19) Connect the 1.25-inch O.D., 1-inch I.D. delivery hose to the pump outlet and the appropriate sub-assembly. Circulate the micro-emulsion through the hose and the sub-assembly to displace any air present in the system.
- 20) Connect the sub-assembly to the drive rod. After confirming that all of the connections are secure, pump the micro-emulsion through the delivery system to displace any water or other fluids in the rods.
- 21) The pump engine RPM and hydraulic settings should remain constant throughout the day to maintain a constant discharge rate.
- 22) The material is now ready to be installed in the subsurface. Use the pumps discharge rate as calculated in step 18 to determine the withdrawal rate of the drive rods needed for the application.
- 23) Slowly withdraw the drive rods using Geoprobe Rod Grip or Pull Plate Assembly (Part AT1222-For 1.25-inch drive rods). While slowly withdrawing single lengths of drive rod (three or four feet), pump the pre-determined volume of micro-emulsion into the aquifer across the desired treatment interval.
- 24) Remove one or two sections of the drive rod at a time. The drive rod may contain some residual material so RegenesiS suggests placing it in a clean, empty bucket and allowing the material to drain. Eventually, the material recovered in the bucket should be returned to the pump hopper for reuse.
- 25) Observe any indications of aquifer refusal such as “surfacing” around the injection rods or previously installed injection points. If aquifer acceptance appears to be low, allow enough time for the aquifer to equilibrate prior to removing the drive rod.
- 26) Repeat steps 19 through 25 until treatment of the entire contaminated vertical zone has been achieved.
- 27) Install an appropriate seal, such as bentonite, above the micro-emulsion injection zone. The seal should span across the entire vadose zone. Depending on soil conditions and local regulations, a bentonite seal using chips or pellets can be used. If the injection hole remains open more than three or four feet below the ground surface sand can be used to fill the hole and provide a base for the bentonite seal. The installation of an appropriate seal assures that



### 3DMe MICRO-EMULSION APPLICATION INSTRUCTIONS (cont)

the micro-emulsion remains properly placed and prevents contaminant migration from the surface. If the micro-emulsion continues to “surface” up the direct-push borehole, an oversized disposable drive tip or wood plug/stake can be used to temporarily plug the hole until the aquifer equilibrates and the material stops surfacing.

- 28) Remove and clean the drive rods as necessary.
- 29) Finish the borehole at the surface as appropriate (concrete or asphalt cap, if necessary).
- 30) Periodically compare the pre- and post-injection discharge rates of the micro-emulsion in the pump hopper or holding tank using any pre-marked volume levels. If volume level indicators are not on the pumps hopper or holding tank use a pre-marked dipstick or alternatively temporary mark the hopper or holding tank with known quantities/volumes of water using a carpenter's grease pencil (Kiel crayon).
- 31) Move to the next probe point, repeating steps 11 through 29.

## Helpful Hints

### 1) *Application in Cold Weather Settings*

As discussed in the Material Overview, Handling, and Safety section, cold weather tends to increase the viscosity of 3DMe as well as decrease the ease of micro-emulsion formation. To optimize an application in cold weather settings Regenesis recommends maintaining the 3DMe concentrate and the associated water at a temperature  $\geq 60^{\circ}\text{F}$  ( $16^{\circ}\text{C}$ ). The following procedures can be used to facilitate the production and installation of a 10:1 v/v 3DMe micro-emulsion.

- Raise and maintain the temperature of the HRC-A to at least  $60^{\circ}\text{F}$  ( $16^{\circ}\text{C}$ ) prior to mixing with water. A hot water bath can be used to heat up the 3DMe concentrate buckets. A Rubbermaid fiberglass Farm Trough Stock Tank (Model 4242-00-GRAY) has been used for this process. This trough can hold up to 16 buckets of 3DMe concentrate.
- Hot water (approximately  $130\text{--}170^{\circ}\text{F}$  or  $54\text{--}77^{\circ}\text{C}$ ) should be added to the tank after the buckets of 3DMe have been placed inside. The hot water should be delivered from a heated pressure washer (Hotsy<sup>®</sup> Model No. 444 or equivalent) or steam cleaner unit.
- It is equally critical that a moderate water temperature ( $>60^{\circ}\text{F}$  or  $16^{\circ}\text{C}$ ) be used in the production of the micro-emulsion. If on-site water supply is below  $60^{\circ}\text{F}$  use a hot water or steam cleaner to generate a small volume (e.g. 5-10% of total water volume) of hot water ( $130\text{--}170^{\circ}\text{F}/54\text{--}77^{\circ}\text{C}$ ). This small volume of hot water should be added to remaining cold water volume to raise the total volume temperature to  $>60^{\circ}\text{F}$ . When the 3DMe concentrate and water each reach a minimum temperature of  $60^{\circ}\text{F}$  or  $16^{\circ}\text{C}$  the two materials are ready for mixing.
- Upon achieving a minimum temperature of  $60^{\circ}\text{F}$  or  $16^{\circ}\text{C}$  (approximately 10-20 minutes). When the 3DMe and the associated water volumes have reached a minimum temperature of  $60^{\circ}\text{F}$  or  $16^{\circ}\text{C}$  (approximately 10-20 minutes) they are ready for mixing.
- In exceptionally harsh winter temperature settings use of a separate insulated pump containment structure and insulated delivery hoses may be necessary.



## 3DMe MICRO-EMULSION APPLICATION INSTRUCTIONS (cont)

- Use a pump with a heater unit.
- Periodically check the temperature of the material in the hopper.
- Re-circulate the 3DMe micro-emulsion through the pump and hose to maintain temperature adequate temperatures.
- Care should be taken to avoid the re-circulation of material volumes that exceed the volume of the pump hopper or holding tank.

**Table 1: Equipment Volume and 3DMe Micro-Emulsion Weight per Unit  
Length of Hose (Feet)**

Equipment	Volume	Product Weight
1-inch OD; 0.625-inch ID hose (10 feet)	0.2 gallon	1.6 lbs.
1.25-inch OD; 0.625-inch ID drive rod (3 feet):	0.05 gallon	0.4 lbs.
1.25-inch OD; 0.625-inch ID drive rod (4 feet):	0.06 gallon	0.5 lbs.

### 2) Pump Cleaning

For best results, use a heated pressure washer to clean equipment and rods periodically throughout the day. Internal pump mechanisms and hoses can be easily cleaned by re-circulating a solution of hot water and a biodegradable cleaner such as Simple Green through the pump and delivery hose. Further cleaning and decontamination (if necessary due to subsurface conditions) should be performed according to the equipment supplier's standard procedures and local regulatory requirements.

### NOTE:

Before using the Rupe Pump, check the following:

- Fuel level prior to engaging in pumping activities (it would be best to start with a full tank)
- Remote control/pump stroke counter LCD display [if no display is present, the electronic counter will need to be replaced (Grainger Stock No. 2A540)]

Monitor pump strokes by observing the proximity switches (these are located on the top of the piston).

### 3) Bedrock Applications

When contaminants are present in competent bedrock aquifers, the use of direct-push technology as a delivery method is not possible. *Regenesis is in the process of developing methods for applying 3DMe via boreholes drilled using conventional rotary techniques.* To develop the best installation strategy for a particular bedrock site, it is critical that our customers call the Technical Services department at Regenesis early in the design process.

The micro-emulsion can be applied into a bedrock aquifer in cased and uncased boreholes. The micro-emulsion can be delivered by simply filling the borehole without pressure or by using a

### 3DMe MICRO-EMULSION APPLICATION INSTRUCTIONS (cont)

single or straddle packer system to inject the material under pressure. Selection of the appropriate delivery method is predicated on site-specific conditions. The following issues should be considered in developing a delivery strategy:

- Is the aquifer's hydraulic conductivity controlled by fractures?
- Backfilling may be the better delivery method in massive, unfractured bedrock. This is particularly true in an aquifer setting with high permeability and little fracturing (such as that found in massive sandstone).
- Down-hole packer systems may be more advantageous in fractured bedrock aquifers.
  - In this case the fracture type, trends, and interconnections should be evaluated and identified.
- Are the injection wells and monitoring wells connected by the same fractures?
- Determine if it is likely that the injection zone is connected to the proposed monitoring points.
- If pressure injection via straddle packers is desired, consideration should be given to the well construction. Specific issues to be considered are:
  - Diameter of the uncased borehole (*will casing diameter allow a packer system to be used under high pressures?*).
  - Diameter of the casing (*same as above*).
  - Strength of the casing (*can it withstand the delivery pressures?*).
  - Length of screened interval (*screened intervals greater than 10 feet will require a straddle packer system*).

**For further assistance or questions please contact Regenesi Technical Services at 949-366-8000.**



# Chemical Reducing Solution (CRS®)

## Installation Instructions:

### General Guidelines

CRS® is a liquid amendment to 3D Microemulsion® that provides ferrous iron ( $\text{Fe}^{2+}$ ) to the reductive dechlorination process, thus enabling *In situ* Chemical Reduction (ISCR) pathways for contaminant destruction. The material is added in a prescribed ratio to the 3D Microemulsion mixture before injection. Exact ratios and mixing quantities should be obtained from your REGENESIS® representative.

### Material Handling and Safety

CRS is a neutral-pH material made from very low toxicity ingredients. However, as with all chemicals, CRS should be handled, used, and disposed of safely in accordance with its Material Safety Data Sheet (MSDS) and in compliance with local and federal regulations.

### Product Mixing and Application

CRS contains reduced ferrous iron ( $\text{Fe}^{2+}$ ) and will oxidize slowly to ferric iron ( $\text{Fe}^{3+}$ ) in air. To maximize the reducing capacity of the solution, exposure to air should be minimized prior to injection of the material. Therefore, it is important that the drums CRS is delivered in stay closed and air-tight until CRS is ready to be added to 3D Microemulsion.

Two methods are recommended for mixing and application of CRS with 3D Microemulsion:

- 1) Direct batch mixing
- 2) Controlled metering with a Dosatron™ chemical dispenser

These two options are outlined below.

### I. Method 1 - Direct batch mixing of CRS

1. Obtain recipe for emulsion preparation and CRS addition from REGENESIS
2. Dilute 3D Microemulsion with the prescribed quantity of water
3. Stir drum of CRS for 30 seconds with a vortex mixer at a mild turbulence setting to ensure solution homogeneity without air entrainment
4. Transfer the prescribed quantity of CRS into the 3D Microemulsion batch
5. Mix the emulsion and CRS batch using a vortex mixer – note: care should be taken to:
  - i. Minimize direct exposure and entrainment of air
  - ii. Mix periodically to maintain homogeneity of batch
6. Inject the final mixture directly into the treatment zone



**CHEMICAL  
REDUCING  
SOLUTION**

## **II. Method 2- Controlled Metering using a Dosatron™ chemical dispenser**

1. Obtain recipe for emulsion preparation and CRS addition from REGENESIS
2. Dilute 3D Microemulsion with the prescribed quantity of water
3. Stir drum of CRS for 30 seconds with a vortex mixer at a mild turbulence setting to ensure solution homogeneity without air entrainment
4. Assemble injection setup to incorporate the Dosatron chemical metering system
5. Inject the diluted batch of 3D Microemulsion using the Dosatron unit to meter the CRS solution into the 3D Microemulsion at the prescribed ratios

**For direct assistance or answers to any questions you may have regarding these instructions, contact REGENESIS Technical Services at 949.366.8000.**

# Bio-Decchlor INOCULUM PLUS (BDI PLUS®)

## Installation Instructions:

### General Guidelines

Bio-Decchlor 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<sup>3</sup> 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.

## 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.



Culture Keg in Cooler

## 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

## 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<sup>3</sup> 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 and dissolved oxygen level will indicate when one can trim down on the sparge pressure and conserve the nitrogen.

### **BDI PLUS Dilution Chart**

<b>Volume of BDI PLUS</b>	<b>Volume of Water</b>
5 liters	50 gal
1 liter	10 gal

<b>Volume of BDI PLUS Concentrate</b>	<b>Volume of Water</b>
0.5 liters	50 gal
0.1 liter	10 gal

- 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).
- 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.
- 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.
- 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.
  - 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.
- Fill the annular space of the drive rods with water. This will minimize the amount of air introduced to the system.
- 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.
- 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.
- Connect the hose from the grout pump to the drive rod assembly.
- Start pumping the BDI PLUS product solution.
- 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.
- 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 Contaminated Site Remediation

## User Manual for the Bio-Dechlor INOCULUM PLUS™ Culture Delivery System



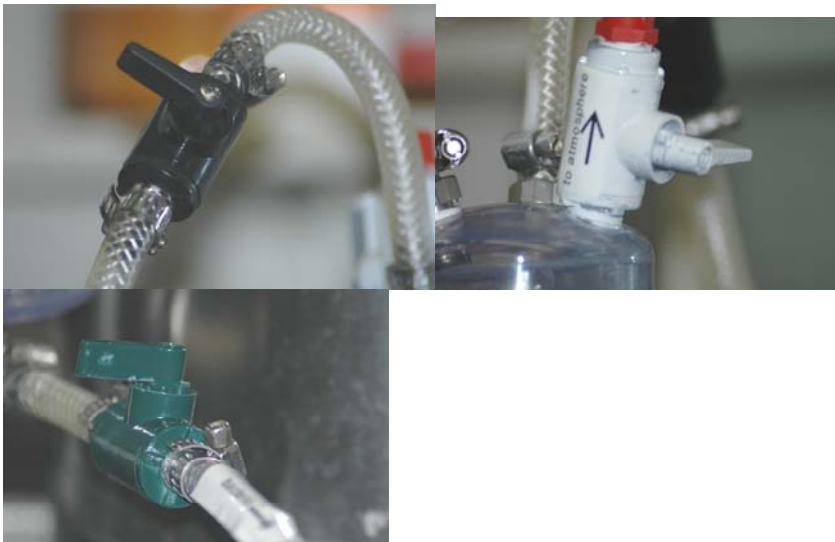
## USER INSTRUCTION

### WARNINGS

1. Keg is pressurized to 10 to 15 psi with Nitrogen before shipping.
2. Wear suitable eye protection, gloves, respirator and protective clothing.
3. Gas cylinders used to dispense culture **MUST** be equipped with a proper pressure regulator.
4. During operation **DO NOT** exceed the keg's maximum working pressure of 15 psi.

### UNPACKING

1. Carefully remove keg and measuring cylinder from shipping container and stand keg upright.
2. Attach measuring cylinder to the keg by using the black Velcro straps.
3. Carefully check the keg, measuring cylinder, connectors, valves and tubing for any damage or defects. If any defects or damage is observed, do not use. Report any damage to Tom Cormack at REGENESIS immediately 949-366-8000. A back-up set of quick connects is provided in the packaging material.
4. Check and ensure that black, white and green valves are in the CLOSED position and grey three-way valve is in position "1" (handle of the valve should be directed to position perpendicular to the body of the valve).

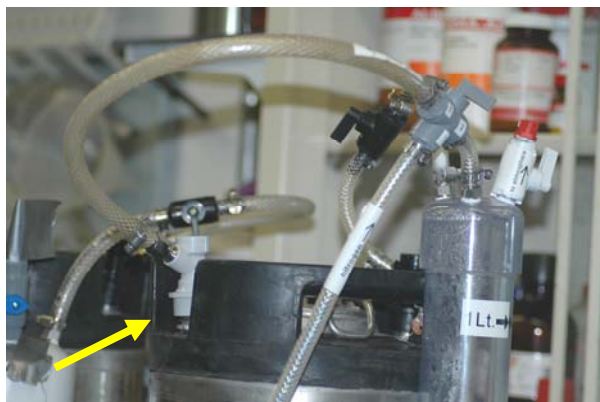


## **SET-UP**

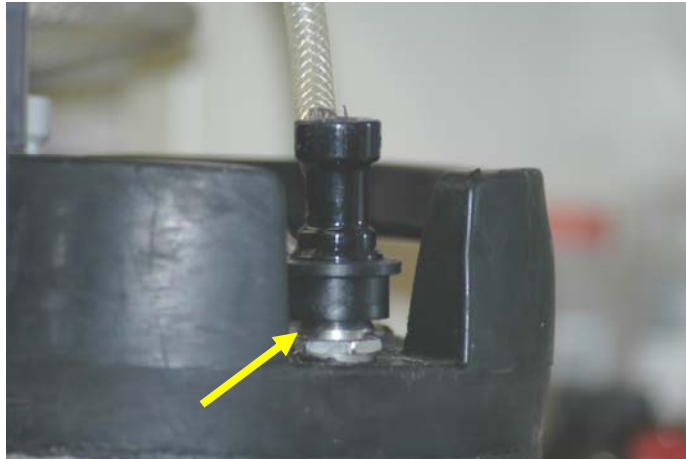
1. Using an appropriate length of reinforced  $\frac{1}{4}$ " ID tubing, connect the tubing marked "Nitrogen tank →" to the gas tank regulator. Another end of the tubing is connected to position "1" of three way grey valve.



2. Connect the GREY connector to Gas "In" fitting of the keg. Be sure that the GREY connector is designed to be connected only to Gas "In" keg's fitting.



3. Connect the Black connector to Liquid "Out" fitting of the keg. Be sure that the Black connector is designed to be connected only to Liquid "Out" keg's fitting. Ensure that the black valve attached to the BLACK quick connect is tightly closed.

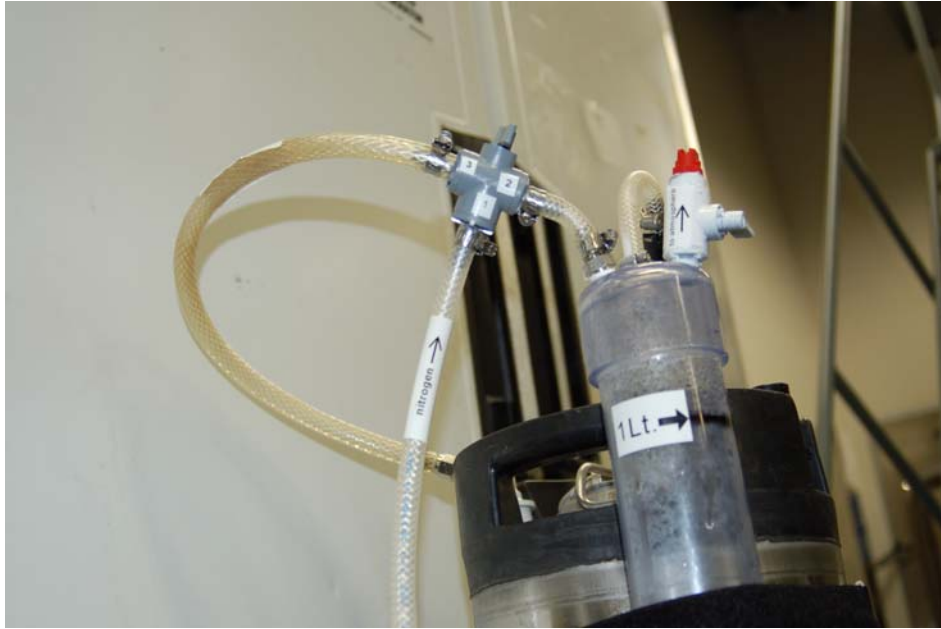


4. Connect an appropriate length of reinforced  $\frac{1}{4}$ " ID tubing marked "Bacteria →" by the barbed fitting to the site tubing to distribute bacterial culture to the desired injection point. **Do Not Connect This Line To The Injection Line Yet**



**Keg and measuring cylinder attached to the keg's fittings black and grey connectors.**





**Measuring cylinder with attached three way grey valve.**



**Keg and measuring cylinder connected to delivery gas tank.**



## **OPERATION**

- 1. Set up the gas pressure on the delivery gas (Nitrogen or Argon) tank regulator at 10 to 15 psi.**
- 2. Remove air from injection line by the following procedure:**
  - A. Be sure that at this point that the injection line is not connected to the injection point.**



- B. Open the green valve located on the bottom of measuring cylinder.**



- C. **Slowly** turn the three way grey valve to position "2" to start supplying the delivery gas (nitrogen, argon) to the measuring cylinder and injection tubing. Flush the cylinder and injection tubing with gas for 2-3 min.



- D. Close the green valve.



- E. Turn the three way grey valve to position "1".



- F. Open the white valve “to atmosphere” position to release any gas pressure in the measuring cylinder. The white valve is equipped with a check valve that prevents the air from being added into the measuring cylinder.



**3. Add the required amount of bacteria to the measuring cylinder:**

- A. Turn the grey three way valve to position “3” to pressurize the keg with delivery gas.



B. **Slowly** open the black valve to add bacteria from the keg to the cylinder.



C. Add the required amount of bacteria and close the black valve.



D. Close the white valve.



4. Transferring the measured amount of bacteria from the measuring cylinder to the injection point:

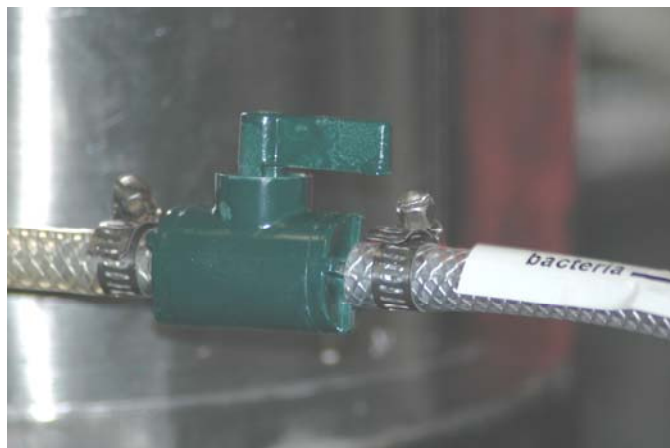
A. Be sure that at this point that the injection line is connected to the injection point.



B. Turn the grey three way valve to position "2" to pressurize the measuring cylinder with delivery gas.



C. **Slowly** open the green valve on the “bacteria →” line to provide the desired flow of bacterial suspension. Delivery of the culture can be monitored by watching the liquid level in the measuring cylinder.



5. After delivery of the desired volume of bacterial suspension, close the green valve.



A. Turn the grey three way valve to position “1”.





6. To add more bacteria, follow the instructions according to steps 3 and 4 above.
7. After finishing distributing the bacteria, disconnect the black and grey connectors from the keg by pulling up on the barrel of the quick connects.

## **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 do not freeze. This can normally be achieved by storing the kegs under ice in the provided coolers. The keg should be pressurized with Nitrogen to pressure 10- 15 psi before storing to ensure a tight seal on the keg cap.

## **SHIPPING**



### **Cooler and Keg Packed for Return Shipment**

After completion of operation, please ship the cooler with keg and all attachments back to the following address:

**Simon Vainberg  
Shaw Environmental, Inc.  
17 Princess Road, Lawrenceville, NJ 08648**

## **APPENDIX D**

### **SVE System O&M Data Forms**

**COLLEGE PLAZA SOUTH**  
**SUBSURFACE SVE SYSTEM OPERATING PARAMETERS**

Date and Time of Arrival:			Bi-Weekly      Monthly      Quarterly
Field Technician(s):			SVE Running Upon Arrival?   YES   NO
Component	Value	Units	Comments
SVE Blower Hour Meter		hr	
Air Flow Rate at SVE Blower		scfm	
Vapor Concentration at SVE Blower		ppmv	
Vacuum - Moisture Separator Inlet (Gauge)		in w.c.	
Vacuum - Moisture Separator Outlet (Gauge)		in w.c.	
Volume of Water in Moisture Separator		gal	
Vacuum at SVE Header (Digital Manometer)		in w.c.	
Air Temperature at Header		°F	
Dilution Air Valve Closed?	YES	NO	
High Water Level Alarm?	YES	NO	
High Vacuum Alarm?	YES	NO	
Check Belt Tension?	YES	NO	
Check Blower Oil Level?	YES	NO	
Grease Blower Bearings?	YES	NO	
Excessive Noise or Vibration?	YES	NO	
Equipment Enclosure Secure?	YES	NO	
Supplies or Parts Needed? (specify)	YES	NO	
Other (explain)			
<b>Notes / Comments</b>			

**COLLEGE PLAZA SOUTH**  
**SUBSURFACE SVE WELL AND OBSERVATION WELL DATA**

Date: _____ Bi-Weekly    Monthly    Quarterly <div style="text-align: right;">(circle one)</div>				
Field Technician(s): _____				
<b>SVE WELL PARAMETERS</b>				
SVE Well	Applied Vacuum in. w.c.	Flow Rate scfm	PID ppmv	Comments
MW-1				
MW-3A				
MW-3B				
MW-4A				
MW-4B				
MW-5A				
MW-5B				
MW-6A				
MW-6B				
MW-7A				
MW-8A				
<b>VACUUM RESPONSE DATA</b>				
Observation Well	Observed Vacuum in. w.c.	Flow Rate scfm	PID ppmv	Comments
MW-2				
VB-1 @ 10'				
VB-1 @ 30'				
VB-1 @ 50'				
VB-1 @ 70'				
P-1				
<b>Notes / Comments</b>				

**APPENDIX B**

**SPECIFICATIONS AND MSDS FOR  
3DME®, CRS® AND BDI PLUS®**



## 3-D Microemulsion® Factory Emulsified Technical Description

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

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

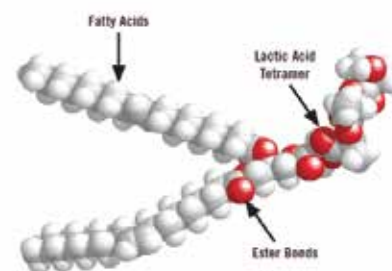
Suspension of 3DME generated by this mixing range from micelles on the order of .02 microns to .05 microns in diameter, to “swollen” micelles, (termed “microemulsions”) which are on the order of .05 to 5 microns in diameter. Once injected into the subsurface in high volumes, the colloidal suspension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

For a list of treatable contaminants with the use of 3DME, view the [Range of Treatable Contaminants Guide](#)



Example of 3-D Microemulsion

FIGURE 1: THE 3-D MICROEMULSION MOLECULAR STRUCTURE



### Chemical Composition

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

# 3-D Microemulsion® Factory Emulsified Technical Description

## Properties

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

## Storage and Handling Guidelines

### Storage

Store in original tightly closed container

Store in a cool, dry, well-ventilated place

Store away from incompatible materials

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

### Handling

Avoid contact with eyes, skin, and clothing

Provide adequate ventilation

Wear appropriate personal protective equipment

Observe good industrial hygiene practices

## Applications

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

Application instructions for this product are contained here [3DME FE Application Instructions](#).

## Health and Safety

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



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

Corporate Headquarters  
1011 Calle Sombra, San Clemente CA 92673  
949.366.8000

European Headquarters  
The Tramshed, Beehive Yard  
Walcot St, Bath BA1 5BB, United Kingdom

**1. Identification**

**Product identifier** 3-D Microemulsion®  
**Other means of identification** None.  
**Recommended use** Remediation of soils and groundwater.  
**Recommended restrictions** None known.  
**Manufacturer/Importer/Supplier/Distributor information**  
**Company Name** RegenesiS  
**Address** 1011 Calle Sombra  
San Clemente, CA 92673  
**Telephone** 949-366-8000  
**E-mail** CustomerService@regenesiS.com  
**Emergency phone number** CHEMTREC® at 1-800-424-9300 (International)

**2. Hazard(s) identification**

**Physical hazards** Not classified.  
**Health hazards** Skin corrosion/irritation Category 2  
Serious eye damage/eye irritation Category 1  
**OSHA defined hazards** Not classified.  
**Label elements**



**Signal word** Danger  
**Hazard statement** Causes skin irritation. Causes serious eye damage.  
**Precautionary statement**  
**Prevention** Wash thoroughly after handling. Wear protective gloves. Wear eye/face protection.  
**Response** If on skin: Wash with plenty of water. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center/doctor. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse.  
**Storage** Store away from incompatible materials.  
**Disposal** Dispose of waste and residues in accordance with local authority requirements.  
**Hazard(s) not otherwise classified (HNOC)** None known.

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

Chemical name	CAS number	%
HRC-PED	823190-10-9	48-53
Fatty Acids (neutralized)	61790-12-3 or 112-80-1	30-35
Glycerol Tripolylactate	201167-72-8	<10

**Composition comments** All concentrations are in percent by weight unless otherwise indicated.

## 4. First-aid measures

<b>Inhalation</b>	Move to fresh air. Call a physician if symptoms develop or persist.
<b>Skin contact</b>	Remove contaminated clothing. Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention. Wash contaminated clothing before reuse.
<b>Eye contact</b>	Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention immediately.
<b>Ingestion</b>	Rinse mouth. Never give anything by mouth to a victim who is unconscious or is having convulsions. Do not induce vomiting without advice from poison control center. Get medical attention if symptoms occur.
<b>Most important symptoms/effects, acute and delayed</b>	Severe eye irritation. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. Skin irritation. May cause redness and pain.
<b>Indication of immediate medical attention and special treatment needed</b>	Provide general supportive measures and treat symptomatically. Keep victim under observation. Symptoms may be delayed.
<b>General information</b>	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

## 5. Fire-fighting measures

<b>Suitable extinguishing media</b>	Water spray. Carbon dioxide (CO <sub>2</sub> ). Dry chemical powder. Foam.
<b>Unsuitable extinguishing media</b>	Do not use water jet as an extinguisher, as this will spread the fire.
<b>Specific hazards arising from the chemical</b>	During fire, gases hazardous to health may be formed. Combustion products may include: carbon oxides, phosphorus compounds and metal oxides.
<b>Special protective equipment and precautions for firefighters</b>	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
<b>Fire fighting equipment/instructions</b>	Move containers from fire area if you can do so without risk. Water spray should be used to cool containers.
<b>Specific methods</b>	Use standard firefighting procedures and consider the hazards of other involved materials.
<b>General fire hazards</b>	No unusual fire or explosion hazards noted.

## 6. Accidental release measures

<b>Personal precautions, protective equipment and emergency procedures</b>	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Surfaces may become slippery after spillage. Wear appropriate protective equipment and clothing during clean-up. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
<b>Methods and materials for containment and cleaning up</b>	<p>Spilled product may create a slipping hazard. The product is immiscible with water and will spread on the water surface.</p> <p>Large Spills: Stop the flow of material, if this is without risk. Use water spray to reduce vapors or divert vapor cloud drift. Dike the spilled material, where this is possible. Cover with plastic sheet to prevent spreading. Absorb in vermiculite, dry sand or earth and place into containers. Following product recovery, flush area with water. Flush area clean with lots of water. Be aware of potential for surfaces to become slippery.</p> <p>Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination.</p> <p>Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS.</p>
<b>Environmental precautions</b>	Avoid discharge into drains, water courses or onto the ground.

## 7. Handling and storage

<b>Precautions for safe handling</b>	Do not get this material in contact with eyes. Avoid contact with eyes, skin, and clothing. Provide adequate ventilation. Wear appropriate personal protective equipment. Observe good industrial hygiene practices.
<b>Conditions for safe storage, including any incompatibilities</b>	Store in original tightly closed container. Store in a cool, dry, well-ventilated place. Store away from incompatible materials (see Section 10 of the SDS). Recommended storage containers: plastic lined steel, plastic, glass, aluminum, stainless steel, or reinforced fiberglass.

## 8. Exposure controls/personal protection

<b>Occupational exposure limits</b>	No exposure limits noted for ingredient(s).
<b>Biological limit values</b>	No biological exposure limits noted for the ingredient(s).
<b>Appropriate engineering controls</b>	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Eye wash facilities and emergency shower must be available when handling this product.
<b>Individual protection measures, such as personal protective equipment</b>	
<b>Eye/face protection</b>	Wear approved, tight fitting indirect vented or non-vented safety goggles where splashing is probable. Face shield is recommended.
<b>Skin protection</b>	
<b>Hand protection</b>	Wear appropriate chemical resistant gloves. Rubber or vinyl-coated gloves are recommended.
<b>Other</b>	Wear appropriate chemical resistant clothing.
<b>Respiratory protection</b>	If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn.
<b>Thermal hazards</b>	Wear appropriate thermal protective clothing, when necessary.
<b>General hygiene considerations</b>	Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

## 9. Physical and chemical properties

<b>Appearance</b>	
<b>Physical state</b>	Liquid.
<b>Form</b>	Semi-solid.
<b>Color</b>	Amber.
<b>Odor</b>	Odorless.
<b>Odor threshold</b>	Not available.
<b>pH</b>	Not available.
<b>Melting point/freezing point</b>	Not available.
<b>Initial boiling point and boiling range</b>	Not available.
<b>Flash point</b>	> 200.0 °F (> 93.3 °C) Closed Cup
<b>Evaporation rate</b>	Not available.
<b>Flammability (solid, gas)</b>	Not available.
<b>Upper/lower flammability or explosive limits</b>	
<b>Flammability limit - lower (%)</b>	Not available.
<b>Flammability limit - upper (%)</b>	Not available.
<b>Explosive limit - lower (%)</b>	Not available.
<b>Explosive limit - upper (%)</b>	Not available.
<b>Vapor pressure</b>	Not available.
<b>Vapor density</b>	Not available.
<b>Relative density</b>	0.9 - 1.1
<b>Solubility(ies)</b>	
<b>Solubility (water)</b>	Insoluble.
<b>Solubility (other)</b>	Slightly soluble in acetone.
<b>Partition coefficient (n-octanol/water)</b>	Not available.
<b>Auto-ignition temperature</b>	Not available.
<b>Decomposition temperature</b>	Not available.
<b>Viscosity</b>	Not available.

## 10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Undergoes hydrolysis in water to form lactic acid, glycerol and fatty acids.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Avoid temperatures exceeding the flash point. Contact with incompatible materials.
Incompatible materials	Strong oxidizing agents. Bases. Acids.
Hazardous decomposition products	Thermal decomposition or combustion may produce: carbon oxides, phosphorus compounds, metal oxides.

## 11. Toxicological information

### Information on likely routes of exposure

Inhalation	May cause irritation to the respiratory system.
Skin contact	Causes skin irritation.
Eye contact	Causes serious eye damage.
Ingestion	Ingestion may cause irritation and malaise.
Symptoms related to the physical, chemical and toxicological characteristics	Severe eye irritation. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. Skin irritation. May cause redness and pain.

### Information on toxicological effects

Acute toxicity	Not available.
Skin corrosion/irritation	Causes skin irritation.
Serious eye damage/eye irritation	Causes serious eye damage.
Respiratory or skin sensitization	
Respiratory sensitization	Not a respiratory sensitizer.
Skin sensitization	This product is not expected to cause skin sensitization.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.
OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)	
Not listed.	
Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
Specific target organ toxicity - single exposure	Not classified.
Specific target organ toxicity - repeated exposure	Not classified.
Aspiration hazard	Not an aspiration hazard.

## 12. Ecological information

Ecotoxicity	The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.
Persistence and degradability	Material is readily degradable and undergoes hydrolysis in several hours.
Bioaccumulative potential	No data available.
Mobility in soil	The product is immiscible in water.
Other adverse effects	None known.

## 13. Disposal considerations

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Dispose of contents/container in accordance with local/regional/national/international regulations.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.



<b>Waste from residues / unused products</b>	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
<b>Contaminated packaging</b>	Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

## 14. Transport information

### DOT

Not regulated as dangerous goods.

### IATA

Not regulated as dangerous goods.

### IMDG

Not regulated as dangerous goods.

**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code** Not established.

## 15. Regulatory information

**US federal regulations** This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.  
One or more components are not listed on TSCA.

### TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

### OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

### CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

### Superfund Amendments and Reauthorization Act of 1986 (SARA)

**Hazard categories** Immediate Hazard - Yes  
Delayed Hazard - No  
Fire Hazard - No  
Pressure Hazard - No  
Reactivity Hazard - No

### SARA 302 Extremely hazardous substance

Not listed.

**SARA 311/312 Hazardous chemical** Yes

### SARA 313 (TRI reporting)

Not regulated.

### Other federal regulations

#### Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

#### Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

**Safe Drinking Water Act (SDWA)** Not regulated.

### US state regulations

#### US. Massachusetts RTK - Substance List

Not regulated.

#### US. New Jersey Worker and Community Right-to-Know Act

Not listed.

#### US. Pennsylvania Worker and Community Right-to-Know Law

Fatty Acids (neutralized) (CAS 61790-12-3 or 112-80-1)

#### US. Rhode Island RTK

Not regulated.

## US. California Proposition 65

California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins.


### International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

\*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).

A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

### 16. Other information, including date of preparation or last revision

Issue date	22-April-2015
Revision date	-
Version #	01
Further information	HMIS® is a registered trade and service mark of the American Coatings Association (ACA).
HMIS® ratings	Health: 3 Flammability: 1 Physical hazard: 0
NFPA ratings	

### Disclaimer

Regenesis cannot anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user's responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use. The information in the sheet was written based on the best knowledge and experience currently available.

## CRS<sup>®</sup> Technical Description

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



Example of CRS

For a list of treatable contaminants with the use of CRS, view the [Range of Treatable Contaminants Guide](#).

### Chemical Composition

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

### Properties

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

### Storage and Handling Guidelines

#### Storage

- Store in original tightly closed container
- Store away from incompatible materials
- Recommended storage containers: plastic-lined steel, plastic, glass, aluminum, stainless steel, or reinforced fiberglass
- Store in a cool, dry, well-ventilated place
- Keep away from extreme heat and strong oxidizing agents

#### Handling

- Avoid prolonged exposure
- Observe good industrial hygiene practices
- Wear appropriate personal protective equipment
- Avoid contact with eyes, skin, and clothing
- Avoid breathing spray mist
- Use with adequate ventilation

# CRS® Technical Description

## Applications

- Permanent injection wells
- Direct-push injection points

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

## Health and Safety

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

**1. Identification**

**Product identifier** Chemical Reducing Solution (CRS®)  
**Other means of identification** None.  
**Recommended use** Soil and Groundwater Remediation.  
**Recommended restrictions** None known.  
**Manufacturer/Importer/Supplier/Distributor information**  
**Company Name** RegenesiS  
**Address** 1011 Calle Sombra  
San Clemente, CA 92673  
**Telephone** 949-366-8000  
**E-mail** CustomerService@regenesiS.com  
**Emergency phone number** CHEMTREC® at 1-800-424-9300 (International)

**2. Hazard(s) identification**

**Physical hazards** Not classified.  
**Health hazards** Not classified.  
**OSHA defined hazards** Not classified.

**Label elements**

**Hazard symbol** None.  
**Signal word** None.  
**Hazard statement** The mixture does not meet the criteria for classification.  
**Precautionary statement**  
**Prevention** Observe good industrial hygiene practices.  
**Response** Wash hands after handling.  
**Storage** Store away from incompatible materials.  
**Disposal** Dispose of waste and residues in accordance with local authority requirements.

**Hazard(s) not otherwise classified (HNOC)** None known.

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

The manufacturer lists no ingredients as hazardous according to OSHA 29 CFR 1910.1200.

Chemical name	CAS number	%
Water	7732-18-5	85-92
Ferrous Gluconate	299-29-6	8-15

**Composition comments** All concentrations are in percent by weight unless otherwise indicated.

**4. First-aid measures**

**Inhalation** Move to fresh air. Call a physician if symptoms develop or persist.  
**Skin contact** Remove contaminated clothing and shoes. Wash off with soap and water. Get medical attention if irritation develops and persists.  
**Eye contact** Rinse with water. Get medical attention if irritation develops and persists.  
**Ingestion** Rinse mouth. Never give anything by mouth to a victim who is unconscious or is having convulsions. Do not induce vomiting without advice from poison control center. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. Get medical attention if symptoms occur.

<b>Most important symptoms/effects, acute and delayed</b>	Direct contact with eyes may cause temporary irritation.
<b>Indication of immediate medical attention and special treatment needed</b>	Treat symptomatically.
<b>General information</b>	If you feel unwell, seek medical advice (show the label where possible). Show this safety data sheet to the doctor in attendance.
<b>5. Fire-fighting measures</b>	
<b>Suitable extinguishing media</b>	Small fires: Dry chemical powder. Larger fires: Water spray, fog or foam.
<b>Unsuitable extinguishing media</b>	None known.
<b>Specific hazards arising from the chemical</b>	During fire, gases hazardous to health may be formed. Combustion products may include: carbon monoxide, carbon dioxide, iron oxides.
<b>Special protective equipment and precautions for firefighters</b>	Use protective equipment appropriate for surrounding materials.
<b>Fire fighting equipment/instructions</b>	Move containers from fire area if you can do so without risk.
<b>Specific methods</b>	Use standard firefighting procedures and consider the hazards of other involved materials. Use water spray to keep fire-exposed containers cool.
<b>General fire hazards</b>	No unusual fire or explosion hazards noted. The product itself does not burn.
<b>6. Accidental release measures</b>	
<b>Personal precautions, protective equipment and emergency procedures</b>	Keep unnecessary personnel away. Avoid contact with spilled material. For personal protection, see section 8 of the SDS.
<b>Methods and materials for containment and cleaning up</b>	<p>This product is miscible in water.</p> <p>Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Cover with plastic sheet to prevent spreading. Absorb in vermiculite, dry sand or earth and place into containers. Following product recovery, flush area with water.</p> <p>Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination.</p> <p>Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS.</p>
<b>Environmental precautions</b>	Avoid discharge into drains, water courses or onto the ground.
<b>7. Handling and storage</b>	
<b>Precautions for safe handling</b>	Avoid contact with eyes, skin, and clothing. Avoid prolonged exposure. Avoid breathing spray mist. Use with adequate ventilation. Observe good industrial hygiene practices. Wear appropriate personal protective equipment (See Section 8).
<b>Conditions for safe storage, including any incompatibilities</b>	Store in original tightly closed container. Store in a cool, dry, well-ventilated place. Store away from incompatible materials (see Section 10 of the SDS). Keep away from extreme heat and strong oxidizing agents.
<b>8. Exposure controls/personal protection</b>	
<b>Occupational exposure limits</b>	No exposure limits noted for ingredient(s).
<b>Biological limit values</b>	No biological exposure limits noted for the ingredient(s).
<b>Appropriate engineering controls</b>	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Provide eyewash station and safety shower.
<b>Individual protection measures, such as personal protective equipment</b>	
<b>Eye/face protection</b>	Use safety glasses. Where contact with eyes is likely, use chemical goggles. Use a face shield as needed.
<b>Skin protection</b>	
<b>Hand protection</b>	Wear appropriate chemical resistant gloves.
<b>Other</b>	Wear suitable protective clothing. Wear appropriate chemical resistant gloves.



<b>Respiratory protection</b>	In case of insufficient ventilation, wear suitable respiratory equipment. If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn. Wear respiratory protection during operations where spraying or misting occurs. If respirators are used, a program should be instituted to assure compliance with OSHA 29 CFR 1910.134.
<b>Thermal hazards</b>	Wear appropriate thermal protective clothing, when necessary.
<b>General hygiene considerations</b>	Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

## 9. Physical and chemical properties

### Appearance

<b>Physical state</b>	Liquid.
<b>Form</b>	Liquid.
<b>Color</b>	Dark green to black.
<b>Odor</b>	Odorless.
<b>Odor threshold</b>	Not available.
<b>pH</b>	6 - 8
<b>Melting point/freezing point</b>	Not available.
<b>Initial boiling point and boiling range</b>	Not available.
<b>Flash point</b>	Not flammable.
<b>Evaporation rate</b>	Not available.
<b>Flammability (solid, gas)</b>	Not applicable.

### Upper/lower flammability or explosive limits

<b>Flammability limit - lower (%)</b>	Not available.
<b>Flammability limit - upper (%)</b>	Not available.
<b>Explosive limit - lower (%)</b>	Not available.
<b>Explosive limit - upper (%)</b>	Not available.
<b>Vapor pressure</b>	Not available.
<b>Vapor density</b>	Not available.
<b>Relative density</b>	1 - 1.2
<b>Solubility(ies)</b>	
<b>Solubility (water)</b>	Miscible
<b>Partition coefficient (n-octanol/water)</b>	Not available.
<b>Auto-ignition temperature</b>	Not available.
<b>Decomposition temperature</b>	Not available.
<b>Viscosity</b>	Not available.

## 10. Stability and reactivity

<b>Reactivity</b>	The product is stable and non-reactive under normal conditions of use, storage and transport.
<b>Chemical stability</b>	A component of this product can oxidize in air: iron (II) to iron (III).
<b>Possibility of hazardous reactions</b>	No dangerous reaction known under conditions of normal use.
<b>Conditions to avoid</b>	Contact with incompatible materials. Keep from freezing.
<b>Incompatible materials</b>	Oxidizing agents.
<b>Hazardous decomposition products</b>	Thermal decomposition can produce oxides of carbon and iron.

## 11. Toxicological information

### Information on likely routes of exposure

Inhalation	Prolonged inhalation may be harmful.
Skin contact	Prolonged or repeated skin contact may result in minor irritation.
Eye contact	Direct contact with eyes may cause temporary irritation.
Ingestion	Expected to be a low ingestion hazard.

**Symptoms related to the physical, chemical and toxicological characteristics** Direct contact with eyes may cause temporary irritation.

### Information on toxicological effects

Acute toxicity	Not expected to be acutely toxic.
Skin corrosion/irritation	Prolonged skin contact may cause temporary irritation.
Serious eye damage/eye irritation	Direct contact with eyes may cause temporary irritation.
Respiratory or skin sensitization	
Respiratory sensitization	Not a respiratory sensitizer.
Skin sensitization	This product is not expected to cause skin sensitization.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

#### OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
Specific target organ toxicity - single exposure	Not classified.
Specific target organ toxicity - repeated exposure	Not classified.
Aspiration hazard	Not an aspiration hazard.
Chronic effects	Prolonged inhalation may be harmful.
Further information	Ferrous Gluconate Dihydrate (6047-12-7) is Generally Recognized as Safe (GRAS) (21 CFR §184.1308).

## 12. Ecological information

Ecotoxicity	The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.
Persistence and degradability	No data is available on the degradability of this product.
Bioaccumulative potential	No data available.
Mobility in soil	Expected to be highly mobile in soil.
Other adverse effects	None known.

## 13. Disposal considerations

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

## 14. Transport information

### DOT

Not regulated as dangerous goods.

### IATA

Not regulated as dangerous goods.

### IMDG

Not regulated as dangerous goods.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not available.

## 15. Regulatory information

### US federal regulations

#### TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

#### OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

#### CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

### Superfund Amendments and Reauthorization Act of 1986 (SARA)

#### Hazard categories

Immediate Hazard - No

Delayed Hazard - No

Fire Hazard - No

Pressure Hazard - No

Reactivity Hazard - No

#### SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical No

#### SARA 313 (TRI reporting)

Not regulated.

### Other federal regulations

#### Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

#### Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.

### US state regulations

#### US. Massachusetts RTK - Substance List

Not regulated.

#### US. New Jersey Worker and Community Right-to-Know Act

Not listed.

#### US. Pennsylvania Worker and Community Right-to-Know Law

Not listed.

#### US. Rhode Island RTK

Not regulated.

#### US. California Proposition 65

Not Listed.

### International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No

Country(s) or region	Inventory name	On inventory (yes/no)*
China	Inventory of Existing Chemical Substances in China (IECSC)	No
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

\*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).

A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

## 16. Other information, including date of preparation or last revision

**Issue date** 26-February-2015

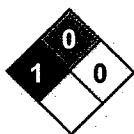
**Revision date** -

**Version #** 01

**Further information** HMIS® is a registered trade and service mark of the American Coatings Association (ACA).

**HMIS® ratings**  
Health: 1  
Flammability: 0  
Physical hazard: 0

**NFPA ratings**



**Disclaimer**

Regenesys cannot anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user's responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use. The information in the sheet was written based on the best knowledge and experience currently available.

## BDI PLUS® Technical Description

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

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



Species of *Dehalococcoides* sp. (DHC)

For a list of treatable contaminants with the use of BDI PLUS, view the [Range of Treatable Contaminants Guide](#)

### Chemical Composition

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

### Properties

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

### Storage and Handling Guidelines

#### Storage

Store in original tightly closed container

Store away from incompatible materials

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

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

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

#### Handling

Avoid prolonged exposure

Observe good industrial hygiene practices

Wear appropriate personal protective equipment

# BDI PLUS® Technical Description

## Applications

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

Application instructions for this product are contained here [BDI PLUS Application Instructions](#).

## Health and Safety

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



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



## 1. Identification

**Product identifier** Bio-Dechlor INOCULUM® Plus  
**Other means of identification** None.  
**Recommended use** Soil and Groundwater Remediation.  
**Recommended restrictions** None known.  
**Manufacturer/Importer/Supplier/Distributor information**  
     **Company Name** RegenesiS  
     **Address** 1011 Calle Sombra  
     San Clemente, CA 92673  
     **Telephone** 949-366-8000  
     **E-mail** CustomerService@regenesiS.com  
     **Emergency phone number** CHEMTREC® at 1-800-424-9300 (International)

## 2. Hazard(s) identification

**Physical hazards** Not classified.  
**Health hazards** Not classified.  
**OSHA defined hazards** Not classified.  
**Label elements**  
     **Hazard symbol** None.  
     **Signal word** None.  
     **Hazard statement** The mixture does not meet the criteria for classification.  
     **Precautionary statement**  
         **Prevention** Observe good industrial hygiene practices.  
         **Response** Wash hands after handling.  
         **Storage** Store away from incompatible materials.  
         **Disposal** Dispose of waste and residues in accordance with local authority requirements.  
**Hazard(s) not otherwise classified (HNOC)** None known.

## 3. Composition/information on ingredients

### Mixtures

The manufacturer lists no ingredients as hazardous according to OSHA 29 CFR 1910.1200.

Chemical name	CAS number	%
Soil Bacteria	Not Applicable	100

**Composition comments** All concentrations are in percent by weight unless otherwise indicated.

## 4. First-aid measures

**Inhalation** Move to fresh air. Call a physician if symptoms develop or persist.  
**Skin contact** Wash off with soap and water. Get medical attention if irritation develops and persists.  
**Eye contact** Rinse with water. Get medical attention if irritation develops and persists.  
**Ingestion** Rinse mouth. Get medical attention if symptoms occur.  
**Most important symptoms/effects, acute and delayed** Direct contact with eyes may cause temporary irritation.  
**Indication of immediate medical attention and special treatment needed** Treat symptomatically.

## General information

If you feel unwell, seek medical advice (show the label where possible). Show this safety data sheet to the doctor in attendance.

## 5. Fire-fighting measures

### Suitable extinguishing media

Carbon dioxide (CO<sub>2</sub>). Water. Foam.

### Unsuitable extinguishing media

None known.

### Specific hazards arising from the chemical

During fire, gases hazardous to health may be formed.

### Special protective equipment and precautions for firefighters

Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

### Fire fighting equipment/instructions

Move containers from fire area if you can do so without risk.

### Specific methods

Use standard firefighting procedures and consider the hazards of other involved materials. Use water spray to keep fire-exposed containers cool.

### General fire hazards

No unusual fire or explosion hazards noted. The product itself does not burn.

## 6. Accidental release measures

### Personal precautions, protective equipment and emergency procedures

Keep unnecessary personnel away. Avoid contact with spilled material. For personal protection, see section 8 of the SDS.

### Methods and materials for containment and cleaning up

This product is miscible in water. Disinfect the spill area with 5% bleach solution after clean-up.

Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Cover with plastic sheet to prevent spreading. Absorb in vermiculite, dry sand or earth and place into containers. Following product recovery, flush area with water.

Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination.

Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS.

### Environmental precautions

Avoid discharge into drains, water courses or onto the ground.

## 7. Handling and storage

### Precautions for safe handling

Avoid prolonged exposure. Observe good industrial hygiene practices. Wear appropriate personal protective equipment (See Section 8).

### Conditions for safe storage, including any incompatibilities

Store in original tightly closed container. Recommended storage containers: plastic lined steel, plastic, glass, aluminum, stainless steel, or reinforced fiberglass. Store away from incompatible materials (see Section 10 of the SDS). Store in a cool, dry area at 4 - 5°C (39 - 41°F).

## 8. Exposure controls/personal protection

### Occupational exposure limits

No exposure limits noted for ingredient(s).

### Biological limit values

No biological exposure limits noted for the ingredient(s).

### Appropriate engineering controls

General ventilation normally adequate. Provide eyewash station.

### Individual protection measures, such as personal protective equipment

#### Eye/face protection

Tightly fitting safety goggles.

#### Skin protection

##### Hand protection

The following glove materials are recommended: vinyl or rubber.

##### Other

Wear suitable protective clothing.

#### Respiratory protection

Not normally needed. In case of insufficient ventilation, wear suitable respiratory equipment. If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn.

#### Thermal hazards

Wear appropriate thermal protective clothing, when necessary.

### General hygiene considerations

Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

## 9. Physical and chemical properties

### Appearance

Physical state	Liquid.
Form	Liquid.
Color	Murky yellow.
Odor	Musty.
Odor threshold	Not available.
pH	Not available.
Melting point/freezing point	Not available.
Initial boiling point and boiling range	212 °F (100 °C)
Flash point	Not flammable.
Evaporation rate	Not available.
Flammability (solid, gas)	Not applicable.
<b>Upper/lower flammability or explosive limits</b>	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	Not available.
Vapor density	Not available.
Relative density	0.9 - 1.1
Solubility(ies)	
Solubility (water)	Soluble.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.

## 10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Contact with incompatible materials. Keep from freezing.
Incompatible materials	Strong oxidizing agents. Bases. Acids.
Hazardous decomposition products	No hazardous decomposition products are known.

## 11. Toxicological information

### Information on likely routes of exposure

Inhalation	Prolonged inhalation may be harmful.
Skin contact	Prolonged or repeated skin contact may result in minor irritation.
Eye contact	Direct contact with eyes may cause temporary irritation.
Ingestion	Ingestion may cause irritation and stomach discomfort.
Symptoms related to the physical, chemical and toxicological characteristics	Direct contact with eyes may cause temporary irritation.

### Information on toxicological effects

<b>Acute toxicity</b>	Not expected to be acutely toxic.
<b>Skin corrosion/irritation</b>	Prolonged skin contact may cause temporary irritation.
<b>Serious eye damage/eye irritation</b>	Direct contact with eyes may cause temporary irritation.
<b>Respiratory or skin sensitization</b>	
<b>Respiratory sensitization</b>	Not a respiratory sensitizer.
<b>Skin sensitization</b>	This product is not expected to cause skin sensitization.
<b>Germ cell mutagenicity</b>	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
<b>Carcinogenicity</b>	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

**OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)**

Not listed.

<b>Reproductive toxicity</b>	This product is not expected to cause reproductive or developmental effects.
<b>Specific target organ toxicity - single exposure</b>	Not classified.
<b>Specific target organ toxicity - repeated exposure</b>	Not classified.
<b>Aspiration hazard</b>	Not an aspiration hazard.
<b>Chronic effects</b>	Prolonged inhalation may be harmful.
<b>Further information</b>	May be harmful by inhalation, ingestion, or skin absorption via bacterial action.

## 12. Ecological information

<b>Ecotoxicity</b>	The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.
<b>Persistence and degradability</b>	This material will degrade in the environment. Material is readily degradable and undergoes hydrolysis in several hours.
<b>Bioaccumulative potential</b>	No data available.
<b>Mobility in soil</b>	Expected to be highly mobile in soil.
<b>Other adverse effects</b>	None known.

## 13. Disposal considerations

<b>Disposal instructions</b>	Collect and reclaim or dispose in sealed containers at licensed waste disposal site.
<b>Local disposal regulations</b>	Dispose in accordance with all applicable regulations.
<b>Hazardous waste code</b>	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
<b>Waste from residues / unused products</b>	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
<b>Contaminated packaging</b>	Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

## 14. Transport information

<b>DOT</b>	Not regulated as dangerous goods.
<b>IATA</b>	Not regulated as dangerous goods.
<b>IMDG</b>	Not regulated as dangerous goods.
<b>Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code</b>	Not available.

## 15. Regulatory information

### US federal regulations

#### TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

#### OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

#### CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

### Superfund Amendments and Reauthorization Act of 1986 (SARA)

**Hazard categories**  
Immediate Hazard - No  
Delayed Hazard - No  
Fire Hazard - No  
Pressure Hazard - No  
Reactivity Hazard - No

#### SARA 302 Extremely hazardous substance

Not listed.

**SARA 311/312 Hazardous chemical**      No

**SARA 313 (TRI reporting)**  
Not regulated.

### Other federal regulations

#### Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

#### Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

**Safe Drinking Water Act (SDWA)**      Not regulated.

### US state regulations

#### US. Massachusetts RTK - Substance List

Not regulated.

#### US. New Jersey Worker and Community Right-to-Know Act

Not listed.

#### US. Pennsylvania Worker and Community Right-to-Know Law

Not listed.

#### US. Rhode Island RTK

Not regulated.

#### US. California Proposition 65

Not Listed.

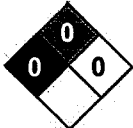
### International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	No
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	No
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	No
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No

<b>Country(s) or region</b>	<b>Inventory name</b>	<b>On inventory (yes/no)*</b>
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	No

\*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).  
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

<b>Issue date</b>	12-February-2015
<b>Revision date</b>	-
<b>Version #</b>	01
<b>Further information</b>	HMIS® is a registered trade and service mark of the American Coatings Association (ACA).
<b>HMIS® ratings</b>	Health: 0 Flammability: 0 Physical hazard: 0
<b>NFPA ratings</b>	
<b>Disclaimer</b>	Regenesis cannot anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user's responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use. The information in the sheet was written based on the best knowledge and experience currently available.