REMEDIAL DESIGN WORK PLAN
VOLUME I

Former TNT Red Star Express Site
97 Industrial Parkway
Town of Kirkwood, Broome County, New York
NYSDEC Site #704028

Prepared for:

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October 2007

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Certification

The undersigned has reviewed the preparation of this work plan. The work plan generally follows the requirements specified in guidance document Division of Environmental Remediation Guidance DER-10 and NYCRR Part 375.

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1.0 Introduction

This Remedial Design Work Plan and Remedial Action Work Plan are being submitted on behalf of USF Red Star, LLC in partial fulfillment of the agreement contained in the Order on Consent and Administrative Settlement (Index Number B7-0521-97-00), with the New York State Department of Environmental Conservation ("NYSDEC") for the Inactive Hazardous Waste Site known as the TNT Red Star Express, Inc. Site #704028. The site is located at 97 Industrial Parkway in the Town of Kirkwood, Broome County (see Figure 1).

The site property is an active trucking terminal and truck repair facility. The property is located in an industrial park, which is surrounded by other commercial and industrial properties and roadways. The site is adjacent to a stream which discharges to the Susquehanna River located approximately 0.4 miles south of the site. The nearest residential property is located approximately 0.15-miles east of the site and separated from the site by the previously mentioned stream and several roads (see Figure 2).

The site was the scene of a 1993 spill of Tetrachloroethene ("PCE"), which migrated into the soil and eventually reached the water table. The contaminated soil was removed shortly after the spill and the groundwater contamination has been the subject of a 2000 Remedial Investigation ("RI") and Feasibility Study ("FS").

2.0 Investigations to Date

2.1 Summary of Remedial Investigation/Feasibility Study

On January 7, 1991, TNT-Red Star Express reported a spill of Tetrachloroethane ("PCE") that occurred when a forklift punctured several drums of PCE releasing approximately 100 gallons into the trailer and eventually onto the asphalt pavement. TNT-Red Star retained an environmental contractor who removed approximately 120 tons of contaminated asphalt and soil under the direction of the NYSDEC. Some PCE remained in the soil and further remediation was completed using soil vapor extraction techniques. The installation of monitoring wells for the spill response and for the RI indicated that PCE had impacted the uppermost groundwater zone. During the RI investigation a second source of contamination near the property's garage building was found. The source of the contamination was a former oil tank and an oil/water separator, which released aromatic hydrocarbons, PCE, and 1,1,1-Trichloroethane into the groundwater.

Beneath the site, the geology is composed of upper layer of alluvium consisting of silty sand. Groundwater in this layer is approximately eight feet below the ground surface. Underlying the alluvium is a glacial till or silt and clay layer. The glacial till has qualities of an aquitard which caps a lower groundwater zone consisting of intervals of clay, silt, sand and gravel. Only one monitoring well was extended into this lower groundwater zone. The groundwater surface in the lower groundwater can rise above the potentiometric surface of the upper-most groundwater zone.

The apparent low permeability of the glacial till has limited the migration of contaminants. However, contaminant migration from the spill areas has resulted in contamination of the adjacent industrial property.

During the RI, a second contaminant plume was discovered and found to originate from the area of the waste oil tank and oil/water separator located next to the maintenance garage building. A floor drain in the maintenance garage discharged into the oil/water separator. From the oil/water separator, effluent discharged into the soil adjacent to the separator and into a drainage swale located along the site's property line approximately 60-feet south of the separator. The soil in the vicinity of the oil/water separator and in the drainage swale was found to be contaminated, but at concentrations generally below clean-up requirements.

This uppermost groundwater contaminant plume contains 1,1,1-Trichloroethane ("TCA") and PCE, and these contaminants have migrated off the site to the south. Although the off-site contamination contravenes NYSDEC's Part 702, Class GA Ambient Groundwater Quality Standards and Guidance Levels, these concentrations are generally less than 50 parts per billion ("ppb") for the individual contaminants.

Following the completion of the RI, a FS was prepared to identify remedial actions for the site. Since the need for remediation at this site was restricted to volatile organic compounds ("VOCs") in groundwater, the objective was to remediate the groundwater to Part 703, Class GA groundwater quality criteria levels which will be protective of both human health and the environment.

After completing the public comment period, the Record of Decision ("ROD") for the site was written in February of 2001 to implement a remedial alternative using the following techniques:

- The installation of a groundwater extraction and treatment system in the source areas of the contamination. Groundwater will be treated in a bioreactor and a portion of the treated groundwater will be injected back into the groundwater through injection wells.
- A treatability study to design the bio-remediation system.
- The installation of injection wells around the source areas to introduce nutrients and/or microbes into the groundwater to enhance the biodegradation of the contaminants.
- Implementation of a long term monitoring program to evaluate the effectiveness of the system will be instituted as a component of the Operation and Maintenance Plan for the site. Monitoring will be required to confirm that natural attenuation is occurring at the leading edge of the plume.
- To prevent future exposures to contaminated groundwater, the NYSDEC will seek to have restrictions placed upon the use of the groundwater at the site. This will help to prevent future exposures to any residual groundwater contamination.

In June of 2007, NYSDEC amended the ROD to focus on using insitu, intrinsic bioremediation exclusively to remediate the VOCs present in the groundwater. This approach is not fundamentally different to the original ROD; however, it eliminates the use of pumping and re-injection wells to remediate the groundwater.

2.2 Bioremediation Bench Study

In 2006 a bioremediation bench study was completed to assess the feasibility of treating the groundwater contamination using a proprietary hydrogen-releasing compound ("HRC") manufactured by Regenesis Corporation. A sample of the soil and groundwater was collected from the area within the original spill for testing.

The testing indicated the native bacteria responded well to HRC and were successful in reducing the concentration of PCE from approximately 15 milligrams per liter ("mg/L") to approximately 1.15 mg/L (average). The removal of PCE was found to be rapid and complete, not allowing daughter products (i.e., 1,2-Dichloroethane and Vinyl Chloride) to form to a concentration of more than 50 micrograms per liter [("µg/L") the detection limit of the analysis]. Normal populations of sulfate reducing bacteria ("SRB") in the test tubes were also supportive that anaerobic conditions were produced, which are needed to dechlorinate some of the more recalcitrant chlorinated daughter products such as 1,2-Dichloroethane.

Although this study showed that the native bacteria could dechlorinate PCE, the "test tube environment" is different than that which can be expected to be found at the Kirkwood site. To determine how successful HRC or similar products will be on actual conditions, a pilot study was completed in 2006.

2.3 HRC Pilot Testing

In September 2006, a pilot test was started to determine the feasibility of using HRC to stimulate intrinsic bioremediation of the contaminants in the groundwater. The project was scheduled to be completed within 90 days and included injecting HRC in the two source areas using an approximate 5 to 7-foot on-center grid over the treatment areas. In each borehole a measured amount of HRC was pumped. In the PCE source area, four pounds of HRC per linear foot of saturated zone was pumped into the saturated zone at each grid center location. In the TCA source area, five pounds of HRC was pumped into the saturated zone at each grid center location. Figure 3 shows the location of the injection grids.

VOC concentrations present in the groundwater from monitoring well MW-3 were encouraging, but also yielded some surprises during the study. The concentration of PCE decreased from 49 µg/L (2005) to 14 µg/L (December 28, 2006) at the end of the study, but during the study the concentration of PCE remain at below detection levels. The samples also found breakdown products of PCE including Trichloroethylene ("TCE") at a concentration of 4 µg/L (December 28, 2006) and cis 1,2-Dichloroethene ("cis") at a concentration of 67 µg/L (December 28, 2006). These compounds were expected, but the results were surprising, since only minor amounts (i.e., 0.71 µg/L) of cis were found during the study (October 2006 through November 2006).

At monitoring well PW-4, the targeted VOCs responded with a significant decrease in overall concentration: TCA dropped to 83 µg/L from 320 µg/L in 2005; 1,1-DCE increased slightly to 6.6 µg/L from below detection limits in 2005; and 1,1-Dichloroethane ("1,1-DCA") decreased slightly to 51 µg/L from 55 µg/L. Chloroethane, which is a potential breakdown product of 1,1-DCA instead of Vinyl Chloride, was also present at 5.3 µg/L. By the end of the study, the TCA concentration dropped to 38 µg/L, the concentration of 1,1-DCE dropped to 1 µg/L, and the concentration of 1,1-DCA dropped to 16 µg/L. Chloroethane was no longer present.

Based on these encouraging results, the groundwater sampling was extended for two quarters to further study the impact of HRC on the groundwater contamination. The results of the follow-up sampling found that the groundwater in the MW-3 area had been achieving groundwater quality requirements since December 2006. In the monitoring well PW-4, the TCA source area, the groundwater quality has not improved since the end of the Pilot Study. The bioremediation process is ongoing at this location, but appears to have stalled into producing Methane. Downgradient of monitoring well PW-4, at monitoring well GP-2, the concentration of TCA has rebounded to an even higher concentration than what was observed prior to the study. The groundwater's bioremediation conditions at GP-2 have also stalled on the production of Methane.

3.0 Identification of Applicable NYSDEC Standards, Criteria, and Guidelines and Permit Requirements

Groundwater quality will be measured to the standards and guidance values as they are authorized in Title 6 of New York State's Codes Rules and Regulations Part 702 and NYSDEC Division of Water Technical and Operational Guidance Series ("TOGS") No. 1.1.1-Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. Table 1 shows the groundwater quality criteria for each of the groundwater contaminants identified during the project.

There are no known permits required for this work since the project will not involve construction or discharges of wastewater to the environment.

4.0 Description of Design

4.1 Basis for Design

The project design is based on the ability of the site's indigenous anaerobic microorganisms to degrade the contaminants. Prior to completing the pilot study, there was little evidence of intrinsic bioremediation occurring in the groundwater; however, other sites with similar contaminants and conditions have had success starting the intrinsic bioremediation process by adding amendments to change the site conditions. In general, these amendments caused the groundwater to become oxygen depleted and provided a source of electrons, which the microorganisms could use to dechlorinate the contaminants. At this site, Leader selected HRC, a lactic acid substrate, which is fermented and releases a source of electrons (hydrogen atoms). A bench study and pilot test were completed to assess whether the intrinsic bioremediation would be feasible.

4.1.1 Review of Bioremediation Process

As stated above, initially there was little evidence that intrinsic bioremediation was occurring at the site, but sites with similar contaminants and conditions had success in initiating intrinsic bioremediation after injecting proprietary amendments. Leader selected a substrate of lactic acid using Regenesis's HRC. Microorganisms can ferment the lactic acid, which causes two reactions:

1) The aerobic microorganisms utilize the available oxygen and create an anaerobic condition in the groundwater; and

2) The fermentation process releases hydrogen atoms and organic acids providing an additional usable source of hydrogen atoms.

Once the groundwater becomes oxygen depleted, anaerobic microorganisms can thrive and use the available hydrogen (or the organic acids) in a chemical reaction to exchange positively charged hydrogen (electrons) for negatively charged ions. The microorganism's objective is not the exchange of ions, but the energy that is released or made available. Since chlorine ions are readily available where chlorinated aliphatic hydrocarbons ("CAH") are present, the microorganisms also use the chlorine ion. There is also competition between which molecules and atoms are used and this can affect the efficiency of the bioremediation process.

The anaerobic conditions in the groundwater facilitate the chemical reactions and enhance the growth of dechlorinating microorganisms ("dechlorinators"). In addition to dechlorinators, there are also methane-producing microorganisms ("methanogens"), which compete with the dechlorinators to use the available hydrogen.

Each group of microorganisms trend to favor specific anaerobic conditions; for example, the methanogens tend to thrive at lower anaerobic conditions or energy levels as measured by oxidation-reduction potential ("ORP"). The ORP energy, measured in volts and favored by the methanogens, is termed "methanogenesis" or "methane reducing." Other microorganisms favor different conditions such as when sulfate is reduced, the dominant microorganisms at this ORP level are known as "sulfate reducing" bacteria or SRBs. As CAHs like TCA and PCE are dechlorinated into TCE, DCA and cis 1,2-DCE, it becomes more difficult to remove chlorine atoms and the ORP value of the groundwater becomes more important. Removing the first chlorine atoms can occur at a relatively wide range of ORP values, but as the CAH molecule gets simpler (fewer chlorine atoms), the ideal ORP range becomes narrower and more lower (more negative). As a result, cis 1,2-DCE and Vinyl Chloride can accumulate in the groundwater. At some sites too much hydrogen is available and the methanogens are favored. These microorganisms use the available hydrogen to form Methane. The methanogens thrive at the higher level of hydrogen and their population numbers dominate the dechlorinators. As a result, the concentration of the simpler CAHs, like cis 1,2-DCE, does not decrease and can sometimes increase. In this situation, the dechlorinators are scavengers and must wait until the level of hydrogen decreases when they can compete with the methanogens.

4.1.2 Results of Pilot Testing

During the last week of September 2006, Leader started a pilot test to determine if HRC would be successful to initiate an intrinsic bioremediation process of the groundwater in both source areas of the site. The results of the Pilot Test were discussed in Section 2.3 "HRC Pilot Testing" and the results are also shown in Table 1. In general, the Pilot Test was successful and showed that a lactic acid substrate like HRC can create the conditions where intrinsic bioremediation of CAHs can occur.

4.1.3 Measurement of Results

To determine progress of the bioremediation process, groundwater samples will be collected on a quarterly basis for water level, groundwater quality parameters (ORP, dissolved oxygen, pH, temperature, conductivity), USEPA Target Compound List ("TCL") volatile organic compounds, Methane, Ethane, Ethene and inorganic carbon (alkalinity). Analytical methods, sample numbers, and quality assurance sample numbers are discussed in the project's Quality Assurance Project Plan.

The monitoring wells proposed for quarterly sampling include all of the site's monitoring wells with the exception of monitoring wells MW-3D and MW-1. The monitoring wells are shown on Figure 4.

4.1.4 Goals

The goal of this project is to remediate the site so the groundwater and soil conditions are protective of human and environmental health. In order to meet this goal several secondary objectives must be satisfied:

- To mitigate the source of contaminants causing groundwater contamination;
- To mitigate the migration of contaminated groundwater from the site to a level which does not present an unacceptable risk to humans and the environment for the current and future use of the site area.

Ideally, the remediation of the groundwater should continue until the contamination reaches a concentration(s) which is below the NYSDEC groundwater quality standards found in TOGS 1.1.1 “Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations.” But reaching these concentrations may be impractical, and a less conservative, but yet protective, concentration should be adopted. When groundwater concentrations reach an asymptotic level (zero slope) for three consecutive quarters all parties should agree to consider the most practical alternative for moving forward.

4.2 Treatment

4.2.1 Areas of Concern

In the past the site has been thought of in terms of its two source areas. Currently, the PCE source area appears to have been remediated, but in the 1,1, 1-TCA-source area and off-site, contaminants still remain. To address the current conditions, treatment is planned for the 1,1, 1-TCA-source area and the off-site areas. The treatment areas are identified in the following sections as Treatment Area A (the 1,1,1-TCA source area) and Treatment Area B (the downgradient areas of the combined plumes) see Figure 6.

The last groundwater sampling of Treatment Area A showed the breakdown of 1,1,1-TCA and the daughter products was stalled by microorganisms which are favoring the production of Methane. It is believed that this condition will relieve itself over time. This project will sample the groundwater in selected monitoring wells prior to treatment to determine when the treatment of Area A should be completed. At this time treatment of both areas A and B is planned. NYSDEC will be included in all discussions of the treatment schedule.

4.2.2 Treatment

The pilot study used HRC, but for this remediation, HRC Advanced (“HRC-A”) will be used. HRC-A is similar to HRC using lactic acid as a substrate for fermentation, but it is different in several important ways: 1) when HRC-A is mixed with water it forms a low viscosity micro-emulsion which can typically be distributed into a wider area than the original HRC formulation; 2) HRC-A's formulation has more available lactic acid, which is available in the groundwater for a longer period of time; and 3) HRC-A is less susceptible to cold temperatures when injecting. Literature for HRC-A, including manufacturer's application rates, material safety data sheets, and installation instructions are available in Appendix A.

4.2.2.1 Treatment Area A

Treatment Area A is centered on the former oil/water separator in the vicinity of monitoring well PW-4. HRC-A will be injected into the subsurface once the concentration of Methane has subsided and breakdown of 1,1,1-TCA is confirmed.

Injections will be made in Treatment Area A using single line of injection points with a spacing of 10-feet based on the injection results from the Pilot Test. The length of the treatment area is approximately 40-feet. Monitoring of the injections will be done to ensure that the correct amount of HRC is applied and there is hydraulic communication between injection points. Four injection points will be used to inject 90 pounds of HRC-A into each borehole at an application rate of 103-pounds/12.5 gallon of emulsion per foot of injection. To ensure the saturated and the capillary zone are treated, the injection interval will start 1 foot above the shallowest water level in the treatment area. Table 2 lists water levels for monitoring wells in the injection areas.

The amount of HRC-A to be used is provided in Appendix A and the injection point spacing will be based on recommendations from Regenesis. Regenesis' staff and Leader used Regenesis' proprietary treatment model, the bench study results, and the pilot test results to determine the amount of HRC-A to be used.

4.2.2.2 Treatment Area B

Treatment Area B is located along the southernmost property line between monitoring well GP-2 and in the vicinity of MW-4 (see Figure 6). This treatment area is intended to address the plume as it exits at the site. The remediation of contaminants at the site property line will create conditions allowing natural attenuation to lower contaminant concentrations in off-site areas. Conducting monitoring of the off-site groundwater quality during remediation will assess whether natural attenuation is occurring.

A barrier of HRC injections will be made immediately upgradient of the property line to treat the groundwater flowing out of Treatment Area A and any contaminants migrating in the transition zone between the PCE source area and monitoring well MW-4. The injections will be done at regular intervals at approximately 10 feet apart. The length of the treatment area will be approximately 100 feet. Approximately 112 pounds of HRC-A will be injected into each borehole at an application rate of approximately 127 pounds/15.5 gallons of emulsion (HRC-A and water) for each foot of injection.

Monitoring of the injections will be done to ensure that a sufficient amount of HRC-A is applied and there is communication between injection points. To ensure the saturated and the capillary zone are treated, the injection interval will start 1 foot above the shallowest water level in the treatment area. Table 2 lists water levels for monitoring wells in the injection areas.

4.2.3 Injection Equipment

The injection of HRC-A will require five components: 1) Direct push injection tools; 2) The injection pump; 3) Mixing pump and feed tank; 4) Hot water system; and 5) Potable water source. Injecting the HRC-A will require the use of direct push injecting tools mounted on a light duty truck and/ or an all-terrain vehicle to maneuver between locations on the uneven terrain along the property line. The direct push equipment will be used because it can drive or push the ejector tip to the correct injection interval while the borehole seals itself around the direct pipe. This allows the HRC-A to be injected under pressure, which can fracture stiff cohesive materials and achieve a better dispersal of the HRC-A.

The injection pump is required to pump the thick consistency of the HRC-A and provide adequate the pressure for maximum distribution. Working in tandem with the injection pump will be a high speed mixing pump. Rotary pump blades, like those found in centrifugal pumps, are ideal for mixing HRC-A. The pump's fluid shearing motion mixes the HRC-A and water (10:1 mix ratio) into a micro-emulsion. The high-speed pump and mixing tank does not allow the HRC-A to settle while the injection pump is fed. The mixing tank is calibrated so the volume of HRC-A can be monitored while injecting to ensure the proper amount of product is delivered. A flow meter or flow totalizer can also be used to monitor the application rate.

A hot water system will be used to produce hot water for mixing and to keep the HRC-A warm (minimum 60-degrees Fahrenheit required) prior to use. Hot water, if needed, will be produced by using a kerosene fired hot water generator or steam generator. Hot water for mixing and a warming bath should be approximately 160-degrees Fahrenheit.

Potable water will be used for cleaning, heating, and mixing purposes. The water source will come from either an on-site faucet or a municipal hydrant.

4.2.4 Injection Process

The field geologist will locate each injection location prior to the start of fieldwork and mark each point with white marking paint or stakes. The field geologist will use a 100-foot measuring tape and existing structures to locate injection points in the field. The locations will aid utility locating services, but also expedite the injection contractor's fieldwork.

The injection project will involve the use of hydraulic equipment, motor vehicles, and chemical products (decontamination products and HRC-A), and involve the potential for handling contaminated groundwater; therefore, all project activities will follow a project Health and Safety Plan (see Appendix B).

The injection process involves pushing the injection tool to the bottom of the injection interval, then injecting the product into the zone while removing the tooling. For each injection point the field geologist will have a table of injection point locations and the water level range, bottom of the interval, the top of the interval, and the amount of HRC-A to be injected. During the injection process the field geologist will monitor the amount of HRC-A being injected by monitoring the mixing tank or the injection systems flow meter.

Prior to beginning fieldwork, the field geologist will measure the volume of the mixing tank and calibrate either the tank with volume markings or by making a volume gauge or ruler that can be used to measure the volume of the tank. Similarly the flow meter will be calibrated by pumping mixed product into a five-gallon pail and comparing the results to the meter.

In the event that the HRC-A is not moving away from the injection point because of less permeable soil, Leader will reduce the injection point spacing. If reducing the injection point spacing does not result in a change in fluid level of the adjacent borehole, potable water may be used to push the HRC-A into the treatment zone. In the event the HRC dispersal cannot be verified, the contractor will collect soil samples from an adjacent location to determine if HRC-A is present.

During the project any wastewater collected during the project will be drummed for disposal. Empty containers and protective equipment will be collected and containerized for disposal by a local licensed solid waste disposal firm.

At the end of the injection project, the contractor will backfill each of the injection points using clean sand, followed by six inches of Bentonite granules, and a cap of four inches of cold patch asphalt, cement or topsoil depending on the existing surface conditions.

At the end of the project the field geologist will have a table of injection points and the volume/weight of HRC injected, the injection interval, and if water was used to push the HRC product.

4.3 Monitoring

4.3.1 Pre-Construction Monitoring

As a part of the mobilization phase of the project, and at least six weeks before the injection of HRC-A, monitoring wells MW-3, PW-4, and GP-2 will be sampled for field parameters (pH, temperature, conductivity, dissolved oxygen, and ORP), USEPA’s TCL volatile organic compounds, Methane, Ethene, Ethane and inorganic carbon (alkalinity). This approach will assess whether the degradation of 1,1,1-TCA in the 1,1,1-TCA-source area has been restarted, and if PCE levels have rebounded. The results of this analysis will determine if Treatment Area A is treated at this time or if the area is allowed more time to further reduce the amount of Methane present. The reduction of Methane and increase of Ethene and Ethane should indicate the restart the 1,1,1-TCA breakdown process.

Sampling will be done in accordance with the project's Quality Assurance Project Plan ("QAPP") and Site Health and Safety Plan. Sampling will use a low flow pump and flow through cell to measure field parameters to identify when groundwater quality (in terms of the field parameters) has equilibrated. The consistency of field parameter values identifies when sampling can occur. Wastewater will be collected for disposal after completion of HRC-A treatment.

During this pre-construction sampling, HRC-A injection points will be located for utility clearances.

4.3.2 Post Construction Monitoring

One month after the injection of HRC, all of the monitoring wells will be sampled for field parameters to determine if the HRC has reacted with the groundwater and if the impact is noticeable in the monitoring wells immediately downgradient of the treatment areas. Following the injection of the HRC all monitoring wells will be sampled quarterly for USEPA TCL volatile organic compounds, Methane, Ethane, Ethene, and alkalinity. Sampling will be done in accordance with the Operation, Maintenance, and Monitoring Plan, the project QAPP and the project Health and Safety Plan.

5.0 Quality Assurance Project Plan

The purpose of the QAPP is to establish procedures using appropriate test methods (or standards) and detection limits (or units of measure) to meet the project's objectives.

5.1 Project Objectives and Data Quality Objectives

The purpose of completing this project is to remediate the site's contaminated groundwater using HRC-A to improve site conditions and stimulate indigenous microorganisms to degrade PCE, 1,1,1-TCA, and their breakdown products. The goal is to have the groundwater quality improve to meet NYSDEC's TOGS groundwater quality criteria.

Since this project involves both the injection of HRC-A and sampling the groundwater there will be different objectives depending on the project activity. The different project activities are described in the following two sections: 5.1.1 Construction Phase and 5.1.2 Groundwater Sampling.

5.1.1 Construction Phase

During the construction phase of the project there are three activities that are critical to the eventual performance of the remediation: location of the injection points; measurement of HRC-A; and measurement of the dispersal of HRC-A.

5.1.1.1 Injection Point Locations

Injection point locations will be determined by the project design. Injection points in the field will be identified using a 100-foot measurement tape graduated in tenths of feet. Monitoring wells and on and off-site structures have been located on the New York State geodetic survey system by a New York State licensed Surveyor and drawn on a scale drawing of the site. The previously surveyed locations of the monitoring wells and structures, and the scale drawing will be used to locate injection points in the field to the nearest foot.

5.1.1.2 Measurement of HRC-A

HRC-A is shipped to the site in graduated 3-gallon pails, which hold 30 pounds of product. Regenesis has specified the amount of HRC-A, in pounds, per foot of contaminated zone based on the sample results from the Pilot Study, Regenesis' proprietary software and expertise. To ensure proper application rates, the mixing tank, flow meter and direct push rods will be calibrated.

Since it is easier to measure the volume of HRC-A in gallons than pounds while completing the field activities, the mixing tank/flow meter will be calibrated in gallons.

This will be done using a known volume container and filling the tank. For each gallon of water used in calibrating the tank, the tank side will be marked. In addition, a gauge will be made and calibrated in gallons so it too can be used to monitor the HRC-A injection. Filling a known volume container and comparing the volume with the flow meter will calibrate the flow meter.

It will also be important to calibrate the drive rods used by the direct push equipment. The rods will be measured against a steel measuring tape. Since each injection point may have a different total depth, the rods will be calibrated prior to use, and then again once the injection point is pushed to its final depth. This approach will enable the operator to know when and where the HRC-A should be injected. Calibration of the rod being extracted will have two reference points: 1) The total depth of the injection point will be placed on the rod; and, 2) The second reference point will be on the fixed point on the equipment. As a depth reference point passes the fixed reference point, the operator will know that HRC-A must be injected. Multiple fixed reference points may be used to eliminate repetitive measuring. As needed, the operator may need to add or repair reference points on the drive rods.

5.1.2 Groundwater Sampling

Groundwater quality will be evaluated by measuring the selected parameters including: field parameters, USEPA TCL volatile organic compounds, total inorganic carbon (alkalinity), Methane, Ethene, and Ethane.

5.1.2.1 Sample Collection and Analysis

Groundwater sampling and analysis will be used to evaluate remediation progress. Sampling will be completed one month following the injection of HRC-A and then quarterly. At the completion of the one-month milestone, only field parameters will be measured in the monitoring wells. Quarterly measurements will involve all monitoring wells and all parameters.

Specific sampling procedures are provided in Appendix C and include pumping each monitoring well using a low flow sample pump and using a flow through cell and portable field instrument to monitor field parameters. Monitoring field parameters will be done during well purging and measured until these parameters are stable (fluctuating less than 10-percent taken at 10 minute monitoring intervals).

The prepared sample containers will be placed on ice to maintain the temperature at approximately 40°F in a shippable container and then shipped for next day delivery to the laboratory.

Analysis of the samples will follow USEPA and ASTM procedures. TCL volatile organic compounds will be analyzed using USEPA Method 8260. Detection limits for TCL volatile organic compounds will be equivalent to NYSDEC's Analytical Services Protocol for the same analysis. Bioremediation specific parameters will be analyzed using the following methods and detection limits:

- Total Inorganic Carbon as Alkalinity, Method 301.1, detection limit of 1 milligram per liter;
- Ethane, AM20-GAX, detection limit per liter 0.025 micrograms per liter;
- Ethene, AM20-GAX, detection limit per liter 0.025 micrograms per liter; and
- Methane, AM20-GAX, detection limit per liter 0.1 micrograms per liter.

5.2 Reporting

The project reporting will involve the collection of field notes, progress reports, construction completion report and project completion report.

Field notes will be placed in a bound field book. Notes will be entered at least at 30-minute increments during the workday and will include activities, discussions, calculations, findings, and conclusions.

Each month a project report will be prepared discussing the past month's activities, the expected activities for the current month. When a monthly report includes sample results, a table will be prepared of the monitoring well results and a written summary of the findings.

At the completion of project, Leader will prepare a written construction report, which will summarize the injection activities, a summary description of problems and their resolution, and a final drawing depicting the location of the injection points. All injection results will be presented in tabular form to show the amount of HRC-A used.

At the completion of the project when TOGS groundwater quality criteria have been achieved or within two years of the remediation start, a report will be prepared to discuss the findings and progress to date.

5.3 Project Management

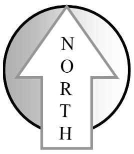
Peter von Schondorf, P.G., of Leader, will be the Project Manager for this project. Mr. von Schondorf will be responsible for field activities, coordination with YRC Worldwide Enterprise Services, and NYSDEC, and the preparation of the final reports.

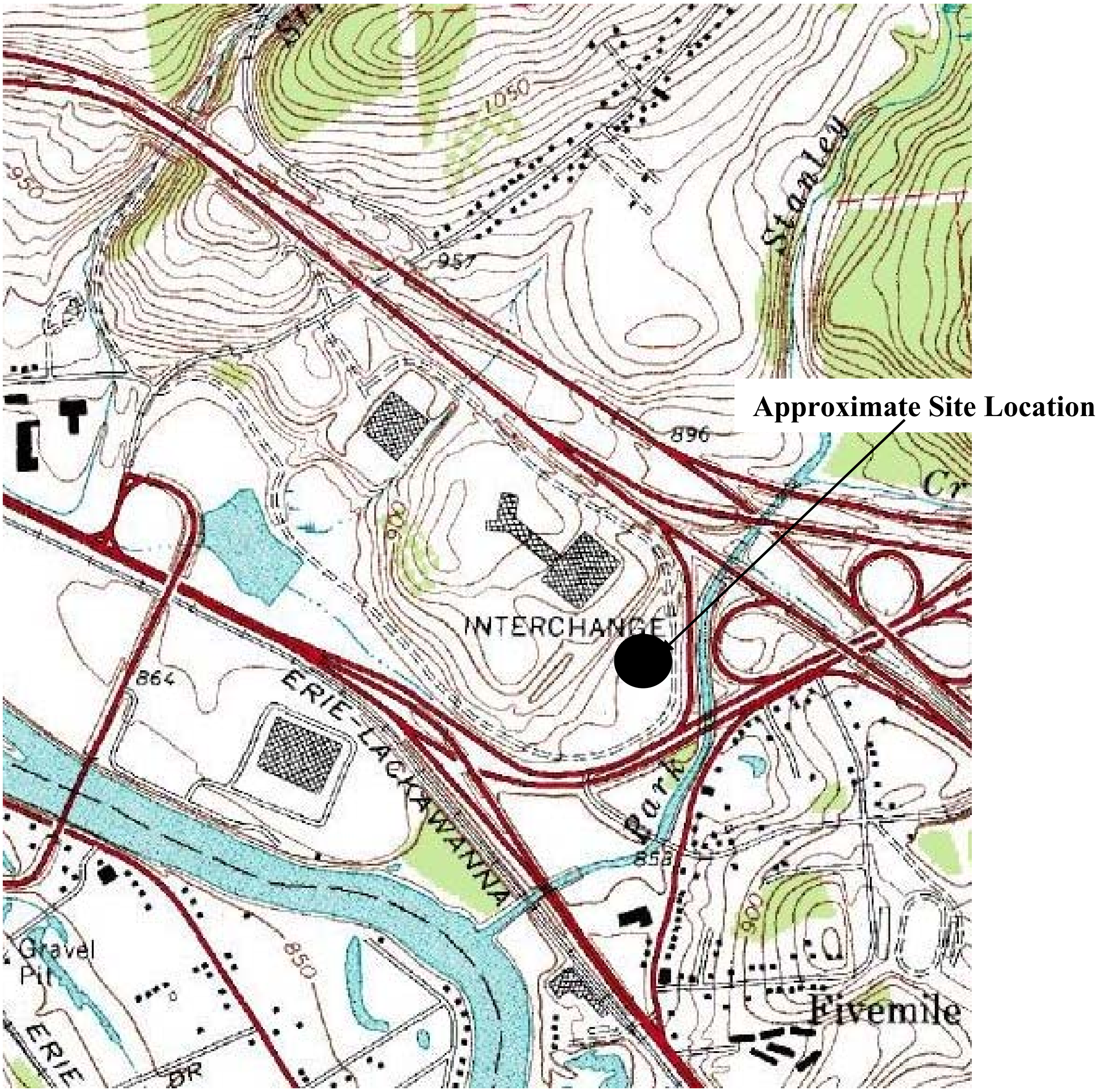
The NYSDEC Project Manager for this project is John Durnin. Mr. Durnin can be reached at 518-402-9768.

Leader’s sampling and report preparation efforts will be supported by the following individuals.

Leader’s office telephone number is 585-248-2413.

Project Engineer:	Jeffrey Wittlinger, PE Principal
Quality Assurance and Quality Control:	Michael Rumrill Principal
Health and Safety:	Mary Ellen Holvey Certified Industrial Hygienist





Title: Location Map
TNT-Red Star Express Site
Kirkwood, NY

Prepared For: USF Red Star LLC
Akron, Ohio

LEADER
Leader Professional Services, Inc
271 Marsh Road-Suite 2
Pittsford, New York 14534
(585) 248-2413
FAX (585) 248-2834

Project	250.014
Date	8/07
Scale	NTS
Drawn	PVS
Checked	MPR
File Name	Site Map
Figure	1

Title: Site Location Map
TNT-Red Star Express Site
Kirkwood, NY

Prepared For: USF Red Star LLC
Akron, Ohio

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Leader Professional Services, Inc
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Pittsford, New York 14534
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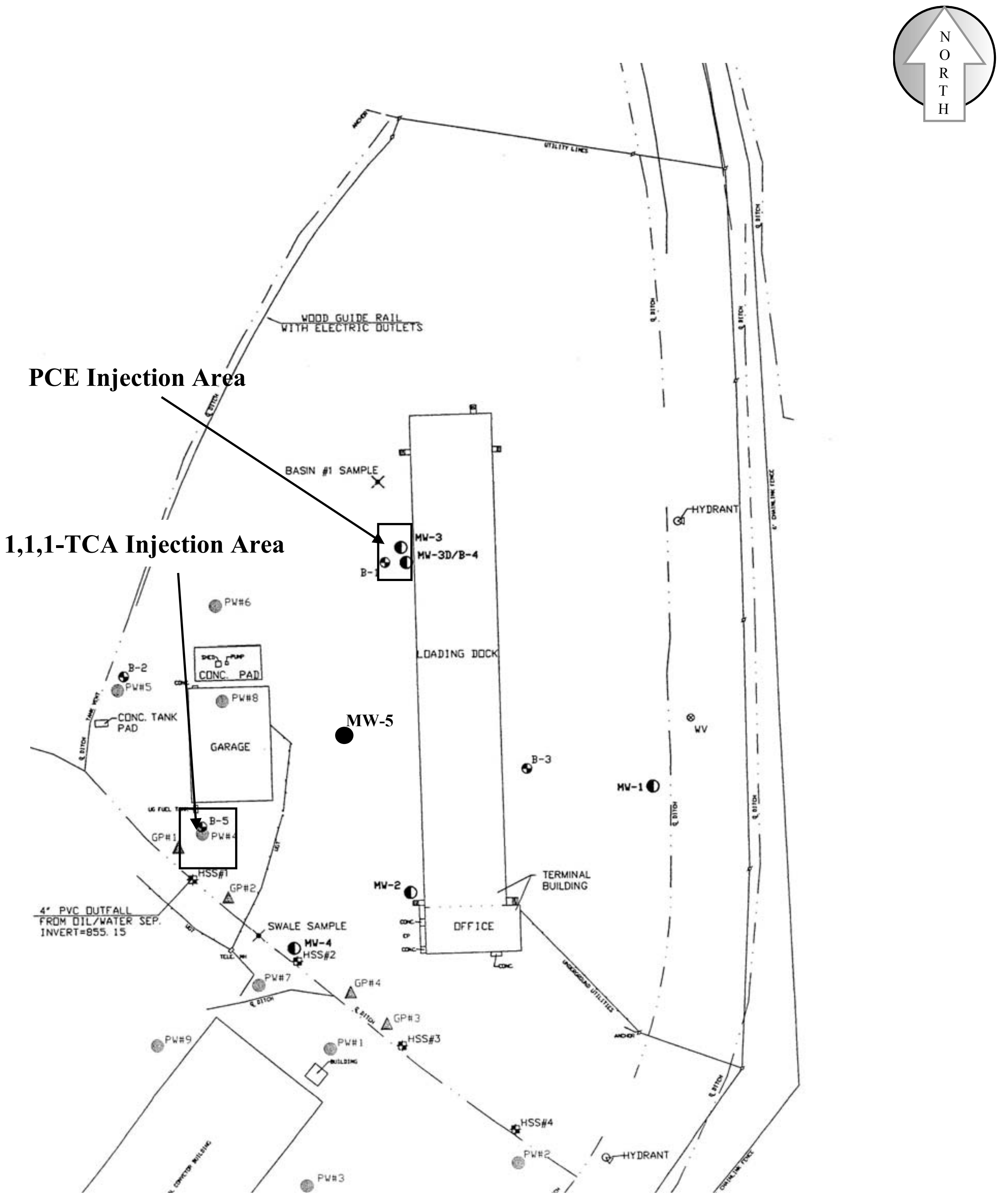
FAX (585) 248-2834

Project	250.014
Date	8/07
Scale	NTS
Drawn	PVS
Checked	MPR
File Name	Site Map
Figure	2



Title: Pilot Study Injection Areas
TNT-Red Star Express Site
Kirkwood, NY

Prepared For: USF Red Star LLC
Akron, Ohio

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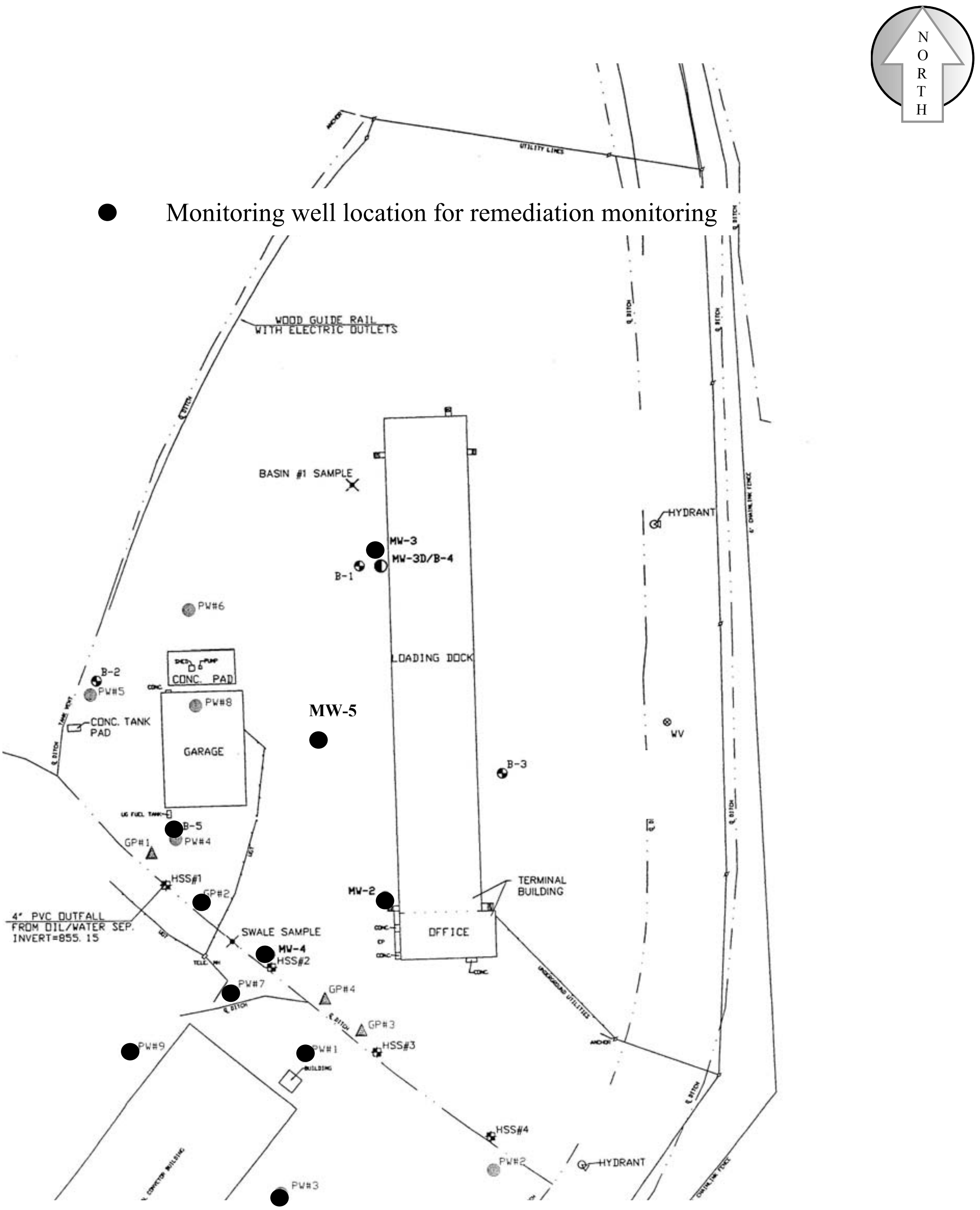
Project	250.014
Date	8/07
Scale	NTS
Drawn	PVS
Checked	MPR
File Name	Site Map
Figure	3



Title: Locations for Remediation Monitoring
TNT-Red Star Express Site
Kirkwood, NY

Prepared For:
USF Red Star LLC
Akron, Ohio

LEADER
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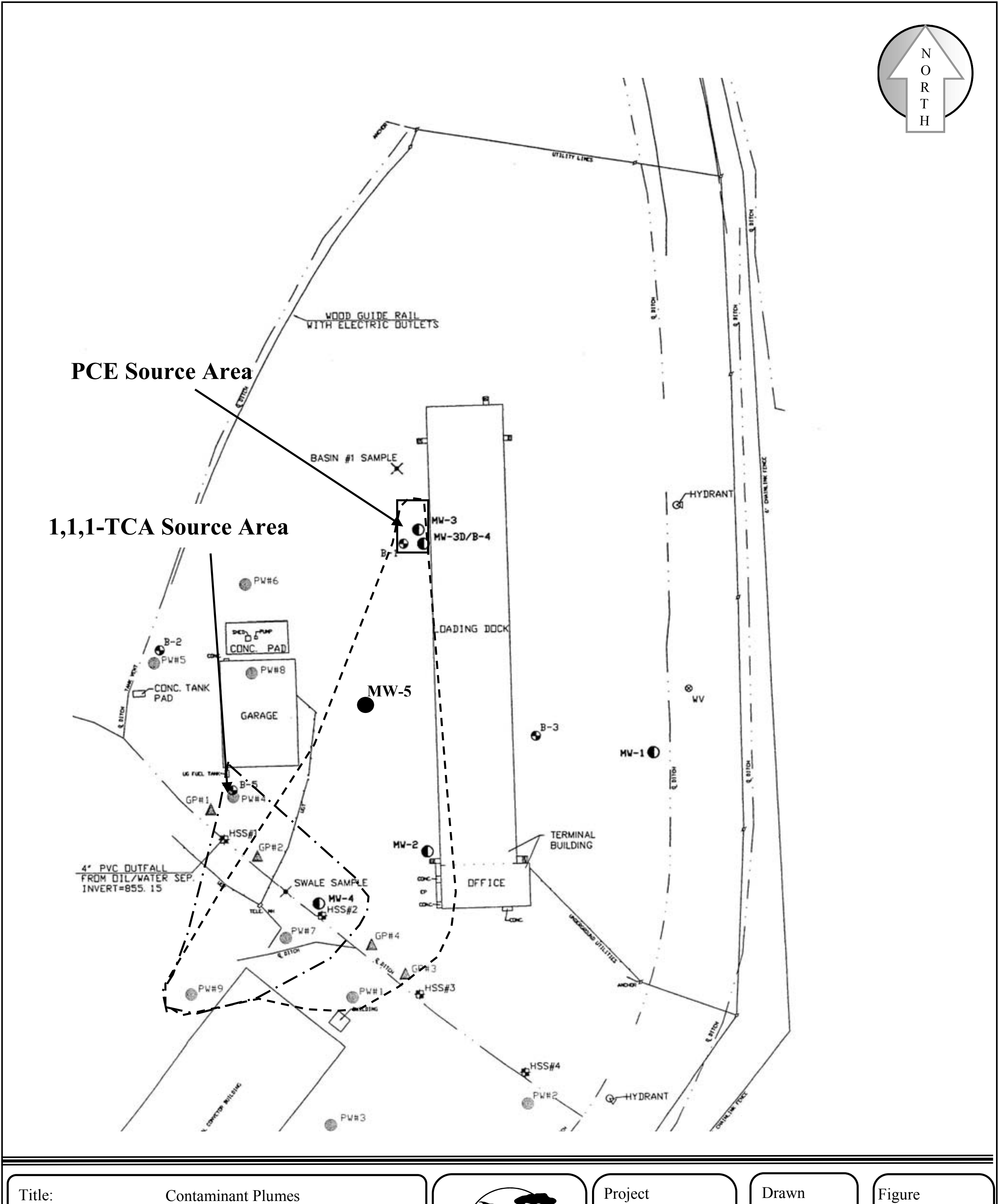
Project	250.014
Date	8/07
Scale	NTS
Drawn	PVS
Checked	MPR
File Name	Site Map
Figure	4



Title: Contaminant Plumes
TNT-Red Star Express Site
Kirkwood, NY

Prepared For: USF Red Star LLC
Akron, Ohio

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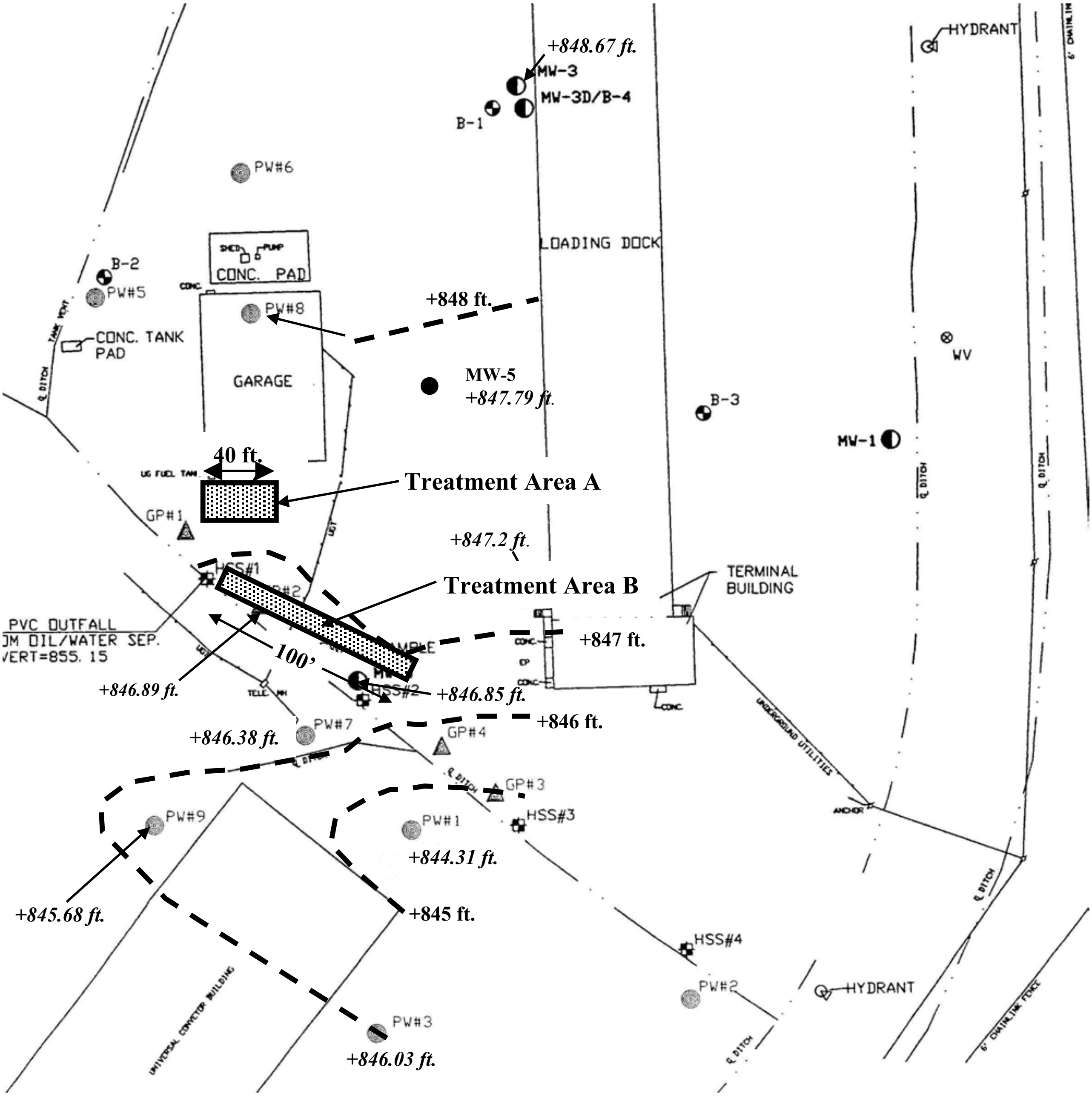
Project	250.014
Date	8/07
Scale	NTS
Drawn	PVS
Checked	MPR
File Name	Site Map
Figure	5

Notes:

+847 ft. = Groundwater elevation above mean sea level in shallow groundwater zone, June 2007

– – – – = Potentiometric contour line



Title:	Treatment Areas TNT-Red Star Express Site Kirkwood, NY
Prepared For:	USF Red Star LLC Akron, Ohio

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Project 250.014

Date 8/07

Scale 1" = 80 ft.

Drawn PVS

Checked MPR

File Name Site Map

Figure 6

Schedule

Mobilization	Days After Start
Pre-construction Sampling	1-3
Utility Layout	1
Review of Sample Results	
Results received	15
Project Report Issued	20
Site Work	
Injections (Treatment Area B)	40
1- Month Monitoring	50
1st. Qtr. Monitoring	130
2nd. Qtr Monitoring	220
3rd. Qtr. Monitoring	310
4th. Qtr. Monitoring	400
5th Qtr. Monitoring	490
6th Qtr. Monitoring	580
7th Qtr. Monitoring	670
8th Qtr. Monitoring	760

* Project progress reports with results issued monthly.

** Injections for Treatment Area A are dependent on quarterly monitoring results.

Title:	Schdule TNT-Red Star Express Site Kirkwood, NY
Prepared For:	USF Red Star LLC Akron, Ohio

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Project	250.014
Date	8/07
Scale	NTS
Drawn	PVS
Checked	MPR
File Name	Site Map
Figure	7

TABLE 1
Monitoring Well
Sample Results
Former USF Red Star Terminal,
Kirkwood, New York

Parameters	Units\Monitoring Well ID	PW1	PW-1	PW-1	PW-1	PW-3	PW-3	PW-3	PW-4	PW-4
		29-Oct-99	31-Mar-05	28-Mar-07	18-Jun-07	29-Oct-99	5-Apr-07	18-Jun-07	25-Oct-99	27-Sep-05
Depth to Water	Feet	10.65	13.00	9.10	13.38	7.10	7.05	9.03	8.55	10.13
Ground Surface Elevation	Feet above mean sea level	857.69	857.69	857.69	857.69	855.06	855.06	855.06	857.84	857.84
Groundwater Elevation	Feet above mean sea level	847.04	844.69	848.59	844.31	847.96	848.01	846.03	849.29	847.71
Temperature	Deg. F	N/A	48.60	48.50	57.30	N/A	48.70	56.80	67.82	N/A
Conductivity	Micro Siemens	N/A	0.74	1.08	1.15	N/A	0.90	1.10	1.16	N/A
Dissolved Oxygen	mg/L	N/A	8.15	2.75	2.24	N/A	7.20	0.00	2.76	N/A
pH	SU	N/A	6.23	6.19	6.22	N/A	6.90	6.07	6.35	N/A
ORP	Millivolts	N/A	129.00	124.00	136.00	N/A	110.00	146.00	-24.00	N/A
Methane	ug/L	N/A	3.0	0.39	0.48	N/A	N/A	1.1	0.1	N/A
Ethane	ug/L	N/A	<0.005	<0.025	<0.025	N/A	N/A	<0.025	<0.01	N/A
Ethene	ug/L	N/A	0.35	<0.025	<0.025	N/A	N/A	<0.025	<0.01	N/A
Acetone	ug/L	ND	ND	ND	ND	12.0	ND	ND	ND	ND
n-Butylbenzene	ug/L	ND	ND	ND	ND	N/A	ND	ND	ND	N/A
sec-Butylbenzene	ug/L	ND	ND	ND	ND	N/A	ND	ND	ND	N/A
2-Butanone	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene	ug/L	ND	N/A	ND	ND	ND	ND	ND	ND	N/A
Naphthalene	ug/L	ND	N/A	ND	ND	ND	ND	ND	ND	N/A
1,2,4-Trimethylbenzene	ug/L	ND	N/A	ND	ND	ND	ND	ND	ND	N/A
1,3,5-Trimethylbenzene	ug/L	ND	N/A	ND	ND	ND	ND	ND	ND	N/A
Xylenes	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ug/L	ND	N/A	ND	ND	ND	ND	ND	ND	N/A
Methylene Chloride	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	ug/L	ND	ND	ND	ND	ND	ND	ND	230.0	55.0
1,1-Dichloroethene	ug/L	ND	ND	ND	ND	ND	ND	ND	280.0	ND
cis 1,2-Dichloroethene	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	ug/L	N/A	NA	ND	ND	N/A	ND	ND	N/A	ND
1,1,1-Trichloroethane	ug/L	ND	ND	ND	ND	ND	ND	ND	3500.0	320.0
Trichloroethene	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	ug/L	4.0	7.1	10.0	8.3	ND	2.6	3.5	ND	ND
Total CVOCs	ug/L	4.0	7.1	10.0	8.3	12.0	2.6	3.5	4010.0	375.0
Total Parents	ug/L	4.0	7.1	10.0	8.3	0.0	2.6	3.5	3500.0	320.0
% of Pretreat Parent	Decimal Equiv.	1.00	1.77	2.50	2.08	0.00	0.64	0.88	1.00	1.00
% daughter products/Total CVOC	Decimal Equiv.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.15

Notes:
N/A = not analyzed
ORP = oxidation-reduction potential
Deg. F = degrees Fahrenheit
mg/L = milligrams per liter
SU = standard units
ug/L = micrograms per liter

TABLE 1
Monitoring Well
Sample Results
Former USF Red Star Terminal,
Kirkwood, New York

Parameters	Units\Monitoring Well ID	PW-4	PW-4	PW-4	PW-4	PW-4	PW-4	PW-7	PW-7	PW-7
		12-Oct-06	27-Oct-07	29-Nov-06	28-Dec-06	28-Mar-07	18-Jun-07	26-Oct-99	28-Mar-07	18-Jun-07
Depth to Water	Feet	10.11	10.24	10.15	9.90	8.90	10.25	14.15	12.45	13.84
Ground Surface Elevation	Feet above mean sea level	857.84	857.84	857.84	857.84	857.84	857.84	860.22	860.22	860.22
Groundwater Elevation	Feet above mean sea level	847.73	847.60	847.69	847.94	848.94	847.59	846.07	847.77	846.38
Temperature	Deg. F	NA	57.00	56.80	51.80	45.80	57.20	N/A	50.90	54.60
Conductivity	Micro Siemens	1.74	2.55	1.70	1.67	2.10	1.79	N/A	0.98	1.25
Dissolved Oxygen	mg/L	NA	0.00	0.10	0.00	0.36	0.23	N/A	2.00	2.89
pH	SU	4.90	5.13	5.40	5.50	5.70	6.10	N/A	6.50	6.08
ORP	Millivolts	-105.00	-112.00	-35.00	-43.00	-31.00	-165.00	N/A	17.00	117.00
Methane	ug/L	N/A	N/A	N/A	960.0	6700.000	4500.000	N/A	0.540	0.710
Ethane	ug/L	N/A	N/A	N/A	48.0	0.025	0.08	N/A	<0.025	<0.025
Ethene	ug/L	N/A	N/A	N/A	14.0	27.00	0.30	N/A	29.00	<0.025
Acetone	ug/L	N/A	56.0	2900.0	17.0	550.0	180.0	ND	ND	ND
n-Butylbenzene	ug/L	N/A	ND	ND	ND	5.5	ND	ND	ND	ND
sec-Butylbenzene	ug/L	N/A	0.9	0.8	1.5	0.9	1.2	ND	ND	ND
2-Butanone	ug/L	N/A	33.0	180.0	54.0	180.0	83.0	ND	ND	ND
Ethylbenzene	ug/L	N/A	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene	ug/L	N/A	ND	ND	0.3	ND	ND	ND	ND	ND
Naphthalene	ug/L	N/A	2.4	1.6	2.2	2.1	ND	ND	ND	ND
1,2,4-Trimethylbenzene	ug/L	N/A	1.1	0.36	1.2	ND	2.1	ND	ND	ND
1,3,5-Trimethylbenzene	ug/L	N/A	ND	ND	ND	ND	ND	ND	ND	ND
Xylenes	ug/L	N/A	0.99	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ug/L	N/A	ND	ND	0.4	ND	ND	ND	ND	ND
Methylene Chloride	ug/L	N/A	ND	0.96	1.0	ND	ND	ND	ND	ND
Chloroethane	ug/L	N/A	5.3	ND	ND	ND	4.3	ND	ND	ND
Carbon Tetrachloride	ug/L	N/A	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	ug/L	N/A	51.0	21.0	16.0	32.0	53.0	ND	0.8	ND
1,1-Dichloroethene	ug/L	N/A	6.6	2.2	1.0	3.2	4.4	ND	ND	ND
cis 1,2-Dichloroethene	ug/L	N/A	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	ug/L	N/A	ND	ND	ND	ND	ND	N/A	ND	ND
1,1,1-Trichloroethane	ug/L	N/A	83.0	25.0	38.0	31.0	38.0	26.0	9.5	2.4
Trichloroethene	ug/L	N/A	0.9	0.68	0.7	ND	ND	ND	ND	ND
Tetrachloroethylene	ug/L	N/A	ND	ND	ND	ND	ND	46.0	29.0	32.0
Total CVOCs	ug/L	0.0	146.8	48.9	55.7	66.2	99.7	72.0	39.3	34.4
Total Parents	ug/L	0.0	83.0	25.0	38.0	31.0	38.0	72.0	38.5	34.4
% of Pretreat Parent	Decimal Equiv.	0.00	0.26	0.08	0.12	0.10	0.12	1	0.53	0.48
% daughter products/Total CVOC	Decimal Equiv.	N/A	0.43	0.49	0.32	0.53	0.62	0	0.02	0.00

Notes:
N/A = not analyzed
ORP = oxidation-reduction potential
Deg. F = degrees Fahrenheit
mg/L = milligrams per liter
SU = standard units
ug/L = micrograms per liter

TABLE 1
Monitoring Well
Sample Results
Former USF Red Star Terminal,
Kirkwood, New York

Parameters	Units\Monitoring Well ID	PW-9	PW-9	PW-9	GP-2	GP-2	GP-2	GP-2	MW-2	MW-2
		29-Oct-99	28-Mar-07	18-Jun-07	1-Apr-99	27-Sep-05	28-Mar-07	18-Jun-07	1-Apr-99	31-Mar-05
Depth to Water	Feet	16.50	13.75	16.50	9.80	8.35	6.65	8.74	9.40	8.50
Ground Surface Elevation	Feet above mean sea level	862.18	862.18	862.18	855.63	855.63	855.63	855.63	857.83	857.83
Groundwater Elevation	Feet above mean sea level	845.68	848.43	845.68	845.83	847.28	848.98	846.89	848.43	849.33
Temperature	Deg. F	N/A	49.60	59.90	N/A	66.20	46.70	57.70	N/A	49.70
Conductivity	Micro Siemens	N/A	1.60	2.30	N/A	0.96	1.68	1.45	N/A	1.18
Dissolved Oxygen	mg/L	N/A	1.50	8.50	N/A	2.30	0.00	2.93	N/A	6.08
pH	SU	N/A	7.60	6.60	N/A	6.07	6.60	6.20	N/A	6.04
ORP	Millivolts	N/A	16.00	131.00	N/A	210.00	-108.00	-231.00	N/A	133.20
Methane	ug/L	N/A	0.760	NS	N/A	NA	790.00	260.00	N/A	<0.015
Ethane	ug/L	N/A	<0.025	NS	N/A	NA	36.00	<0.025	N/A	ND
Ethene	ug/L	N/A	43.0	NS	N/A	NA	120.00	0.04	N/A	ND
Acetone	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Butylbenzene	ug/L	ND	ND	ND	ND	N/A	ND	ND	ND	N/A
sec-Butylbenzene	ug/L	ND	ND	ND	ND	N/A	ND	ND	ND	N/A
2-Butanone	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene	ug/L	ND	ND	ND	ND	N/A	ND	ND	ND	N/A
Naphthalene	ug/L	ND	ND	ND	ND	N/A	ND	ND	ND	N/A
1,2,4-Trimethylbenzene	ug/L	ND	ND	ND	ND	N/A	ND	ND	ND	N/A
1,3,5-Trimethylbenzene	ug/L	ND	ND	ND	ND	N/A	ND	ND	ND	N/A
Xylenes	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ug/L	ND	ND	ND	ND	N/A	ND	ND	ND	N/A
Methylene Chloride	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	ug/L	ND	ND	ND	ND	ND	ND	3.4	ND	ND
Carbon Tetrachloride	ug/L	ND	ND	1.3	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	ug/L	32.0	16.0	7.8	96.0	3.5	150.0	170.0	ND	ND
1,1-Dichloroethene	ug/L	1.5	1.1	ND	24.0	2.4	5.4	14.0	ND	ND
cis 1,2-Dichloroethene	ug/L	ND	ND	ND	ND	ND	6.4	3.9	ND	ND
Dichlorodifluoromethane	ug/L	N/A	ND	ND	N/A	1.5	ND	ND	N/A	ND
1,1,1-Trichloroethane	ug/L	4.2	49.0	11.0	2200.0	120.0	110.0	660.0	ND	ND
Trichloroethene	ug/L	ND	ND	ND	ND	ND	ND	1.2	ND	ND
Tetrachloroethylene	ug/L	15.0	1.4	1.0	7.4	26.0	ND	7.2	8.0	8.9
Total CVOCs	ug/L	52.7	67.5	21.1	2327.4	153.4	271.8	859.7	8.0	8.9
Total Parents	ug/L	19.2	50.4	12.0	2207.4	146.0	110.0	667.2	8.0	8.9
% of Pretreat Parent	Decimal Equiv.	1.00	2.63	0.63	1.00	1.00	0.75	4.57	1.00	1.00
% daughter products/Total CVOC	Decimal Equiv.	0.64	0.25	0.37	0.05	0.04	0.60	0.22	0.00	0.00

Notes:
N/A = not analyzed
ORP = oxidation-reduction potential
Deg. F = degrees Fahrenheit
mg/L = milligrams per liter
SU = standard units
ug/L = micrograms per liter

TABLE 1
Monitoring Well
Sample Results
Former USF Red Star Terminal,
Kirkwood, New York

Parameters	Units\Monitoring Well ID	MW-2	MW-2	MW-3	MW-3	MW-3	MW-3	MW-3	MW-3	MW-3
		28-Mar-07	18-Jun-07	1-Apr-99	27-Sep-05	12-Oct-06	27-Oct-06	29-Nov-06	28-Dec-06	28-Mar-07
Depth to Water	Feet	8.90	10.62	8.10	9.23	9.05	8.62	8.78	8.47	7.65
Ground Surface Elevation	Feet above mean sea level	857.83	857.83	858.40	858.40	858.40	858.40	858.40	858.40	858.40
Groundwater Elevation	Feet above mean sea level	848.93	847.21	848.93	850.30	849.35	849.78	849.62	849.93	849.17
Temperature	Deg. F	46.76	56.48	N/A	62.06	N/A	57.38	58.40	55.2	49.46
Conductivity	Micro Siemens	1.00	1.29	N/A	0.49	0.47	1.87	0.74	0.98	0.42
Dissolved Oxygen	mg/L	5.40	2.90	N/A	2.24	N/A	0.10	0.60	0	0.30
pH	SU	6.80	6.18	N/A	7.22	7.00	7.46	7.32	6.7	7.40
ORP	Millivolts	6.00	115.00	N/A	-90.00	-98.00	-166.00	-147.00	-130	-104.00
Methane	ug/L	2.70	1.50	N/A	<0.01	N/A	N/A	N/A	52	15.0
Ethane	ug/L	<0.025	<0.025	N/A	<0.01	N/A	N/A	N/A	<0.025	<0.025
Ethene	ug/L	<0.025	<0.025	N/A	<10	N/A	N/A	N/A	79	<0.025
Acetone	ug/L	ND	ND	ND	ND	N/A	ND	ND	92.0	ND
n-Butylbenzene	ug/L	ND	ND	ND	N/A	N/A	ND	ND	ND	ND
sec-Butylbenzene	ug/L	ND	ND	ND	N/A	N/A	ND	ND	ND	ND
2-Butanone	ug/L	ND	ND	ND	ND	N/A	ND	ND	ND	ND
Ethylbenzene	ug/L	ND	ND	ND	ND	N/A	0.94	ND	ND	ND
Isopropylbenzene	ug/L	ND	ND	ND	N/A	N/A	ND	ND	ND	ND
Naphthalene	ug/L	ND	ND	ND	N/A	N/A	1.0	ND	ND	ND
1,2,4-Trimethylbenzene	ug/L	ND	ND	ND	N/A	N/A	2.0	ND	ND	ND
1,3,5-Trimethylbenzene	ug/L	ND	ND	ND	N/A	N/A	0.56	ND	ND	ND
Xylenes	ug/L	ND	ND	ND	ND	N/A	2.5	ND	ND	ND
1,2,4-Trichlorobenzene	ug/L	ND	ND	ND	N/A	N/A	ND	ND	ND	ND
Methylene Chloride	ug/L	ND	ND	ND	ND	N/A	ND	0.9	0.9	ND
Chloroethane	ug/L	ND	ND	ND	ND	N/A	ND	ND	ND	ND
Carbon Tetrachloride	ug/L	ND	ND	ND	ND	N/A	ND	ND	ND	ND
1,1-Dichloroethane	ug/L	ND	ND	ND	ND	N/A	ND	ND	0.3	ND
1,1-Dichloroethene	ug/L	ND	ND	ND	ND	N/A	ND	ND	ND	ND
cis 1,2-Dichloroethene	ug/L	ND	ND	ND	ND	N/A	ND	0.71	67.0	36.0
Dichlorodifluoromethane	ug/L	ND	ND	N/A	ND	N/A	ND	ND	ND	ND
1,1,1-Trichloroethane	ug/L	ND	ND	ND	ND	N/A	ND	0.57	0.6	ND
Trichloroethene	ug/L	ND	ND	ND	ND	N/A	ND	ND	4.0	0.5
Tetrachloroethylene	ug/L	9.5	4.0	1500.0	49.0	N/A	ND	ND	14.0	1.8
Total CVOCs	ug/L	9.5	4.0	1500.0	49.0	N/A	7.0	2.2	178.8	38.3
Total Parents	ug/L	9.5	4.0	1500.0	49.0	N/A	0.0	0.6	14.6	1.8
% of Pretreat Parent	Decimal Equiv.	1.07	0.45	1.00	1.00	N/A	100.00	0.01	0.30	0.04
% daughter products/Total CVOC	Decimal Equiv.	0.00	0.00	0.00	0.00	N/A	0.00	0.32	0.40	0.95

Notes:
N/A = not analyzed
ORP = oxidation-reduction potential
Deg. F = degrees Fahrenheit
mg/L = milligrams per liter
SU = standard units
ug/L = micrograms per liter

TABLE 1
Monitoring Well
Sample Results
Former USF Red Star Terminal,
Kirkwood, New York

Parameters	Units\Monitoring Well ID	MW-3	MW-4	MW-4	MW-4
		18-Jun-07	1-Apr-99	27-Sep-05	5-Apr-07
Depth to Water	Feet	9.73	7.20	7.65	7.30
Ground Surface Elevation	Feet above mean sea level	858.40	855.10	855.10	855.10
Groundwater Elevation	Feet above mean sea level	848.67	847.90	847.45	847.80
Temperature	Deg. F	59.00	N/A	66.20	46.20
Conductivity	Micro Siemens	0.67	N/A	0.98	1.20
Dissolved Oxygen	mg/L	0.26	N/A	1.93	2.00
pH	SU	7.20	N/A	6.26	6.70
ORP	Millivolts	-62.00	N/A	3.00	23.00
Methane	ug/L	8.6	N/A	N/A	N/A
Ethane	ug/L	<0.025	N/A	N/A	N/A
Ethene	ug/L	<0.025	N/A	N/A	N/A
Acetone	ug/L	ND	ND	ND	ND
n-Butylbenzene	ug/L	ND	ND	N/A	ND
sec-Butylbenzene	ug/L	ND	ND	N/A	ND
2-Butanone	ug/L	ND	ND	ND	ND
Ethylbenzene	ug/L	ND	ND	ND	ND
Isopropylbenzene	ug/L	ND	ND	N/A	ND
Naphthalene	ug/L	ND	ND	N/A	ND
1,2,4-Trimethylbenzene	ug/L	ND	ND	N/A	ND
1,3,5-Trimethylbenzene	ug/L	ND	ND	N/A	ND
Xylenes	ug/L	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ug/L	ND	ND	N/A	ND
Methylene Chloride	ug/L	ND	ND	ND	ND
Chloroethane	ug/L	ND	ND	ND	ND
Carbon Tetrachloride	ug/L	ND	ND	ND	ND
1,1-Dichloroethane	ug/L	ND	ND	ND	ND
1,1-Dichloroethene	ug/L	ND	ND	ND	ND
cis 1,2-Dichloroethene	ug/L	ND	ND	ND	ND
Dichlorodifluoromethane	ug/L	ND	N/A	1.3	ND
1,1,1-Trichloroethane	ug/L	ND	12.0	1.9	ND
Trichloroethene	ug/L	ND	ND	ND	ND
Tetrachloroethylene	ug/L	ND	98.0	12.0	26.4
Total CVOCs	ug/L	0.0	110.0	15.2	26.4
Total Parents	ug/L	0.0	110.0	13.9	26.4
% of Pretreat Parent	Decimal Equiv.	0.00	1.00	0.13	0.24
% daughter products/Total CVOC	Decimal Equiv.	N/A	0.00	0.00	0.00

Notes:
N/A = not analyzed
ORP = oxidation-reduction potential
Deg. F = degrees Fahrenheit
mg/L = milligrams per liter
SU = standard units
ug/L = micrograms per liter

TABLE 2
Water Depths from Ground Surface in the Treatment Zone Monitoring Wells

Monitoring Well	Minimum Depth	Maximum Depth
PW-4	8.55 ft.	10.25 ft.
GP-2	6.65	9.8
MW-4	7.2	8.25

APPENDIX A

HRC-A LITERATURE

HRC *Advanced* Design Software for Grid Treatment

June 2006

Regenesis Technical Support: USA (949) 366-8000 www.regenesis.com

Site Name: Treatment Area A TNT Red Star
Location: Kirkwood NY
Consultant: Leader

COSTS PROVIDED ARE FOR STANDARD HRC ADVANCED (HRC-A) MICROEMULSION

Site Conceptual Model/Extent of Plume Requiring Remediation

Width of plume (intersecting gw flow direction)	40	ft			
Length of plume (parallel to gw flow direction)	20	ft	=	800	ft^2
Depth to contaminated zone	10	ft			
Thickness of contaminated saturated zone	10	ft			
Nominal aquifer soil (gravel, sand, silty sand, silt, clay, etc.)	silty sand				
Total porosity	0.35		Effective porosity:	0.3	
Hydraulic conductivity	0.7	ft/day	=	2.5E-04	cm/sec
Hydraulic gradient	0.0037	ft/ft			
Seepage velocity	3.2	ft/yr	=	0.009	ft/day
Treatment Zone Pore Volume	2,800	ft^3		20,947	gallons

Dissolved Phase Electron Donor Demand	Contaminant Conc (mg/L)	Contaminant Mass (lb)	Stoichiometry cont/H_2 (wt/wt)	H_2 Req. (lb)
Tetrachloroethene (PCE)	0.00	0.0	20.7	0.00
Trichloroethene (TCE)	0.00	0.0	21.9	0.00
cis-1,2-dichloroethene (DCE)	0.00	0.0	24.2	0.00
Vinyl Chloride (VC)	0.00	0.0	31.2	0.00
1,1,1-Trichloroethane (TCA)	0.04	0.0	22.2	0.00
1,1-Dichlorochloroethane (DCA)	0.50	0.1	24.7	0.00
User added, also add stoich. demand and Koc (see pull-dow	0.00	0.0	0.0	n/a
User added, also add stoich. demand and Koc (see pull-dow	0.00	0.0	0.0	n/a

carbon tetrachloride ▾ **<- pull-down menu**

Sorbed Phase (SP) Electron Donor Demand:

Soil bulk density	1.76	g/cm^3	=	110	lb/cf
Fraction of organic carbon (foc)	0.003	range: 0.0001 to 0.01			

(Values are estimated using SP = foc*Koc*Cgw) (Adjust Koc as necessary to provide realistic estimates)	Koc (L/kg)	Contaminant Conc (mg/kg)	Contaminant Mass (lb)	Stoichiometry cont/H_2 (wt/wt)	H_2 Req. (lb)
Tetrachloroethene (PCE)	371	0.00	0.0	20.7	0.00
Trichloroethene (TCE)	122	0.00	0.0	21.9	0.00
cis-1,2-dichloroethene (DCE)	80	0.00	0.0	24.2	0.00
Vinyl Chloride (VC)	2.5	0.00	0.0	31.2	0.00
1,1,1-Trichloroethane (TCA)	304	0.04	0.0	22.2	0.00
1,1-Dichlorochloroethane (DCA)	33	0.05	0.0	24.7	0.00
User added, also add stoich. demand and Koc (see pull-dow	0	0.00	0.0	0.0	n/a
User added, also add stoich. demand and Koc (see pull-dow	0	0.00	0.0	0.0	n/a

Competing Electron Acceptors (CEAs):	CEA Conc (mg/L)	CEA Mass (lb)	Stoich. (wt/wt) e^- acceptor/H_2	H_2 Req. (lb)
Oxygen Demand	2.00	0	8.0	0.04
Nitrate Demand	5.00	1	12.4	0.07
Bioavailable Manganese Demand	5.00	1	27.5	0.03
Bioavailable Iron Demand	25.00	4	55.9	0.08
Sulfate Demand	31.00	5	12.0	0.45

Microbial Demand Factor	3	Recommend 1-4x
Safety Factor	1.75	Recommend 1-4x

Injection Point Spacing:

Injection spacing within rows (ft)	12.5	# points per row:	4
Injection spacing between rows (ft)	20.0	# of rows:	1
Advective travel time between rows (days)	2317	Total # of points:	4

Project HRC-A Concentrate Material Requirements:

Amount of HRC-A Concentrate Required (lbs)	358 Minimum Dose Override	Volume of HRC-A Concentrate Required (gals)	45

Standard 10:1 Vol (H_2O):Vol (HRC-A) Microemulsion Production Requirements:

	Lbs.		Gallons
HRC-A Concentrate	358	HRC-A Concentrate	45
Water at tempurature >60 °F	3,753	Water at a temperature >60 °F	450
Total	4,111	**Total**	495

Microemulsion Application Rate:

	Lbs.		Gallons
10:1 V/V Microemulsion App. Rate per Foot	102.8	10:1 V/V Microemulsion App. Rate per Foot	12.4
0:1 V/V Microemulsion App. Rate per Point	1028	10:1 V/V Microemulsion App. Rate per Point	124

Est.% of Effective Pore Vol. Displaced by HRC-A Microemulsion 2.76%

Optional Additional Dilution Calculations for Standard HRC-A Microemulsion:

	Gallons	
Desired % Eff.Pore Vol. Displaced by Microemulsion	**3.5%**	
Add. Water Required to Mix with Standard Microemulsion	133	
Total Vol. of Water Required	583	
Total Vol. of Diluted Microemulsion	628	
Vol. of Diluted Microemulsion applied per ft	16	
Vol. of Diluted Microemulsion applied per pt	157	
Water : HRC-A mixing ratio V/V	13	parts water to 1 part HRC Adv Microemulsion

Project Summary:

Number of HRC Adv delivery points (adjust as necessary for site)			4	
HRC Adv microemulsion application rate in Lbs/ft			102.8	
Corresponding amount of HRC Adv microemulsion per point (lb)			1028	
Number of 30 lb HRC Adv concentrate buckets per injection point			3.0	
Total number of 30 lb HRC Adv concentrate buckets			12	
Total amount of HRC Adv concentrate (lb)			360	
Total amount of standard HRC Adv microemulsion (lb)			**4,111**	
HRC Adv unit cost ($/lb of standard microemulsion)		$	0.42	**0**
Total Material Cost for Standard HRC Adv. Microemulsion		**$**	**1,727**	
Shipping and Tax Estimates in US Dollars				
Sales tax	rate: 0.00%	$	-	
Total material cost		$	1,727	
Shipping of HRC Adv (call for quote)		$	-	
Total HRC Adv Microemulsion Material Cost		**$**	**1,727**	

HRC Adv Installation Cost Estimate (responsibility of customer to contract work)			**Other Project Costs**		
Length of each injection point (ft)		20	Design and regulatory issues	$	-
Total length for direct push for project (ft)		80	Groundwater monitoring and rpt	$	-
Est. daily application footage rate (check using est. HRC-A pumping rate)		250	Other	$	-
Estimated points per day (10 to 30 is typical for direct push)		12.5	Other	$	-
Required number of days		1	Other	$	-
Mobilization/demobilization cost for injection subcontractor	$	-	Other	$	-
Daily rate for injection subcontractor	$	-	Other	$	-
Total injection subcontractor cost for application	$	-	Other	$	-
Total Install Cost (not including consultant, lab, etc.)	**$**	**1,727**	**Total Project Cost**	**$**	**1,727**

HRC *Advanced* Design Software for Grid Treatment

June 2006

Regenesis Technical Support: USA (949) 366-8000 www.regenesis.com

Site Name: Treatment Area B TNT Red Star
Location: Kirkwood NY
Consultant: Leader

COSTS PROVIDED ARE FOR STANDARD HRC ADVANCED (HRC-A) MICROEMULSION

Site Conceptual Model/Extent of Plume Requiring Remediation

Width of plume (intersecting gw flow direction)	100	ft				
Length of plume (parallel to gw flow direction)	20	ft		=	2,000	ft^2
Depth to contaminated zone	10	ft				
Thickness of contaminated saturated zone	10	ft				
Nominal aquifer soil (gravel, sand, silty sand, silt, clay, etc.)	silty sand					
Total porosity	0.35		Effective porosity:		0.3	
Hydraulic conductivity	0.7	ft/day		=	2.5E-04	cm/sec
Hydraulic gradient	0.0037	ft/ft				
Seepage velocity	3.2	ft/yr		=	0.009	ft/day
Treatment Zone Pore Volume	7,000	ft^3			52,367	gallons

Dissolved Phase Electron Donor Demand	Contaminant Conc (mg/L)	Contaminant Mass (lb)	Stoichiometry cont/H_2 (wt/wt)	H_2 Req. (lb)
Tetrachloroethene (PCE)	0.01	0.0	20.7	0.00
Trichloroethene (TCE)	0.00	0.0	21.9	0.00
cis-1,2-dichloroethene (DCE)	0.01	0.0	24.2	0.00
Vinyl Chloride (VC)	0.00	0.0	31.2	0.00
1,1,1-Trichloroethane (TCA)	0.60	0.3	22.2	0.01
1,1-Dichlorochloroethane (DCA)	0.23	0.1	24.7	0.00
User added, also add stoich. demand and Koc (see pull-dow	0.00	0.0	0.0	n/a
User added, also add stoich. demand and Koc (see pull-dow	0.00	0.0	0.0	n/a

carbon tetrachloride ▼ **<- pull-down menu**

Sorbed Phase (SP) Electron Donor Demand:

Soil bulk density	1.76	g/cm^3 =	110	lb/cf
Fraction of organic carbon (foc)	0.003	range: 0.0001 to 0.01		

(Values are estimated using SP = foc*Koc*Cgw) (Adjust Koc as necessary to provide realistic estimates)	Koc (L/kg)	Contaminant Conc (mg/kg)	Contaminant Mass (lb)	Stoichiometry cont/H_2 (wt/wt)	H_2 Req. (lb)
Tetrachloroethene (PCE)	371	0.01	0.0	20.7	0.00
Trichloroethene (TCE)	122	0.00	0.0	21.9	0.00
cis-1,2-dichloroethene (DCE)	80	0.00	0.0	24.2	0.00
Vinyl Chloride (VC)	2.5	0.00	0.0	31.2	0.00
1,1,1-Trichloroethane (TCA)	304	0.55	1.2	22.2	0.05
1,1-Dichlorochloroethane (DCA)	33	0.02	0.1	24.7	0.00
User added, also add stoich. demand and Koc (see pull-dow	0	0.00	0.0	0.0	n/a
User added, also add stoich. demand and Koc (see pull-dow	0	0.00	0.0	0.0	n/a

Competing Electron Acceptors (CEAs):	CEA Conc (mg/L)	CEA Mass (lb)	Stoich. (wt/wt) e^- acceptor/H_2	H_2 Req. (lb)
Oxygen Demand	2.00	1	8.0	0.11
Nitrate Demand	5.00	2	12.4	0.18
Bioavailable Manganese Demand	5.00	2	27.5	0.08
Bioavailable Iron Demand	25.00	11	55.9	0.20
Sulfate Demand	31.00	14	12.0	1.13

Microbial Demand Factor	3	Recommend 1-4x
Safety Factor	1.75	Recommend 1-4x

Injection Point Spacing:

Injection spacing within rows (ft)	12.5	# points per row:	8
Injection spacing between rows (ft)	20.0	# of rows:	1
Advective travel time between rows (days)	2317	Total # of points:	8

Project HRC-A Concentrate Material Requirements:

Amount of HRC-A Concentrate Required (lbs)	895 Minimum Dose Override	Volume of HRC-A Concentrate Required (gals)	111

Standard 10:1 Vol (H_2O):Vol (HRC-A) Microemulsion Production Requirements:

	Lbs.		Gallons
HRC-A Concentrate	895	HRC-A Concentrate	111
Water at tempurature >60 °F	9,257	Water at a temperature >60 °F	1,110
Total	10,153	**Total**	1,221

Microemulsion Application Rate:

	Lbs.		Gallons
10:1 V/V Microemulsion App. Rate per Foot	126.9	10:1 V/V Microemulsion App. Rate per Foot	15.3
0:1 V/V Microemulsion App. Rate per Point	1269	10:1 V/V Microemulsion App. Rate per Point	153

Est.% of Effective Pore Vol. Displaced by HRC-A Microemulsion 2.72%

Optional Additional Dilution Calculations for Standard HRC-A Microemulsion:

	Gallons	
Desired % Eff.Pore Vol. Displaced by Microemulsion	**3.5%**	
Add. Water Required to Mix with Standard Microemulsion	350	
Total Vol. of Water Required	1,460	
Total Vol. of Diluted Microemulsion	1,571	
Vol. of Diluted Microemulsion applied per ft	20	
Vol. of Diluted Microemulsion applied per pt	196	
Water : HRC-A mixing ratio V/V	13	parts water to 1 part HRC Adv Microemulsion

Project Summary:

Number of HRC Adv delivery points (adjust as necessary for site)		8	
HRC Adv microemulsion application rate in Lbs/ft		126.9	
Corresponding amount of HRC Adv microemulsion per point (lb)		1269	
Number of 30 lb HRC Adv concentrate buckets per injection point		3.7	
Total number of 30 lb HRC Adv concentrate buckets		30	
Total amount of HRC Adv concentrate (lb)		900	
Total amount of standard HRC Adv microemulsion (lb)		**10,153**	
HRC Adv unit cost ($/lb of standard microemulsion)	$	0.42	0
Total Material Cost for Standard HRC Adv. Microemulsion	**$**	**4,264**	
Shipping and Tax Estimates in US Dollars			
Sales tax rate: 0.00%	$	-	
Total material cost	$	4,264	
Shipping of HRC Adv (call for quote)	$	-	
Total HRC Adv Microemulsion Material Cost	**$**	**4,264**	

HRC Adv Installation Cost Estimate (responsibility of customer to contract work)			**Other Project Costs**		
Length of each injection point (ft)		20	Design and regulatory issues	$	-
Total length for direct push for project (ft)		160	Groundwater monitoring and rpt	$	-
Est. daily application footage rate (check using est. HRC-A pumping rate)		250	Other	$	-
Estimated points per day (10 to 30 is typical for direct push)		12.5	Other	$	-
Required number of days		1	Other	$	-
Mobilization/demobilization cost for injection subcontractor	$	-	Other	$	-
Daily rate for injection subcontractor	$	-	Other	$	-
Total injection subcontractor cost for application	$	-	Other	$	-
Total Install Cost (not including consultant, lab, etc.)	**$**	**4,264**	**Total Project Cost**	**$**	**4,264**

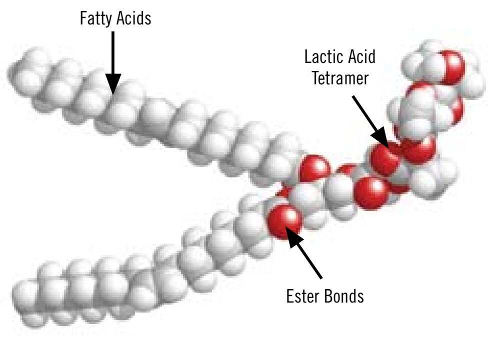
HRC ADVANCED™
HYDROGEN RELEASE COMPOUND

Achieve Rapid and Sustained Reductive Dechlorination through High-Volume, Wide-Area, Electron Donor Distribution

PRODUCT FEATURES

- **Low-Cost**
  - Lower cost than other specialty electron donors
- **Wide Area/High Volume - Microemulsion Application**
  - Increases contact with contaminants and reduces number of injection points required for treatment
- **Enhanced distribution through Micellar Transport**
  - Unlike oil products, HRC Advanced forms micelles (Figure 2) which are mobile in groundwater and significantly enhance electron donor distribution after injection
- **Persistent and Long Lasting Hydrogen Source**
  - Provides free lactic acid, controlled-release lactic acid and long release fatty acids for effective hydrogen production for periods up to 5 years.
- **Incorporates Hydrogen Release Compound (HRC®) Technology**
  - Successfully applied on over 1000 sites worldwide

FIGURE 1: THE HRC ADVANCED™ MOLECULAR STRUCTURE



PRODUCT COMPOSITION

COMPOSITION

HRC Advanced™ has a molecular structure specifically designed to maximize cost effective anaerobic treatment of contaminants in subsurface soils and groundwater. This structure (patent applied for) is composed of free lactic acid, controlled-release lactic acid (polylactate) and certain fatty acid components which are esterified to a carbon backbone molecule of glycerin (Figure 1).

When injected into contaminated soil and groundwater, HRC Advanced produces a sequential, staged release of its electron donor components. The immediately available free lactic acid is fermented rapidly while the controlled-release lactic acid is metabolized at a more controlled, more gradual rate. The fatty acids are converted to hydrogen over a mid to long range timeline giving HRC Advanced an exceptionally long electron donor release profile. This staged fermentation provides an immediate, mid-range and very long term, controlled-release supply of hydrogen (electron donor) to fuel the reductive dechlorination process.

Typical longevity is rated up to 2 years on a single injection and up to 5 years under optimal conditions, e.g. low permeability, low consumptive environments.

APPLICATION APPROACHES

HRC Advanced applications can be configured in several different ways including: grids, barriers, excavations, etc. The material itself can be applied to the subsurface through the use of direct-push injection, hollow-stem auger, existing wells or re-injection wells. HRC Advanced is typically applied in high volumes as an emulsified micellar suspension (microemulsion). The microemulsion is easily pumped into the subsurface and is produced on-site by mixing specified volumes of water and delivered HRC Advanced concentrate. Detailed preparation and installation instructions are available at www.regenesis.com.

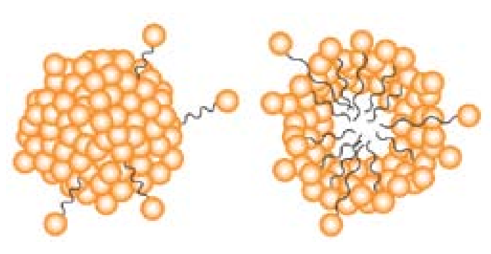
In some (rare) instances the concentrated material can be directly applied, however it is highly recommended that Regenesis Technical Services be consulted prior to any non-emulsified, concentrated applications.

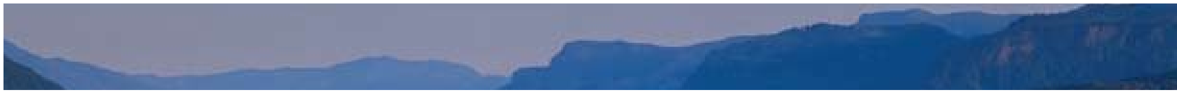
HRC Advanced material is usually applied throughout the entire vertical thickness of the determined treatment area. Once injected, the emulsified HRC Advanced moves out into the subsurface pore spaces via micellar transport, eventually coating surfaces (Figure 2). Over time, released soluble components of the HRC Advanced are distributed within the aquifer via the physical process of advection and the concentration driven forces of diffusion.

MORE ON MICELLES

Micelles (Figure 2) are groups (spheres) of molecules with the hydrophilic group facing out to the water and the "tails" or lipophilic moiety facing in. They are formed during the HRC Advanced emulsification process and provide the added benefit of increased distribution via migration to areas of lower concentration.

FIGURE 2: MICELLE REPRESENTATION





Achieve Rapid and Sustained Reductive Dechlorination through High-Volume, Wide-Area, Electron Donor Distribution

HRC ADVANCED™
HYDROGEN RELEASE COMPOUND

PERFORMANCE

Case Study #1

A site in Massachusetts showed high levels of PCE and its daughter products TCE and cis-DCE which had been consistently present for more than two years. HRC Advanced was applied in a grid configuration around monitoring well #16. In Figure 3, the contaminant concentration results indicate a rapid decrease in the parent product PCE and evidence of reductive dechlorination as demonstrated by the relative increases in daughter products TCE and cis-DCE.

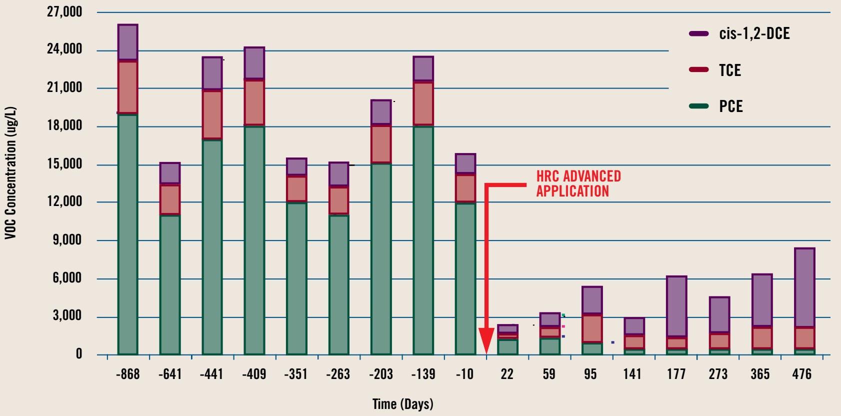


FIGURE 3: MW-16 CONTAMINANT CONCENTRATION DATA

Case Study #2

A site in Florida was characterized with PCE contamination approaching 225 ug/L. A total of 1080 pounds of HRC Advanced was applied in a grid configuration through 16 direct-push points, with about 5 feet between each point and at a rate of approximately 5 lbs. per vertical foot. Monitoring in well 103 at 75 days post-HRC Advanced injection indicated that PCE was reduced by 67% then leveled off for about 75 days then dropped another 22% for a total of 89% reduction over a 275 day period. TOC levels remain elevated at 17-19 mg/L after 275 days and daughter products remain at low levels (Figure 4).

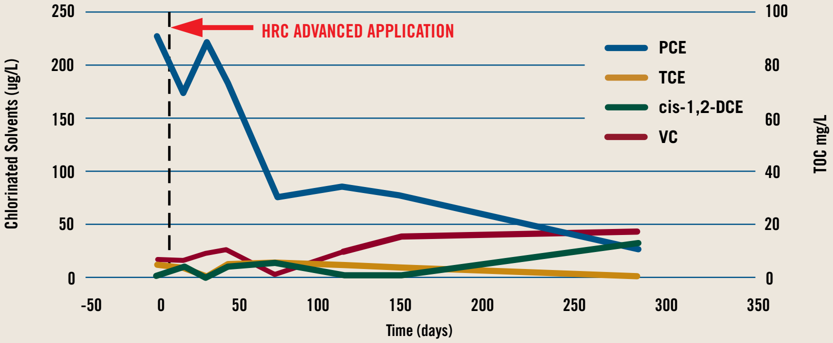


FIGURE 4: MW-103 CONTAMINANT CONCENTRATION DATA

Simplified HRC Advanced Application Pictorial

(details regarding the HRC Advanced microemulsion and how it is made on site are available from Regenesis).

Delivered HRC Advanced is mixed with water to form a microemulsion

The microemulsion is prepared in high volumes for adequate subsurface distribution

The HRC Advanced microemulsion is then injected in high-volumes into the treatment area

HRC ADVANCED™
HYDROGEN RELEASE COMPOUND
Micro-emulsion

REGENESIS
Advanced Technologies for Groundwater Resources

Hydrogen Release Compound Advanced (HRC Advanced™)

INSTALLATION INSTRUCTIONS

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

Introduction

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

Material Overview Handling and Safety

HRC-A 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 HRC-A concentrate (net weight) and a nominal volume of 3.7 gallons. At room temperature, HRC-A concentrate is a liquid material with a viscosity of approximately 500 centipoise, roughly the equivalent of pancake syrup. The viscosity of HRC-A is not temperature sensitive above 50 ºF (10 ºC). However, below 50 ºF 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 ºF so that it can be easily handled. HRC-A concentrate should be stored in a warm, dry place that is protected from direct sunlight. It is common for stored HRC-A 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. HRC-A 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 HRC-A to Water Ratio

HRC-A 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 HRC-A. Although micro-emulsions can be easily produced using greater water volumes than 10 parts, e.g. 20 to 50 parts water to 1 part HRC-A, the initial micro-emulsion should never be produced below a ratio of less than 10 parts water: 1 part HRC-A v/v. **WARNING: Do not attempt to produce a micro-emulsion at less than 10 parts water to 1 part HRC-A ratio v/v. This will produce an undesirable and unstable solution.**

The field production of HRC-A 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 HRC-A as this will produce an undesirable and unstable large emulsion. Always add the HRC-A to a large volume of water.

As indicated previously the 10:1 ratio of water to HRC-A 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 HRC-A 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 HRC-A 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 HRC-A will produce a larger volume of the suspension, it will lower the concentration of HRC-A per gallon of solution. Thus, the benefit of using a high water/HRC-A v/v ratio in order to affect a greater pore volume of the subsurface aquifer is offset by the dilution of the HRC-A 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 HRC-A micro-emulsion).

It is important that the user plan in advance the v/v HRC-A/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 HRC-A micro-emulsion, the subsurface does not readily accept the volume of solution as designed, the user can adjust downward the v/v water to HRC-A ratio until a more concentrated suspension is produced (this solution should never drop below the required 10 parts water:1 part HRC-A v/v production ratio). For more information on designing a HRC-A/water ratios to meet specific site conditions, please contact Regenesis Technical Services.

Direct Push Application Requirements

One of the best methods to deliver the HRC-A 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 applier to more cost effectively distribute the HRC-A 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 is specific to direct-push equipment. Please contact Regenesis Technical Services to assist you with dedicated injection well applications.

In general, Regenesis strongly recommends application of the HRC-A 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 <u>injection pump requirements are different than the requirements of the mixing pump</u> (see Mixing to Generate HRC-A Micro-emulsion).** High pressure, positive displacement pumps and progressive cavity pumps are appropriate for injecting HRC-A. 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 HRC-A solution and specific aquifer conditions present at the site.

The installation of the HRC-A 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 HRC-A Micro-Emulsion

The application of HRC-A requires the creation of a micro-emulsion. Technically the optimal suspension is an HRC-A-in-water suspension containing micro-emulsions. Before beginning the mixing procedure the user should have in mind the desired water to HRC-A 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. **<u>This pump will be a different pump than that used to inject the HRC-A micro-emulsion into the subsurface</u>.** If the user is uncertain as to requirements for the pump or the applicability of a certain pump, please contact Regenesis Technical Services. Regenesis typically suggests using a water trailer/pump apparatus commonly found at equipment rental facilities. Regenesis 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.

<u>To ensure that proper micro-emulsion suspension is generated Regenesis suggests a two-step process that simply requires mixing at least 10 parts water to 1 part HRC-A concentrate using water at a temperature ≥ 60°F.</u>

Step 1) Regenesis recommends that the HRC-A 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 HRC-A concentrate containing 3.7 gallons of material should be mixed with 37 gallons of water.

<u>Example:</u> 6 buckets x 3.7 gallons HRC-A concentrate/bucket yields a total of 22.2 gallons of HRC-A concentrate. Thus, a 10:1 v/v solution will require 222 gallons of water (22.2 gallons HRC-A concentrate x 10 gallons water yields 222 gallons of water). A nominal total volume micro-emulsion would result from the summation of the HRC-A 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 HRC-A buckets <u>slowly poured</u> into the tank. Each bucket of HRC-A concentrate should be poured at a <u>slow rate (approx. 1 minute per bucket)</u> and the contents of the tank continually recirculated using the high hear centrifugal pump. A period of 1-2 minutes should be allowed between addition of each subsequent bucket of HRC-A concentrate to allow the centrifugal pump to continue to shear and mix the water/HRC-A concentrate. Upon addition of the entire volume of HRC-A concentrate the pump should remain on to allow the solution mixture to recirulate. The recirculation of the HRC-A 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.

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 HRC-A 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.

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

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 HRC-A as well as decrease the ease of micro-emulsion formation. To optimize an application in cold weather settings Regenesis recommends maintaining the HRC-A concentrate and the associated water at a temperature ≥60^{o}F (16^{o}C). The following procedures can be used to facilitate the production and installation of a 10:1 v/v HRC-A micro-emulsion.

- Raise and maintain the temperature of the HRC-A to at least 60°F (16°C) prior to mixing with water. A hot water bath can be used to heat up the HRC-A 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 HRC-A concentrate.
- Hot water (approximately 130-170°F or 54-77°C) should be added to the tank after the buckets of HRC-A have been placed inside. The hot water should be delivered from a heated pressure washer (Hotsy® Model No. 444 or equivalent) or steam cleaner unit.
- It is equally critical that a moderate water temperature (>60°F or 16^{o}C) be used in the production of the micro-emulsion. If on-site water supply is below 60^{o}F use a hot water or steam cleaner to generate a small volume (e.g. 5-10% of total water volume) of hot water (130–170^{o}F/54-77^{o}C). This small volume of hot water should be added to remaining cold water volume to raise the total volume temperature to >60^{o}F. When the HRC-A concentrate and water each reach a minimum temperature of 60°F or 16°C the two materials are ready for mixing.

- Upon achieving a minimum temperature of 60°F or 16°C (approximately 10-20 minutes). When the HRC-A and the associated water volumes have reached a minimum temperature of 60°F or 16°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.

- Use a pump with a heater unit.
- Periodically check the temperature of the material in the hopper.
- Re-circulate the HRC-A 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 HRC-A 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 HRC-A 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 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 Regenesis Technical Services at 949-366-8000.

HRC ADVANCED™
HYDROGEN RELEASE COMPOUND
Micro-emulsion

Section 9 - Special Protection or Handling

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

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

Section 10 - Other Information

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

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

Section 3 - Physical Data

Melting Point:	**Not Available (NA)**
Boiling Point:	**Not Determined (ND)**
Flash Point:	**ND**
Density:	**1.3 g/cc**
Solubility:	**Acetone and DMSO**
Appearance:	**Viscous amber gel/liquid**
Odor:	**Not detectable**
Vapor Pressure:	**None**

Section 4 - Fire and Explosion Hazard Data

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

Water may be used to keep exposed containers cool.

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

Section 5 - Toxicological Information

Acute Effects:	**May be harmful by inhalation, ingestion, or skin absorption. May cause irritation. To the best of our knowledge, the chemical, physical, and toxicological properties of the glycerol tripolylactate have not been investigated. Listed below are the toxicological information for glycerol and lactic acid.**
RTECS#:	**MA8050000** **Glycerol**

Section 5 - Toxicological Information (cont)

Irritation data:	**SKN-RBT 500 MG/24H MLD**	**BIOFX* 9-4/1970**
	85JCAE-,207,1986	**85JCAE-,207,1986**
	EYE-RBT 126 MG MLD	**85JCAE -,656,86**
	EYE-RBT 500 MG/24H MLD	**AJOPAA 29,1363,46**
	SKN-RBT 5MG/24H SEV	
	EYE-RBT 750 UG SEV	
Toxicity data:	**ORL-MUS LD50:4090 MG/KG**	**NIIRDN 6,215,1982**
	FRZKAP (6),56,1977	**FEPRA7 4,142,1945**
	SCU-RBT LD50:100 MG/KG	**RCOCB8 56,125,1987**
	ORL-RAT LD50:12600 MG/KG	**ARZNAD 26,1581,1976**
	IHL-	**NIIRDN 6,215,1982**
	RATLC50:>570MG/M3/1HBIOFX*9-	**ARZNAD 26,1579,1978**
	4/1970 IPR-RAT LD50: 4420 MG/KG	**JAPMA8 39,583,1950**
	IVN-RAT LD50: 5566 MG/KG	**DMDJAP 31,276,1959**
	SCU-MUS LD50: 91 MG/KG	**BIOFX* 9-4/1970**
	IPR-MUS LD50: 8700 MG/KG	**NIIRDN 6,215,1982**
	IVN-MUS LD50: 4250 MG/KG	**JIHTAB 23,259,1941**
	ORL-RBT LD50: 27 GM/KG	**FMCHA2-,C252,91**
	SKN-RBT LD50:>10GM/KG	**FMCHA2-,C252,91**
	IVN-RBT LD50: 53 GM/KG	**FAONAU 40,144,67**
	ORL-GPG LD50: 7750 MG/KG	**JIHTAB 23,259,41**
	ORL-RAT LD50:3543 MG/KG	**FMCHA2-,C252,91**
	SKN-RBT LD50:>2 GM/KG	
	ORL-MUS LD50: 4875 MG/KG	
	ORL-GPG LD50: 1810 MG/KG	
	ORL-QAL LD50: >2250 MG/KG	
Target Organ data:	**Behavioral (headache), gastrointestinal (nausea or vomiting), Paternal effects (spermatogenesis, testes, epididymis, sperm duct), effects of fertility (male fertility index, post-implantation mortality).**	
RTECS#:	**OD2800000** **Lactic acid**	

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

Section 6 - Health Hazard Data

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

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

First Aid Procedures

Inhalation:	**Remove to fresh air. If not breathing give artificial respiration. In case of labored breathing give oxygen. Call a physician.**
Ingestion:	**No effects expected. Do not give anything to an unconscious person. Call a physician immediately.**
Skin Contact:	**Flush with plenty of water. Contaminated clothing may be washed or dry cleaned normally.**
Eye contact:	**Wash eyes with plenty of water for at least 15 minutes lifting both upper and lower lids. Call a physician.**

Section 7 - Reactivity Data

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

Section 8 - Spill, Leak or Accident Procedures

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

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

eXtended release formula Hydrogen Release Compound (HRC-X™)
MATERIAL SAFETY DATA SHEET (MSDS)

Last Revised: March 24, 2004

Section 1 - Material Identification

Supplier:

REGENESIS
1011 Calle Sombra
San Clemente, CA 92673

Phone: 949.366.8000

Fax: 949.366.8090

E-mail: info@regenesis.com

Chemical Name: Propanoic acid, 2-[2-[2-(2-hydroxy-1-oxopropoxy)-1-oxopropoxy]-1-oxopropoxy]-1,2,3-propanetriyl ester

Chemical Family: Organic Chemical

Trade Name: *eXtended release formula* Hydrogen Release Compound (HRC-X™), Glycerol tripolylactate and Glycerol

Product Use: Used to remediate contaminated soil and groundwater (environmental applications)

Section 2 – Chemical Identification

CAS#	Chemical
201167-72-8	Glycerol Tripolylactate
56-81-5	Glycerol
50-21-5	Lactic Acid

APPENDIX B

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

HRC-A Injections

Former TNT Red Star Express Site
97 Industrial Parkway
Town of Kirkwood, Broome County, New York
NYSDEC Site #704028

Prepared for:

USF Red Star LLC
3517 Embassy Parkway
Akron, Ohio 44333

Prepared by:

Leader Professional Services, Inc.
271 Marsh Road, Suite 2
Pittsford, New York 14534

October 2007

250.014

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ATTACHMENTS

1.0 Project Personnel Responsibilities

Project organization is presented below in Section 1.5.

1.1 Principle-In-Charge

The Principle-In-Charge for this project will be Michael Rumrill. Mr. Rumrill will act in a supervisory capacity over all Leader Professional Services, Inc. (Leader) employees and their subcontractors and the planned site activities with respect to the project site. Mr. Rumrill has the authority to direct site operations, including the performance of this health and safety plan. The project manager will have the required 29CFR 1910.120 40-Hour Training and have an updated 8-Hour Refresher Training Certificate.

1.2 Project Manager and Supervisor

The Project Manager and Supervisor will be Mr. Peter von Schondorf of Leader. If a substitute is required, the Project Supervisor will be an employee of Leader. The project supervisor oversees all field and related activities specific to the project when the project manager is not on the site. The project manager will have the required 29CFR 1910.120 40-Hour Training and have an updated 8-Hour Refresher Training Certificate.

1.3 Health and Safety Officer

Ms. Mary Ellen Holvey is the site's health and safety officer ("HSO"). Ms. Holvey has the authority to stop work if any operation threatens the health and safety of workers or the public. The HSO may designate a member of the work party for site health and safety responsibilities when the HSO can not be on site. The HSO will have the required 29CFR 1910.120 40-Hour Training and have an updated 8-Hour Refresher Training Certificate.

1.4 Project Team

Personnel and subcontractors on the project team will be responsible for the completion of the work plan's required tasks. All personnel on the project team will comply with the site safety plan and ensure that the site safety and health officer or supervisor is notified of any unsafe conditions. It is anticipated that the project team will consist of one to three individuals. This may vary due to any changes that occur during the actual site work. All personnel on the project team will have the required 29CFR 1910.120 40-Hour Training and participate in daily tailgate health and safety meetings.

1.5 Project Organization

Project Manager – Michael Rumrill, Leader
Site Supervisor - Peter von Schondorf, P.G., Leader
Health and Safety Officer – Mary Ellen Holvey, Leader

2.0 Site Standard Operating Safety Procedures

Standard operating and safety procedures include safety precautions and operating practices that all personnel will follow. These include:

2.1 Personal Precautions

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in any area designated contaminated.

- Hands and face must be thoroughly washed upon leaving the work area.

- Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.

- No facial hair, which interferes with a satisfactory fit of the mask-to-face seal, is allowed on personnel required to wear respirators. Personnel will use the negative pressure fit test prior to each use of the equipment.

- Contact with contaminated or suspected contaminated surfaces should be avoided. Whenever possible, do not walk through puddles, leachate, discolored surfaces, kneel on ground, lean, sit or place equipment on drums, containers, or the ground.

- Medicine and alcohol can enhance or mask the effects from exposure to toxic chemicals. Prescribed drugs should not be taken by field personnel where the potential for absorption, inhalation, or ingestion of toxic substances exists unless specifically approved by a qualified physician. Alcoholic beverages should be avoided in the off-duty hours during the project.

2.2 Operations

- All personnel going on-site must be adequately trained and thoroughly briefed on anticipated hazards, equipment to be worn, safety practices to be followed, emergency procedures, and communications.

- All personnel going into areas designated for wearing protective equipment must wear any required respiratory protection and chemical protective clothing.

- Personnel on-site must use the buddy system when wearing respiratory protection. As a minimum, one person, suitably equipped, is required as safety backup during initial entry.

- Visual contact must be maintained between pairs on-site and safety personnel. Entry team members should remain together to assist each other during emergencies.

- During continual operations, on-site workers act as safety backup to each other. Off-site personnel provide emergency assistance.

  Communications using radios, hand signals, signs, or other means must be maintained between team members at all times.

- Wind indicators visible to all site personnel should be strategically located throughout the site.

- Personnel and equipment in the contaminated area should be minimized to reduce the potential for cross-contamination and the generation of decontamination waste.

- The project manager, or his designee, and the HSO will establish work areas for various operational activities.

- Procedures for leaving a contaminated area must be planned and implemented prior to going on-site. Work areas and decontamination procedures have been established based on expected site conditions and are described in the project Work Plan.

3.0 Health and Safety Hazards

The potential hazards that may be experienced during the performance of the Work Plan include: chemical exposures from contact with contaminated groundwater; hazards inherent to working with drilling and sampling equipment and working within an active truck terminal; slip, trip, and fall hazards; and heat stress from performing heavy work while wearing protective clothing. The extent of contamination is well known, but monitoring for the presence of organic vapors will be conducted. To prevent unnecessary exposures to vapors and to limit the potential for cross-contamination, all work areas will be limited from general access. The formation of distinctive work zones will also assist in reducing the potential hazards that may exist at working at the trucking terminal.

To further reduce the potential for accidents to involve moving trucks and forklifts, Leader will coordinate each field activity with the terminal manager(s) so drivers and terminal personnel know where investigative activities are occurring on the Site. To reduce accidents from occurring that involve slip, trip, and fall hazards and hypothermia, work will be monitored by the Site HSO and workers will be encouraged to use the "buddy-system" while lifting heavy tools or items to reduce early fatigue while wearing protective clothing.

Table 1 list potential health and safety hazards that may be encountered based on general Site tasks. This list has been compiled based on the scheduled activities and potential Site conditions.

4.0 Personal Protective Equipment

4.1 Protective Equipment

All personnel will be provided with appropriate personal safety equipment and protective clothing. Each individual will be properly trained in the use of this safety equipment before the start of field activities. Safety equipment and protective clothing shall be used as directed by the Project Manager and/or Site HSO. All such equipment and clothing will be cleaned and maintained in proper condition by the personnel. The Site HSO will monitor the maintenance of personnel protective equipment to ensure proper procedures are followed.

Personal protective equipment will be worn at all times designated by this Health and Safety Plan. Levels of protective clothing and equipment are not expected to exceed Level C. Results from the previous groundwater samplings and on-site readings will be used to set action levels and levels of personal protection.

The personal protective equipment levels designated below are in conformance with EPA criteria for Level A, B, C, and D protection. All respiratory protective equipment used will be approved by National Institute for Occupational Safety and Health ("NIOSH") and Mine Safety and Health Administration ("MSHA"). Although the conditions within the proposed work areas are well known, monitoring will be completed at all times, but it is doubtful that levels of respiratory protection will exceed Level D.

4.2 Level C Protection

A. Personal Protective Equipment

- Half-face, air-purifying, canister-equipped respirator (MSHA/NIOSH approved) for acid/gas/organic vapor with particulate filter
- Chemical-resistant clothing (overalls and long sleeved jacket; coveralls or hooded, one piece or two-piece chemical-splash suit; disposable chemical resistant one-piece suits)
- Work Clothes (Long Shelve Shirt and pants)
- Gloves (outer), chemical resistant
- Gloves (inner), chemical resistant
- Boots (inner), leather work shoe with steel toe and shank
- Boots (outer), chemical resistant (disposable*)
- Hard Hat (face shield*)
- Safety Glasses or goggles
- Taping between suit and gloves, and suit and boots

*Optional

B. Criteria for Selection

Meeting all of these criteria permits use of Level C Protection.

- Measured air concentration of identified substances will be reduced by the respirator to, at, or below the substance's Threshold Limit Value (TLV)/Permissible Exposure Limits (PEL) and the concentration is within the service limit of the canister.
- Atmospheric contaminant concentrations do not exceed IDLH levels.
- Atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect the small area of skin left unprotected by chemical resistant clothing.

4.3 Level D Protection

A. Personal Protective Equipment

- Work Clothes (Long shelve shirt and pants)

- Leather, steel-toed boots

- As required:

    - Hard hat
    - Safety glasses/goggles
    - Hearing protection
    - Gloves

B. Criteria for Selection

Meeting all of these criteria permits the use of Level D Protection.

- Measured air concentrations of identified substances are below the substances Permissible Exposure Limit (PEL) or TLV.

- Oxygen content is > 19.5%.

- No unknown substances are present.

5.0 Decontamination

It is expected that the usual level of protection to be Level D. Level C will be used when potential exposures to contaminants justify increased protection. A decontamination zone will be set up at the entrance of each work zone. Based on the level of expected exposure to contaminants, the following decontamination protocol will be used.

5.1 Personnel Decontamination

It is expected that a minimum of Level D decontamination will be continually in effect at the site. On these occasions when higher levels of protection are required, appropriate decontamination procedures will be used. The extent of the decontamination procedures will be at the discretion of the site Health and Safety Officer.

In general, decontamination involves removing potentially contaminated soil from gloves and clothing, followed by scrubbing with a non-phosphate soap/water solution and clean water rinses. As a general rule, protective clothing will be removed in the reverse order as it was put on: gloves and boots off first, followed by protective suits and then breathing apparatus. As the different types of waste are generated, the team members will segregate the waste into different drums. Potentially contaminated soil and sediment will be placed into one drum and decontamination waste fluid into a second drum. All disposable items will be placed into a dry goods drum.

Certain parts of contaminated respirators, harness assemblies and leather or cloth components, are difficult to decontaminate. If grossly contaminated, they may have to be discarded. Rubber components can be soaked in soap and water and scrubbed with a brush. In addition to being decontaminated, all respirators, non-disposable protective clothing, and other personal articles must be sanitized before they can be used again unless they are assigned to individuals. The manufacturer's instruction should be followed in sanitizing the respirator masks. The Site HSO will be responsible for supervising the proper protective equipment.

All decontamination wastewaters will be collected and disposed of according to applicable regulations. This disposal will be done at the direction of the Project Manager.

5.2 Equipment Decontamination

Decontamination will be applicable to all activities on site and be completed in the contamination reduction zone ("CRZ") section of the exclusion zone. All equipment (i.e., tools, monitoring equipment, etc.) will receive initial decontamination. All equipment that has been in contact with contaminants shall be stored in an area within the limits of the existing exclusion zone or shall be thoroughly decontaminated prior to leaving the area. Decontamination will consist of cleaning of the entire piece of equipment to the satisfaction of the Site Supervisor or the HSO. Decontamination will be a multi-process task, first, all loose dirt or other foreign materials will be removed from equipment surface. Scrubbing with a synthetic wire brush may be required to remove materials that adhere to the surfaces. After the loose dirt is removed, the equipment will be washed using a detergent and water solution and a wire brush followed by successive rinses with clean water. Washing with hot water from a power washer may be substituted for a synthetic wire brush.

All dirty equipment will be stored on plastic sheeting in such a manner that decontamination waters can be collected and disposed of in accordance with applicable regulations. Clean equipment not in use will be covered with plastic and stored at a designated storage area.

Air monitoring equipment will be protected with an outer coating (i.e. plastic), if there is a potential for the equipment to come into contact with potentially contaminated materials prior to the initial entry into the exclusion zone. Decontamination will then consist of removal of the protective coating in a manner that will not contaminate the air monitoring equipment.

6.0 Site Air Monitoring

Field activities associated with the work tasks at the Site may pose hazardous conditions, such as the release of hazardous substances into the worker's breathing zone. These substances may be in the form of vapors, dusts, or mists that can enter the body through ingestion, inhalation, or direct skin or eye contact. If the HSO, relying on instrument observations and odor, determines that a condition exists in which workers may be exposed to airborne hazardous materials, the HSO will upgrade the team's level of respiratory protection and complete chemical specific monitoring.

The following paragraphs describe the monitoring parameters to be evaluated during the start of the project. As the project continues, other site-specific monitoring will be required based on site conditions and experience at the site. Because this project will be completed in the winter and the proposed work area is covered with asphalt, the concern about contaminated dust being an issue is reduced. Similarly, combustible materials have not been identified as a contaminant in the soil or groundwater, thus the necessity for oxygen and combustible gas monitors is not supported. All instruments to be used during site activities will meet the established requirements set forth by OSHA, MSHA, NIOSH, and state agencies where applicable.

Equipment observations will be made during work progress with direct reading organic vapor meter. Monitoring will take place in the work zone and workers breathing zone, up and down-wind from the work zone and at the Site perimeter. Monitoring within the work zone will be taken at least every 15 to 30-minutes. Monitoring up and down-wind of the work zone will be completed at least every 30 to 60 minutes and monitoring at the Site perimeter will be completed at least every 60 minutes. If elevated readings are obtained (elevated compared to up-wind readings or compared to Site specific action levels), then the frequency of taking measurements will be increased at the monitoring stations.

Based on preliminary monitoring well sampling data, it is anticipated that organic vapors will be below 1 ppm. Organic vapor concentrations will be the primary measure for upgrading or downgrading worker respiratory protective equipment and implementing additional precautions or procedures (See Table 2, Action Levels).

All site monitoring will be conducted by or under the direction of the Site HSO. All readings obtained will be recorded in a dedicated site notebook maintained by the Project Supervisor or designate. The Site HSO will maintain all monitoring instruments throughout the site investigation to ensure their reliability and proper operation.

7.0 Action Levels

Action levels have been established for the upgrade and downgrade in the levels of personal protective equipment. Table 2 lists the action levels, airborne concentrations and their respective personal protection for unknown sources of organic vapor concentrations. Section 8.0 discusses the minimal personal protection required for specific site activities based on current information. Changes to these specified levels are dependent on the result of air monitoring as outlined below.

8.0 Site Activities and Associated Personnel Protective Requirements

The levels of protection have been assigned anticipated Site activities (below) and represent a best estimate of exposure potential and protective equipment needed for that exposure. The site HSO will revise those levels of protection, up or down, based on air monitoring results, and on-site assessments of actual exposures.

- *Level D* - General site work with limited physical contact with contaminated soil by personnel. If workers must pick up contaminated tools or a soil samples, protective chemical resistant gloves will be worn. Respiratory protection is not required because contaminant action levels cited on Table 2 are not exceeded.

- *Modified Level C* - General site work where personnel will be in direct contact with contaminated soil or groundwater, but respiratory protection is not required because contaminant action levels cited on Table 2 are not exceeded.

- *Level C* - General site work where personnel will be in direct contact with contaminated soil or groundwater, and organic vapor measurements or dust measurements are greater than those action levels cited on Table 2.

9.0 Contingency Plan

The Project Supervisor or HSO is responsible for implementing the Contingency Plan whenever there is either a threat to human health or an environmental hazard. Possible Contingency Plan situations include actual or imminent fires, explosions or spills.

The individual discovering the emergency situation is to notify the Project Supervisor or HSO who will then notify the appropriate organizations as described in Table 3.

9.1 Assessment

The Project Supervisor is responsible for ascertaining any possible health or environmental hazards and determining the need for evacuation and notification of the proper authorities.

9.2 Control Procedures

The team member or site employee discovering a fire, explosion, spill or other emergency situation is responsible for notifying the Project Supervisor or Site HSO and as much as possible, provide the information listed in Table 3.0. The Project Supervisor or Emergency Response Coordinator will assess the situation to determine if it can be adequately handled by site personnel or if additional assistance is needed.

Before any team member attempts to extinguish a fire, clean-up and contain a spill or take any action, he or she must be aware of the properties of the material involved and its associated hazards. All team members are familiarized with this information during the initial tail grate safety meeting and are instructed on the proper protective clothing to be worn in such a situation.

Table 3 includes a list of the organizations that are available to provide emergency assistance.

9.3 Fire and/or Explosion

The most serious emergency situation that could be faced at the site would be a chemical release or major fire. In the event of a fire or explosion, the Project Supervisor or Site HSO should be notified as described in the preceding section. The Project Supervisor or Emergency Response Coordinator is responsible for determining the requirements for outside assistance as well as the necessity for site evacuation.

The Kirkwood Fire Department will be notified immediately once a fire is detected. Small fires can be extinguished using a fire extinguisher located at the site. Larger fires will require the assistance of the fire department. The fire department will be informed of the nature of the fire and wastes at the site, and if water can be used to extinguish fire.

9.4 Spill and/or Material Releases

The procedure for notification of the Project Supervisor and, or Site HSO are described in Section 9.2. In the event of a spill NYSDEC will be notified immediately. Spilled materials will be confined and absorbed with absorbent materials and the spent absorbents placed into drums or temporarily on plastic sheeting until it can be put into drums or a roll-off container for disposal.

10.0 Work Areas

The Project Supervisor and HSO, and if needed the Contractor, will clearly layout and identify work areas in the field and will limit equipment, operations, and personnel as defined in the following areas:

a) "Exclusion Zone" - This area will include all areas where environmental monitoring has shown or it is suspected that a contamination may exist and be a potential exposure problem to workers. The level of personnel protective equipment required in these areas will be determined by the Site HSO. The area will be clearly delineated from the decontamination area. As work within the hazardous zone proceeds, the delineating boundary will be relocated as necessary to prevent the accidental contamination of nearby people and equipment. The Exclusion Zone will be delineated by plastic caution tape, barriers, or fencing (e.g., chain link, snow, or orange plastic fencing).

b) Contamination Reduction Zone (CRZ) - This zone will occur at the interface of "Contaminated" and "Clean" areas and will provide for the decontamination of equipment and materials and the transfer of equipment from the Clean Area to the Exclusion Zone. This area will contain all required emergency equipment, etc. This area will be clearly delineated by plastic tape, barriers or fencing (e.g., chain link, snow, or orange plastic fencing).

c) Support Zone ("Clean" Area) - This area is the remainder of the work site and project site. The "Clean" area will be clearly delineated and procedures implemented to prevent active or passive contamination from the work site.

The function of the “Clean” area includes:

1) An entry area for personnel, material, and equipment to the “Contaminated Zone” area of site operations through the neutral zone.

2) An exit for decontaminated personnel, materials, and equipment from the “CRZ” area of site operations; and

3) A clean storage area for safety and work equipment.

11.0 Safety Equipment and Protective Clothing Specifications

All project team members and contractors will have the following safety equipment:

- Air purifying respirator with appropriate cartridges

- All protective clothing including, but not limited to:

    - Tyvek and washable PVC rain suits
    - Gloves
    - Boots

- Safety glasses

- Hearing protection

- Hard hats

12.0 Air Emissions Control

The Project Team and subcontractor shall have on site all equipment and personnel necessary to monitor and control air emissions.

It is not expected that air emissions will pose a significant risk to health and safety or to the environment due to the nature of the contaminants on this project.

The Project Manager(s) and/or the Site HSO will make the determination for requiring monitoring and control of air emissions with the assistance of the following monitoring equipment and the action levels cited on Table 2. It is anticipated that an organic vapor analyzer and chemical specific detection tubes will be used to measure the concentration of most organic contaminants in the air. These two measurement devices will handle the bulk of the real-time contaminant monitoring.

13.0 Additional Health and Safety Comments

1) The Site HSO will ensure that all safety equipment and protective clothing is kept clean and well maintained.

2) All prescription eyeglasses in use on this project will be safety glasses and will be compatible with respirators. No contact lenses shall be allowed on-site.

3) All disposable or reusable gloves worn on the site will be approved by the HSO.

4) During periods of prolonged respirator usage in contaminated areas, respirator filters will be changed upon breakthrough and at a minimum filters will be changed daily.

5) Footwear used on-site will be covered by rubber over-boots when entering or working in the "Exclusion Zone" area or "CRZ." Boots will be washed with water and detergents to remove dirt and contaminated sediment before leaving the "CRZ."

6) All personnel protective equipment used on-site will be decontaminated or disposed of at the end of the workday.

7) All air purifying respirators will be individually assigned and not interchanged between workers without cleaning and sanitizing.

8) Any team member or Contractor unable to pass a fit test as a result of facial hair or facial configuration shall not enter or work in an area that requires respiratory protection.

9) The Contractor will ensure that all project team members shall have vision or corrected vision to at least 20/40 in one eye.

10) Team members found to be disregarding any provision of this plan will, at the request of the HSO, be barred from the project.

11) Used disposable outerwear will be removed upon leaving CRZ and will be placed inside disposable containers labeled for that purpose. These containers will be stored at the site at the designated staging area. Leader will be responsible for proper disposal of these materials at the completion of the project.

12) Tyvek or PVC rain suits that become torn or badly soiled will be replace immediately.

13) Eating, drinking, chewing gum or tobacco, smoking, etc., will be prohibited in the exclusion zones and CRZ zones.

14) All personnel will thoroughly cleanse their hands, face, forearms, and other exposed areas prior to eating, smoking, or drinking.

15) All personnel will wash their hands, face, and forearms before using toilet facilities.

16) No alcohol, firearms, or drugs (without prescription) will be allowed on-site at any time.

14.0 Miscellaneous Health and Safety Items

14.1 Hypothermia

Pervious Clothing: When the ambient air temperature dips below 40^o F. the Site HSO will begin to monitor employees for signs of hypothermia. Monitoring will take the form of measuring oral temperatures. The air temperature will be measured two times a day when the air temperature is expected to be below 40^o F or as determined by the Site HSO.

Impervious Clothing: When the ambient air temperature has dip below 40^o F. the Site HSO will begin to monitor employees for signs of hypothermia. Monitoring will take the form of measuring oral temperatures and checking an individual's verbal and physical responses. As the air temperature dips below 32^o F., oral temperatures will be measured at the direction of the Site HSO and, or every hour during work periods.

In the event that the oral temperature at the beginning of the rest period drops below 96^o F., the employee will be decontaminated and be advised to proceed to a heated room or vehicle and remove wet clothing and to drink warm fluids. At the end of the rest period, the oral temperature will be taken again to ensure that the employee's temperature is above 96^o F. If the oral temperature has remained below 96^o F., the employee will be advised to take a shower to increase his/her temperature. However, if the oral temperature still remains below 96^o F. after the shower, the employee will be immediately sent to consult with a physician.

A fluid/electrolyte replacement will be used as necessary to minimize fluid loss. This liquid supplement will be stored in a cooler or thermos at the edge of the decontamination zone in plastic squeeze bottles. The plastic bottles will be marked with individual's names. Disposable cups with lids and straws may be used in place of the squeeze bottles.

Prior to drinking within the decontamination zone, the project personnel shall follow the following decontamination procedures:

1) Personnel shall wash and rinse their outer gloves and remove them.

2) Personnel shall remove their hard hats and respirators and place on a table.

3) Personnel shall remove their inner gloves and place them on a table.

4) Personnel shall wash and rinse their face and hands.

5) Personnel shall carefully remove their personal bottle or cup from the cooler to ensure that their outer clothes do not touch any bottles, cups, etc.

6) The used bottle or cups will not be returned to the cooler, but will be placed in a receptacle or container to be cleaned or disposed of.

7) Personnel shall replace their respirators, hard hats, gloves, and tape gloves prior to re-entering the hazardous zone.

14.2 Retention On-Site

During the course of the project, it is expected that waste materials will be retained on-site until removed by Leader or USF. All waste containers will be labeled according to DOT and other regulations where appropriate. Waste materials, both drummed and bulk, will be stored in designated areas. All waste drums will be sealed before they are moved from the exclusion zone.

14.3 Equipment and Material Decontamination

All equipment and material used in this project shall be thoroughly decontaminated using procedures described in the project Work Plan before it is removed from the project site. Debris and contaminated clothing and tools which cannot be decontaminated, shall be disposed of.

14.4 Communications

Telephone communications will be available at all times on the site. A telephone will be maintained in the Leader's vehicle.

Communication procedures are outlined in the Contingency Plan in Section 9.0 of the Health and Safety Plan.

Table 3 contains an emergency call list and will be posted in one of the team member's vehicles.

14.5 On-Site Hygiene Facilities

The office lavatories will be available for decontaminated team members and subcontractors in building the garage building or terminal building. Water will be available in the CRZ for decontamination.

A first aid kit will be kept in the support zone at the Site at all times.

15.0 Tailgate Safety Meetings

The HSO or the designated representative will conduct daily tailgate safety meetings each workday and will be mandatory for all project personnel. The meetings will provide information on the anticipated site conditions and the work to be completed that day. Attachment A contains a form for documenting Safety Meetings. Completed forms will be retained in Leader's project file.

Additional safety meetings will be held on an as required basis.

16.0 Medical Surveillance

All team members and subcontractors that may potentially have contact with hazardous substances at concentrations above the permissible exposure level (PEL) will be part of a Medical Monitoring Program as outlined in 29CFR 1910.134 and 29CFR 1910.120.

TABLE 1

KNOWN AND POTENTIAL HEALTH AND SAFETY HAZARDS
TNT-RED STAR SITE
KIRKWOOD, NEW YORK

Known and Potential Site Hazards: *Chemical* (See Attachment B for information sheets and/or MSDSs)

1) Contaminants

- Chlorinated solvents
- Ketones
- Aromatics
- PAHs

2) Known Chemical Hazards

See Attached

3) Review of Symptoms

Symptoms of exposure to hazardous wastes and in particular to the contaminants above will be reviewed with all site personnel. Symptoms of both acute and chronic exposures will be covered. In addition, the on-site coordinators will be advised to watch for outward evidence of changes in workers' health. These outward symptoms may include fatigue, loss of appetite, depression, drowsiness, vertigo, dizziness, nervousness or irritability, skin irritations or discoloration, eye irritation, or muscular soreness.

Note the number and nature of potential contaminants mandate that contact of waste materials with the exposed skin must not be allowed to occur under any circumstances.

Known and Potential Site Hazards: *Non-Chemical*

- General Physical Hazards. Since the project will take place at an active truck terminal, the physical hazards include:
  - Vehicular traffic
  - Moving parts of drilling equipment
  - Underground and aboveground utilities
  - Slip, trip, and fall
  - Splashing and spraying liquids

TABLE 2

ACTION LEVELS
TNT RED STAR SITE
KIRKWOOD, NEW YORK

Unknown Organic Vapor Concentrations (ppm)[1]	Level of Protection
< 1	Level D
≥ 1 < 10	Level C
>10	Level B

Anticipated Chemical Contaminants[2]	Time Weight Average (ppm)
Perchloroethylene	100
1,1,1-Trichloroethane	350
1,1-Dichloroethane	100
1,2-Dichloroethylene	50
Trichloroethylene	100
Vinyl Chloride	1

Note:

1. Unknown organic vapor action levels are based on the lowest known exposure limits for chlorine (PEL = 1 ppm, IDLH = 30 ppm). The air purifying cartridge limitation for chlorine is 10 ppm.

2. Petroleum oil and Diesel fuel are present in tanks on the site and the chlorinated compounds have been either identified in groundwater samples or they are common breakdown products of perchloroethylene.

TABLE 3

EMERGENCY CALL LIST
TNT-RED STAR SITE
KIRKWOOD, NEW YORK

Fires - Spills

Kirkwood Fire Department Police Ambulance	911

Provide the following information to the agencies:

- Name of person making the call
- Company and location
- Nature of fire (fire calls only)
- Name and estimated amount of chemical released to the environment (spills only)
- Time of release
- Remedial action taken to correct the problem

Site Contacts

Michael Rumrill (Leader Professional Services)	428-2413
Peter von Schondorf (Leader Professional Services)	455-6309

ATTACHMENT A

SAFETY MEETING SIGN-OFF SHEETS

SAFETY MEETING ATTENDENCE SIGN-OFF SHEET

Person	Date

ATTACHMENT B

MATERIAL SAFETY DATA SHEETS

CORNELL

Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format) For Cornell University Convenience Only

TETRACHLOROETHENE, 0-663

The information in this document is compiled from information maintained by the United States Department of Defense (DOD). Anyone using this information is solely reponsible for the accuracy and applicability of this information to a particular use or situation.
Cornell University does not in any way warrant or imply the applicability, viability or use of this information to any person or for use in any situation.

Section 1 - Product and Company Identification
TETRACHLOROETHENE, 0-663

Product Identification: TETRACHLOROETHENE, 0-663
Date of MSDS: 07/01/1988 **Technical Review Date:** 11/03/1994
FSC: 6810 **NIIN: LIIN:** 00N054677
Submitter: N EN
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: CHEM SERVICE INC
Post Office Box: 3108
Manufacturer's Address1:
Manufacturer's Address2: WEST CHESTER, PA 19381
Manufacturer's Country: US
General Information Telephone: 215-692-3026
Emergency Telephone: 215-692-3026
Emergency Telephone: 215-692-3026
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: N
Published: Y
CAGE: 84898
Special Project Code: N

Contractor Information

Contractor's Name: CHEM SERVICE INC
Post Office Box: 3108
Contractor's Address1: N/K
Contractor's Address2: WEST CHESTER, PA 19381
Contractor's Telephone: 215-692-3026
Contractor's CAGE: 84898

Contractor Information

Contractor's Name: CHEM SERVICE, INC
Post Office Box: 599
Contractor's Address1: 660 TOWER LN
Contractor's Address2: WEST CHESTER, PA 19301-9650
Contractor's Telephone: 610-692-3026
Contractor's CAGE: 8Y898

Section 2 - Compositon/Information on Ingredients
TETRACHLOROETHENE, 0-663

Ingredient Name: ETHYLENE, TETRACHLORO-; (TETRACHLOROETHYLENE) (SARA III)
Ingredient CAS Number: 127-18-4 **Ingredient CAS Code:** M
RTECS Number: KX3850000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:

% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: 25 PPM **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 25 PPM;100 PPM STEL **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 100 LBS
DOT Reporting Quantity: 100 LBS
Ozone Depleting Chemical: N

Ingredient Name: EYE PROTECTION: FULL LENGTH FACESHIELD (FP N).
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: N/K (FP N) **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K (FP N) **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ING 2: ARRIVED. INGESTION: CALL MD IMMEDIATELY (FP N).
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K

OSHA PEL: N/K (FP N) **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K (FP N) **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: SUPP DATA: RESPS. IF PATIENT IS IN CARD ARREST ADMIN CPR. CONTINUE LIFE SUPPORTING MEASURES UNTIL MED ASSIST HAS (ING 3)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: N/K (FP N) **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K (FP N) **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Section 3 - Hazards Identification, Including Emergency Overview
TETRACHLOROETHENE, 0-663

Health Hazards Acute & Chronic: CONT LENSES SHOULD NOT BE WORN IN LAB. ALL CHEMS SHOULD BE CONSIDERED HAZ-AVOID DIRECT PHYS CONT! CAN BE HARMFUL IF ABSORB THRU SKIN. CAN BE HARMFUL IF INHALED. CAN BE FATAL IF ABSORB THRU SKIN! CAN B E FATAL IF INHALED! MAY BE FATAL IF SWALLOWED! SUSPECTED CARCIN-MAY PRDCE CANCER. LACHRYMATOR-CAUSES (EFTS OF OVEREXP)

Signs & Symptoms of Overexposure:
HLTH HAZ: SEV EYE IRRIT. VAPS &/OR DIRECT EYE CONT CAN CAUSE SEV EYE BURNS. CAN CAUSE EYE IRRIT. VAPS &/OR DIRECT EYE CONT CAN CAUSE SEV EYE BURNS. CAN CAUSE EYE IRRIT. CAN CAUSE SKIN IRRIT. CAN CAUSE SKIN BURNS. CAN CAUSE SEV SKIN BURNS. CAN BE HARMFUL IF SWALLOWED. CAN CAUSE LIVER INJ. CAN CAUSE KIDNEY INJ. (SUPDAT)

Medical Conditions Aggravated by Exposure:

NONE SPECIFIED BY MANUFACTURER.

LD50 LC50 Mixture: LD50 (ORAL,RAT): 8850 MG/KG.

Route of Entry Indicators:
- **Inhalation:** YES
- **Skin:** YES
- **Ingestion:** YES

Carcenogenicity Indicators
- **NTP:** YES
- **IARC:** YES
- **OSHA:** NO

Carcinogenicity Explanation: TETRACHLOROETHYLENE: IARC MONOGRAPHS SUPP, VOL 7, PG 355, 1987: GRP 2B. NTP 7TH ANNUAL REPORT ON CARCINS, 1994: (SUPDAT)

Section 4 - First Aid Measures
TETRACHLOROETHENE, 0-663

First Aid:
AN ANTIDOTE IS SUBSTANCE INTENDED TO COUNTERACT EFT OF POIS. IT SHOULD BE ADMIN ONLY BY PHYS/TRAINED EMER PERS. MED ADVICE CAN BE OBTAINED FROM POIS CNTRL CNTR. EYE: FLUSH CONTINUOUSLY W/WATER FOR AT LST 15-20 MINS. SKIN: FLUSH W/WATER FOR15-20 MINS. IF NO BURNS HAVE OCCURRED-USE SOAP & WATER TO CLEANSE SKIN. INHAL: REMOVE PATIENT TO FRESH AIR. ADMIN OXYGEN IF PATIENT IS HAVING DFCLTY (SUPDAT)

Section 5 - Fire Fighting Measures
TETRACHLOROETHENE, 0-663

Fire Fighting Procedures:
WEAR NIOSH/MSHA APPROVED SCBA AND FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire or Explosion Hazard:
NONE SPECIFIED BY MANUFACTURER.
Extinguishing Media:
CARBON DIOXIDE, DRY CHEMICAL POWDER OR SPRAY.
Flash Point: Flash Point Text: NON-FLAMMABLE

Autoignition Temperature:
- **Autoignition Temperature Text:** N/A
- **Lower Limit(s):** N/A
- **Upper Limit(s):** N/A

Section 6 - Accidental Release Measures
TETRACHLOROETHENE, 0-663

Spill Release Procedures:
EVACUATE AREA. WEAR APPROPRIATE OSHA REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE OR SIMILAR MATERIAL. SWEEP UP AND PLACE IN AN

APPROPRIATE CONTAINER. HOLD FOR DISPOSAL. WASH CONTAMINATE D SURFACES TO REMOVE ANY RESIDUES.

Section 7 - Handling and Storage
TETRACHLOROETHENE, 0-663

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
TETRACHLOROETHENE, 0-663

Repiratory Protection:
WEAR NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN (FP N).
Ventilation:
CHEMICAL SHOULD BE HANDLED ONLY IN HOOD.
Protective Gloves:
IMPERVIOUS GLOVES (FP N).
Eye Protection: ANSI APPRVD CHEM WORKERS GOGG & (ING 4)
Other Protective Equipment: USE APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.EMER EYEWASH & DELUGE SHOWER WHICH MEET ANSI DESIGN CRITERIA (FP N).
Work Hygenic Practices: NONE SPECIFIED BY MANUFACTURER.
Supplemental Health & Safety Information: EXPLAN OF CARCIN: ANTIC TO BE CARCIN. ANIMAL: LIVER TUMORS. EFTS OF OVEREXP: CAN BE IRRIT TO MUC MEMB. PRLNGD EXPOS MAY CAUSE NAUS/HDCH, DIZZ &/OR EYE DMG. AVOID CONSUMPTION OF ALCOHOL BEFORE & AFTER HNDLG OF CMPD BECAUSE IT WILL INCR TOX OF CMPD. FIRST AID PROC: BRTHG. IF PATIENT HAS STOPPED BRTHG ADMIN ARTF (ING 2)

Section 9 - Physical & Chemical Properties
TETRACHLOROETHENE, 0-663

HCC:
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: 250F,121C
Melting/Freezing Point: Melting/Freezing Text: 71.6F,22C
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: 14 @ 20C **Vapor Density:** N/A
Percent Volatile Organic Content:
Specific Gravity: 1.623
Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: NOT APPLICABLE
Solubility in Water: INSOLUBLE
Appearance and Odor: COLORLESS LIQUID.
Percent Volatiles by Volume: N/K

Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
TETRACHLOROETHENE, 0-663

Stability Indicator: YES
Materials to Avoid:
STRONG BASES, OXIDIZING AGENTS.
Stability Condition to Avoid:
NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomposition Products:
DECOMPOSITION LIBERATES TOXIC FUMES. DECOMPOSITION PRODUCTS ARE CORROSIVE.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NOT RELEVANT.

Section 11 - Toxicological Information
TETRACHLOROETHENE, 0-663

Toxicological Information:
N/P

Section 12 - Ecological Information
TETRACHLOROETHENE, 0-663

Ecological Information:
N/P

Section 13 - Disposal Considerations
TETRACHLOROETHENE, 0-663

Waste Disposal Methods:
BURN IN CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER. DISPOSE OF IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS (FP N).

Section 14 - MSDS Transport Information
TETRACHLOROETHENE, 0-663

Transport Information:
N/P

Section 15 - Regulatory Information
TETRACHLOROETHENE, 0-663

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
TETRACHLOROETHENE, 0-663

Other Information:
N/P

HAZCOM Label Information

Product Identification: TETRACHLOROETHENE, 0-663
CAGE: 84898
Assigned Individual: N
Company Name: CHEM SERVICE INC
Company PO Box: 3108
Company Street Address1: N/K
Company Street Address2: WEST CHESTER, PA 19381 US
Health Emergency Telephone: 215-692-3026
Label Required Indicator: Y
Date Label Reviewed: 11/03/1994
Status Code: C
Manufacturer's Label Number:
Date of Label: 11/03/1994
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: Y
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: WARNING
Health Hazard: Moderate
Contact Hazard: Moderate
Fire Hazard: None
Reactivity Hazard: None

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CORNELL

Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format) For Cornell University Convenience Only

111 TRICHLOROETHANE

The information in this document is compiled from information maintained by the United States Department of Defense (DOD). Anyone using this information is solely reponsible for the accuracy and applicability of this information to a particular use or situation.
Cornell University does not in any way warrant or imply the applicability, viability or use of this information to any person or for use in any situation.

Section 1 - Product and Company Identification
111 TRICHLOROETHANE

Product Identification: 111 TRICHLOROETHANE
Date of MSDS: 01/01/1987 **Technical Review Date:** 12/05/1998
FSC: 6810 **NIIN:** 00-930-6311
Submitter: G AW
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: DIHOMA CHEMICAL MANUFACTURING, INC.
Manufacturer's Address1: ROUTE 3, BOX 375
Manufacturer's Address2: MULLINS, SC 29574
Manufacturer's Country: US
General Information Telephone: 803-423-7799
Emergency Telephone: 803-423-7799
Emergency Telephone: 803-423-7799
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: Y
Published: Y
CAGE: 0FMP6
Special Project Code: N

Item Description

Item Name: TRICHLOROETHANE,TECHNICAL
Item Manager:
Specification Number: 0-T-620
Type/Grade/Class: TYPE III
Unit of Issue:
Unit of Issue Quantity:
Type of Container: CAN

Contractor Information

Contractor's Name: DIHOMA CHEMICAL & MFG INC
Contractor's Address1: RT 3
Contractor's Address2: MULLINS, SC 29574
Contractor's Telephone: 803-423-7799
Contractor's CAGE: 0FMP6

Section 2 - Compositon/Information on Ingredients
111 TRICHLOROETHANE

Ingredient Name: 111 TRICHLORO ETHANE
Ingredient CAS Number: 71-55-6 **Ingredient CAS Code:** M
RTECS Number: KJ2975000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: <95.0

% Enviromental Weight:
Other REC Limits: NONE RECOMMENDED
OSHA PEL: 350 PPM **OSHA PEL Code:** M
OSHA STEL: **OSHA STEL Code:**
ACGIH TLV: 350 PPM **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 1000 LBS
DOT Reporting Quantity: 1000 LBS
Ozone Depleting Chemical: 1

Ingredient Name: CARBON DIOXIDE (PROPELLANT)
Ingredient CAS Number: 124-38-9 **Ingredient CAS Code:** M
RTECS Number: FF6400000 **RTECS Code:** M
=WT: **=WT Code:**
=Volume: **=Volume Code:**
>WT: **>WT Code:**
>Volume: **>Volume Code:**
<WT: **<WT Code:**
<Volume: **<Volume Code:**
% Low WT: **% Low WT Code:**
% High WT: **% High WT Code:**
% Low Volume: **% Low Volume Code:**
% High Volume: **% High Volume Code:**
% Text: NK
% Enviromental Weight:
Other REC Limits: NONE RECOMMENDED
OSHA PEL: NOT ESTABLISHED **OSHA PEL Code:** M
OSHA STEL: **OSHA STEL Code:**
ACGIH TLV: NOT ESTABLISHED **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
111 TRICHLOROETHANE

Health Hazards Acute & Chronic: N/P

Signs & Symptoms of Overexposure:
N/P

Medical Conditions Aggravated by Exposure:
N/P

LD50 LC50 Mixture: N/P

Route of Entry Indicators:
    Inhalation: N/P
    Skin: N/P

Ingestion: N/P

Carcenogenicity Indicators
NTP: N/P
IARC: N/P
OSHA: N/P

Carcinogenicity Explanation: N/P

Section 4 - First Aid Measures
111 TRICHLOROETHANE

First Aid:
N/P

Section 5 - Fire Fighting Measures
111 TRICHLOROETHANE

Fire Fighting Procedures:
N/P
Unusual Fire or Explosion Hazard:
N/P
Extinguishing Media:
N/P
Flash Point: Flash Point Text: NONE

Autoignition Temperature:
Autoignition Temperature Text: NK
Lower Limit(s):
Upper Limit(s):

Section 6 - Accidental Release Measures
111 TRICHLOROETHANE

Spill Release Procedures:
N/P

Section 7 - Handling and Storage
111 TRICHLOROETHANE

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
111 TRICHLOROETHANE

Repiratory Protection:
N/P
Ventilation:

N/P
Protective Gloves:
N/P
Eye Protection: N/P
Other Protective Equipment: N/P
Work Hygenic Practices: N/P
Supplemental Health & Safety Information: N/P

Section 9 - Physical & Chemical Properties
111 TRICHLOROETHANE

HCC: V2
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: N/A
Melting/Freezing Point: Melting/Freezing Text: N/A
Decomposition Point: Decomposition Text: N/A
Vapor Pressure: N/P **Vapor Density:** N/P
Percent Volatile Organic Content:
Specific Gravity: N/P
Volatile Organic Content Pounds per Gallon:
pH: N/P
Volatile Organic Content Grams per Liter:
Viscosity: NK
Evaporation Weight and Reference: N/P
Solubility in Water: N/P
Appearance and Odor:
Percent Volatiles by Volume: N/P
Corrosion Rate: N/P

Section 10 - Stability & Reactivity Data
111 TRICHLOROETHANE

Stability Indicator: N/P
Materials to Avoid:
N/P
Stability Condition to Avoid:
N/P
Hazardous Decomposition Products:
N/P
Hazardous Polymerization Indicator: N/P
Conditions to Avoid Polymerization:
N/P

Section 11 - Toxicological Information
111 TRICHLOROETHANE

Toxicological Information:
N/P

Section 12 - Ecological Information
111 TRICHLOROETHANE

Ecological Information:
N/P

Section 13 - Disposal Considerations
111 TRICHLOROETHANE

Waste Disposal Methods:
N/P

Section 14 - MSDS Transport Information
111 TRICHLOROETHANE

Transport Information:
N/P

Section 15 - Regulatory Information
111 TRICHLOROETHANE

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
111 TRICHLOROETHANE

Other Information:
N/P

HMIS Transportation Information

Product Identification: 111 TRICHLOROETHANE
Transporation ID Number: 92803
Responsible Party CAGE: 0FMP6
Date MSDS Prepared: 01/01/1987
Date MSDS Reviewed: 10/09/1996
MFN: 10/09/1996
Submitter: G AW
Status Code: C

Container Information
- **Unit of Issue:**
- **Container Quantity:**
- **Type of Container:** CAN
- **Net Unit Weight:** NK

Article without MSDS: N
Technical Entry NOS Shipping Number: NK
Radioactivity: NK
Form:
Net Explosive Weight: NK

Coast Guard Ammunition Code: NK
Magnetism: N/P
AF MMAC Code: NK
DOD Exemption Number: NK
Limited Quantity Indicator:
Multiple Kit Number: 0
Kit Indicator: N
Kit Part Indicator: N
Review Indicator: Y
Additional Data:
NK

Department of Transportation Information

DOT Proper Shipping Name: CONSUMER COMMODITY
DOT PSN Code: DTJ
Symbols: D
DOT PSN Modifier:
Hazard Class: ORM-D
UN ID Number:
DOT Packaging Group:
Label: NONE
Special Provision(s):
Packaging Exception:
Non Bulk Packaging: 156,306
Bulk Packaging: NONE
Maximimum Quanity in Passenger Area: 30KGGROSS
Maximimum Quanity in Cargo Area: 30KGGROSS
Stow in Vessel Requirements: A
Requirements Water/Sp/Other:

IMO Detail Information

IMO Proper Shipping Name: AEROSOLS/AEROSOL PRODUCT ?
IMO PSN Code: AKH
IMO PSN Modifier:
IMDG Page Number: SEE 9022
UN Number: 1950
UN Hazard Class: 9?
IMO Packaging Group: -
Subsidiary Risk Label: -
EMS Number: 2-13
Medical First Aid Guide Number:

IATA Detail Information

IATA Proper Shipping Name: AEROSOLS, FLAMMABLE
IATA PSN Code: ALS
IATA PSN Modifier: (EACH NOT EXCEEDING 1 L CAPACITY)
IATA UN Id Number: 1950
IATA UN Class: 2.1
Subsidiary Risk Class:
UN Packaging Group:
IATA Label: FLAMMABLE GAS
Packaging Note for Passengers: 203
Maximum Quantity for Passengers: 75KG

Packaging Note for Cargo: 203
Maximum Quantity for Cargo: 150KG
Exceptions:

AFI Detail Information

AFI Proper Shipping Name: AEROSOLS, FLAMMABLE, N.O.S.
AFI Symbols: *
AFI PSN Code: ALR
AFI PSN Modifier: (EACH NOT EXCEEDING 1L CAPACITY)
AFI UN Id Number: UN1950
AFI Hazard Class: 2.1
AFI Packing Group: N/A
AFI Label:
Special Provisions: P4
Back Pack Reference: A6.3

HAZCOM Label Information

Product Identification: 111 TRICHLOROETHANE
CAGE: 0FMP6
Assigned Individual: N
Company Name: DIHOMA CHEMICAL & MFG INC
Company PO Box:
Company Street Address1: RT 3
Company Street Address2: MULLINS, SC 29574 US
Health Emergency Telephone: 803-423-7799
Label Required Indicator: Y
Date Label Reviewed: 10/12/1999
Status Code: A
Manufacturer's Label Number:
Date of Label:
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: N/P
Eye Protection Indicator: N/P
Skin Protection Indicator: N/P
Respiratory Protection Indicator: N/P
Signal Word: N/P
Health Hazard:
Contact Hazard:
Fire Hazard:
Reactivity Hazard:

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eXtended release formula Hydrogen Release Compound (HRC-X™)
MATERIAL SAFETY DATA SHEET (MSDS)

Last Revised: **March 24, 2004**

Section 1 - Material Identification

Supplier:

REGENESIS

1011 Calle Sombra
San Clemente, CA 92673

Phone: **949.366.8000**

Fax: **949.366.8090**

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

Chemical Name:	**Propanoic acid, 2-[2-[2-(2-hydroxy-1-oxopropoxy)-1-oxopropoxy]-1-oxopropoxy]-1,2,3-propanetriyl ester**
Chemical Family:	**Organic Chemical**
Trade Name:	***eXtended release formula* Hydrogen Release Compound (HRC-X™), Glycerol tripolylactate and Glycerol**
Product Use:	**Used to remediate contaminated soil and groundwater (environmental applications)**

Section 2 – Chemical Identification

CAS#	**Chemical**
201167-72-8	**Glycerol Tripolylactate**
56-81-5	**Glycerol**
50-21-5	**Lactic Acid**

Section 3 - Physical Data

Melting Point:	**Not Available (NA)**
Boiling Point:	**Not Determined (ND)**
Flash Point:	**ND**
Density:	**1.3 g/cc**
Solubility:	**Acetone and DMSO**
Appearance:	**Viscous amber gel/liquid**
Odor:	**Not detectable**
Vapor Pressure:	**None**

Section 4 - Fire and Explosion Hazard Data

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

Water may be used to keep exposed containers cool.

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

Section 5 - Toxicological Information

Acute Effects:	**May be harmful by inhalation, ingestion, or skin absorption. May cause irritation. To the best of our knowledge, the chemical, physical, and toxicological properties of the glycerol tripolylactate have not been investigated. Listed below are the toxicological information for glycerol and lactic acid.**
RTECS#:	**MA8050000** **Glycerol**

Section 5 - Toxicological Information (cont)

Irritation data:	**SKN-RBT 500 MG/24H MLD**	**BIOFX* 9-4/1970**
	85JCAE-,207,1986	**85JCAE-,207,1986**
	EYE-RBT 126 MG MLD	**85JCAE -,656,86**
	EYE-RBT 500 MG/24H MLD	**AJOPAA 29,1363,46**
	SKN-RBT 5MG/24H SEV	
	EYE-RBT 750 UG SEV	
Toxicity data:	**ORL-MUS LD50:4090 MG/KG**	**NIIRDN 6,215,1982**
	FRZKAP (6),56,1977	**FEPRA7 4,142,1945**
	SCU-RBT LD50:100 MG/KG	**RCOCB8 56,125,1987**
	ORL-RAT LD50:12600 MG/KG	**ARZNAD 26,1581,1976**
	IHL-	**NIIRDN 6,215,1982**
	RATLC50:>570MG/M3/1HBIOFX*9-	**ARZNAD 26,1579,1978**
	4/1970 IPR-RAT LD50: 4420 MG/KG	**JAPMA8 39,583,1950**
	IVN-RAT LD50: 5566 MG/KG	**DMDJAP 31,276,1959**
	SCU-MUS LD50: 91 MG/KG	**BIOFX* 9-4/1970**
	IPR-MUS LD50: 8700 MG/KG	**NIIRDN 6,215,1982**
	IVN-MUS LD50: 4250 MG/KG	**JIHTAB 23,259,1941**
	ORL-RBT LD50: 27 GM/KG	**FMCHA2-,C252,91**
	SKN-RBT LD50:>10GM/KG	**FMCHA2-,C252,91**
	IVN-RBT LD50: 53 GM/KG	**FAONAU 40,144,67**
	ORL-GPG LD50: 7750 MG/KG	**JIHTAB 23,259,41**
	ORL-RAT LD50:3543 MG/KG	**FMCHA2-,C252,91**
	SKN-RBT LD50:>2 GM/KG	
	ORL-MUS LD50: 4875 MG/KG	
	ORL-GPG LD50: 1810 MG/KG	
	ORL-QAL LD50: >2250 MG/KG	
Target Organ data:	**Behavioral (headache), gastrointestinal (nausea or vomiting), Paternal effects (spermatogenesis, testes, epididymis, sperm duct), effects of fertility (male fertility index, post-implantation mortality).**	
RTECS#:	**OD2800000**	
	Lactic acid	

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

Section 6 - Health Hazard Data

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

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

First Aid Procedures

Inhalation:	**Remove to fresh air. If not breathing give artificial respiration. In case of labored breathing give oxygen. Call a physician.**
Ingestion:	**No effects expected. Do not give anything to an unconscious person. Call a physician immediately.**
Skin Contact:	**Flush with plenty of water. Contaminated clothing may be washed or dry cleaned normally.**
Eye contact:	**Wash eyes with plenty of water for at least 15 minutes lifting both upper and lower lids. Call a physician.**

Section 7 - Reactivity Data

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

Section 8 - Spill, Leak or Accident Procedures

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

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

Section 9 - Special Protection or Handling

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

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

Section 10 - Other Information

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

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

MAPQUEST

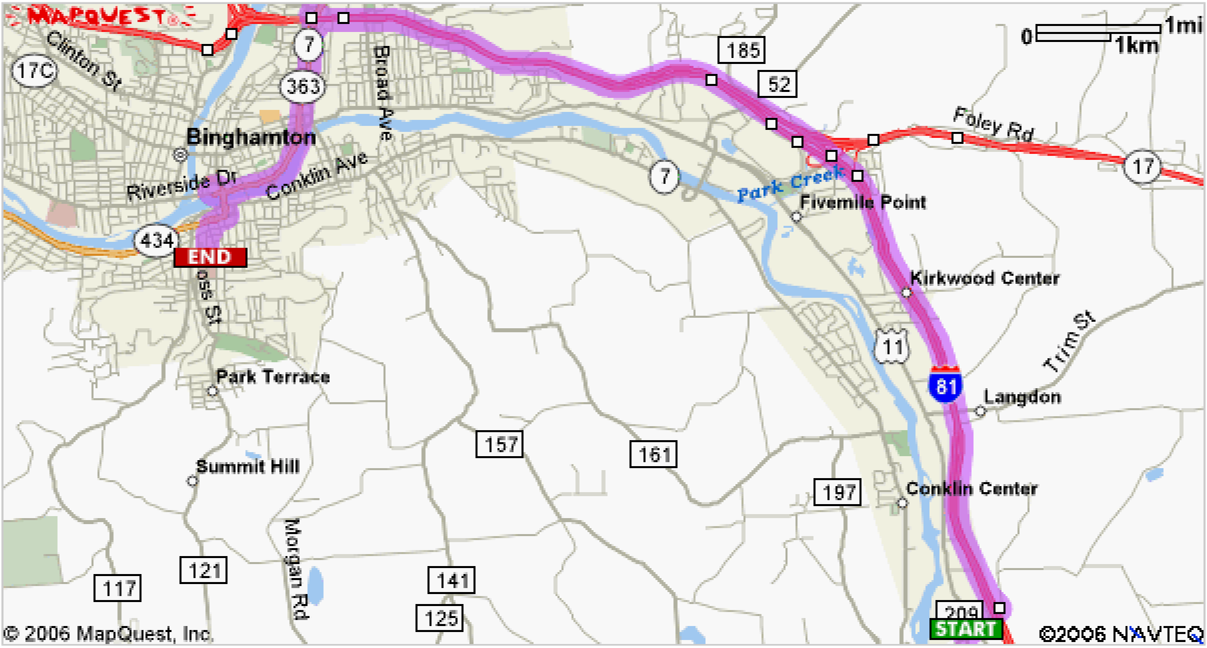
Start: **Kirkwood, NY US**

End: **Binghamton General Hospital**:
607-762-2200
10-42 Mitchell Ave, Binghamton,
NY 13903, US

Notes:

	Directions	**Distance**
	Total Est. Time: 15 minutes **Total Est. Distance:** 11.93 miles	
START	**1:** Start out going NORTHEAST on CR-20 toward CEDARHURST RD.	0.3 miles
NORTH 81	**2:** Merge onto I-81 N via EXIT 1 on the LEFT.	8.3 miles
4N-S EXIT	**3:** Take the RT-17 exit- EXIT 4N-S- toward HILLCREST / BINGHAMTON.	<0.1 miles
4S EXIT	**4:** Take the RT-7 exit- EXIT 4S- on the LEFT toward BINGHAMTON.	0.3 miles
WEST 363	**5:** Merge onto NY-363 W.	1.9 miles
RAMP	**6:** Take the N Y 434 WEST ramp toward VESTAL.	0.2 miles
WEST 434	**7:** Merge onto NY-434 W.	0.3 miles
←	**8:** Turn LEFT onto S WASHINGTON ST.	<0.1 miles
→	**9:** Turn RIGHT onto VESTAL AVE.	<0.1 miles
←	**10:** Turn LEFT onto MITCHELL AVE.	0.1 miles
END	**11:** End at **Binghamton General Hospital** 10-42 Mitchell Ave, Binghamton, NY 13903, US	

Total Est. Time: 15 minutes **Total Est. Distance:** 11.93 miles



Start:
Kirkwood, NY US

End:
Binghamton General Hospital:
607-762-2200
10-42 Mitchell Ave, Binghamton, NY
13903, US

APPENDIX C

GROUNDWATER SAMPLING PROCEDURES

Procedures for Groundwater Quality Sampling

The purpose of this document is to explain the procedures that will be followed during all groundwater sampling activities at the Site.

The water quality sampling will take place over a period of several days. The first day will consist of the pre-sampling activities listed below. All of the water level measurements for the wells to be sampled during each round will be made in a single day. Wells will be evacuated and sampled during the same day.

PRE-SAMPLING ACTIVITIES

Well Maintenance Check

Prior to every sampling event, a routine inspection of the condition of the protective casing and surface seal will be performed. The protective casing will be inspected for the integrity of the locking cap and the surface seal. In addition, each well will be checked for any other signs of damage or inadvertent entry. Observations of any irregularities will be noted in the field logbook, as well as the well number, date, and time.

Air Monitoring

In order to provide workers with the proper respiratory protection for sampling, air monitoring in the breathing zone and immediately over the wellhead will be performed immediately after the initial uncapping. Health and safety procedures that are appropriate to the ambient air conditions will be implemented. Readings for both the breathing zone and wellhead will be recorded in the field logbook. See the Health and Safety Plan for respiratory protection action levels, and a description of the proper air monitoring equipment.

Water Level Measurements

The depth to groundwater will be measured with an electronic depth-indicating sounder. The probe will be lowered into the well until the meter indicates water is reached. The probe will be raised above the water level and slowly lowered again until water is indicated. The cable will be held against the side of the inner protective casing for water level measurements and a depth reading taken. The value will be recorded to the nearest 0.01 foot in the field logbook. The measurement will be repeated three times and the measurement recorded. The probe will be raised to the surface and together with the amount of cable that was wetted in the well, will be decontaminated with a wipe followed by a distilled/deionized water rinse.

The calibrated cable on the depth indicator will be checked against a surveyor's steel tape once per quarter year. A new cable will be installed if the cable has changed by more than 0.01 percent (0.01 feet for a 100-foot cable).

WELL EVACUATION

Overburden Monitoring Wells

- The well will be purged with a low flow peristaltic pump. The pump's acrylic or PVC intake tubing will be lowered into the monitoring well to a point that is approximately in the center of the monitoring well screen or in the center of the water column. The discharge end of the tubing will be placed into a flow-through cell from which groundwater quality parameters will be measured. The discharge from the flow-through cell will be routed into a five-gallon bucket for discharge measurement. For sampling water flow will be approximately 0.25 liters per minute or until a constant stream of water is obtained. The water level in the monitoring well will also be monitored and not allowed to drop below 0.125 feet from the original pre-sampling static water level.
- When the groundwater quality is stable indicating that a representative sample of groundwater can be collected, the discharge end of the tubing will be disconnected from the flow-through cell and routed into a five-gallon bucket to collected spills from the filling of sample containers.
- The appropriate sample vials will be filled slowly and with a constant stream of water (flow) to avoid sample aeration and the field parameter tests conducted as described in "Field Measurements."

FIELD MEASUREMENTS

A portion of the groundwater collected during the sampling procedures will be subjected to the field tests of temperature, dissolved oxygen ("DO"), turbidity, specific electrical conductance, oxidation-reduction potential ("ORP") and pH. Field measurements will be conducted on the well purge water immediately prior to sample collection. Groundwater for these tests will be collected and measured in a plastic flow-through cell. All field test parameters will be measured with a portable water quality instrument such as a Horiba U-22 Water Quality Monitoring System. Temperature will be measured to the nearest tenth of a degree and the value recorded in the field logbook. Turbidity will be measured in standardized nephelometeric turbidity units ("N.T.U."). After each measurement the N.T.U. value of the sample will be recorded. The goal of the well purging will be to reduce the turbidity of the groundwater extracted from the monitoring well to less than or equal to 50 N.T.U. The specific electrical conductance will be measured to the nearest 1unit and recorded in the field logbook. The pH will be measured to the nearest 0.1-pH unit and the reading recorded in the field logbook. The DO will be measured to the nearest 0.1 unit and the reading recorded in the field logbook. The ORP will be measured to the nearest 1-millivolt and the reading recorded in the field logbook. Calibration will be conducted according to manufacturer's specifications.

EQUIPMENT DECONTAMINATION

All of the sampling equipment (excluding the water quality probes) will be decontaminated between sampling events using the following procedures or disposed of a dedicated piece of equipment.

- An initial wash with trisodium phosphate dissolved in clean water;
- Clean water rinse;
- Five percent nitric acid rinse;
- Distilled/deionized water rinse;
- Pesticide Grade Methanol rinse;
- Distilled/deionized water rinse; and
- Air dry.

Decontamination wastewater will be collected in containers and disposed of properly.

SAMPLE LABELS

Sample labels will be placed on all samples and will contain the following information:

- Date and time of collection;
- Sample location;
- Sample number;
- Analysis to be performed; and
- Sampler's initials.

FIELD LOG BOOKS

The field logbooks used during sampling procedures will include the following information:

- Sampler's name (initials);
- Sampling location;
- Static water level (depth to water);
- Depth to bottom of the well;
- Calculated well volume;
- Actual evacuation volume;
- Date and time;
- Analyses to be performed;

- Preservation method;
- Field meter calibration information;
- General remarks (weather conditions, etc.); and
- Sample number.

All entries will be made in black indelible ink with a ballpoint pen and will be written legibly. Entry errors will be crossed out with a single line, dated, and initialed by the person making the correction. The Quality Assurance Officer on a weekly basis will review Field logbooks

SAMPLE CHAIN-OF-CUSTODY

A chain-of-custody form will be completed after sample collection event. The chain-of-custody forms will accompany the samples to the laboratory. The field personnel collecting the samples will be responsible for the custody of the samples until transportation to the laboratory. Sample transfer will require the individuals relinquishing and receiving the samples to sign, date, and note the time on the chain-of-custody forms.

REMEDIAL ACTION WORK PLAN
VOLUME II

Former TNT Red Star Express Site
97 Industrial Parkway
Town of Kirkwood, Broome County, New York
NYSDEC Site #704028

Prepared for:

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271 Marsh Road, Suite 2
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August 2007

250.014

Table of Contents

1.0 Introduction/Purpose

This Remedial Action Work Plan is for the remediation of the former TNT Red Star Express, Inc. site located in the Town of Kirkwood, in Broome County. The site is on the NYSDEC's Inactive Hazardous Waste Site Registry and identified by site identification #704028. This work plan was prepared in partial fulfillment of the Order on Consent, index #B7-0521-97-09, between USF Red Star LLC, ("USF") the successor to TNT Red Star Express, Inc., and the New York State Department of Environmental Conservation ("NYSDEC"). The Order on Consent was issued to address the site's need for remediation and includes the development of appropriate work plans, reports, and construction activities required to remediate the site. A Record of Decision ("ROD") for the site was signed on February 23, 2001 requiring USF to implement a groundwater pumping system and a bioreactor treatment system to clean up the site's groundwater contamination problem. In July 2007 NYSDEC issued an Explanation of Significant Difference changing the ROD to insitu intrinsic bioremediation of the groundwater using Regenesis' Hydrogen Releasing Compound ("HRC").

This work plan was prepared as a complement to the Remedial Design Work Plan.
Covered in this Remedial Action Work Plan will be the following topics:

- Location of Constructed Facilities (Injection locations);
- Standards, Criteria and Guidelines (including inspections, monitoring, and professional certifications);
- Controls (dusts, odors, and organic vapors) and Monitoring;
- Health and Safety Plan;
- Estimated Cost;
- Schedule;
- Institutional Controls; and
- Operation, Maintenance, and Monitoring Plan.

2.0 Location of Constructed Facilities and SCGs

2.1 Location of Constructed Facilities

The remediation of the site will require no constructed facilities, but will require the injection of a lactic acid substrate to change site conditions enhancing the insitu intrinsic bioremediation process. The lactic acid substrate to be used will be Regenesis' HRC-A. The injection of the HRC-A will be done in two areas of the site also referred to as treatment areas:

1. Treatment Area A is the former oil/water separator area where 1,1,1-Trichloroethane ("1,1,1-TCA") is the primary contaminant; and

2. Treatment Area B is located along the southernmost property line between monitoring well GP-2 and immediately east of monitoring well MW-4.

Currently, only Treatment Area B will be completed because Treatment Area A is still utilizing the HRC injected during the September 2006 Pilot Study. Monitoring will identify when additional injections of HRC-A will be needed. The HRC-A will be injected using direct push tools, which will inject the HRC-A within the contaminated zone. The remedial design work plan specifies the amount of HRC-A (per foot of contaminated zone) required and the depth of the top and bottom of the contaminated zone. In general, each treatment zone will be constructed as two parallel lines of injection points. The downgradient injection point locations will be offset from the upgradient injection points by half the distance between the upgradient injection points.

2.2 Standards, Criteria, and Guidelines

The Standards, Criteria, and Guidelines ("SCGs") for this project will include the following;

- Technical Operational Guidance Series ("TOGS") 1.1.1 Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations.

- Title 6 of New York State Code Rules and Regulations Part 702 "Derivation and Use of Standards and Guidance Values."

- Title 6 of New York State Code Rules and Regulations Part 371 "Identification and Listing of Hazardous Waste."

- Title 6 of New York State Code Rules and Regulations Part 375 "Environmental Remediation Program."
- NYSDEC's Draft DER-10 Technical Guidance for Site Investigation and Remediation, December 2002.

Most important of the SCGs will be the TOGS 1.1.1 Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, which specify the acceptable levels of chemicals in the groundwater. In general the chemicals found in the groundwater, which require remediation, have a groundwater quality criteria of 5 micrograms per liter ("µg/L") with the exception of Vinyl Chloride, which has a limit of 2 µg/L.

In addition to these regulatory requirements, the NYSDEC requires all remedial work plans be prepared under the supervision and certified by an engineer licensed by the State of New York.

3.0 Control (dusts, odors, and organic vapors) and Monitoring

The HRC injection procedures are addressed in the Remedial Design Work Plan (Volume I). This document addresses the control of dusts, odors, and organic vapors. Other health and safety and exposure concerns are addressed in the project Health and Safety Plan. will be addressed. It is envisioned that dusts, odors and organic vapors will not be an issue, because of the type of activity planned and our experience with the site conditions. However, the potential for organic vapors is present and will be monitored for during the injection and sampling activities. Dust is not expected to be an issue because there will be no excavating work and the products being used are viscous liquids and water. If workers detect odors or if monitoring reveals organic vapors are a problem by either being a nuisance or exceeding the Health and Safety Plan's action level, activities will be suspended until the problem can be resolved. If the problem cannot be addressed, the Health and Safety Officer will require an appropriate upgrade in worker safety equipment and perimeter monitoring.

4.0 Health and Safety Plan

The Site’s Health and Safety Plan for the planned activities is provided as Appendix B.

5.0 Estimated Cost

The estimated cost for implementing the remediation and two years of monitoring is approximately $180,000.00.

6.0 Schedule

The schedule for the project is presented in phases on Figure 7. The project phases include:

- Procurement and mobilization;
- Implementation; and
- Operation, Maintenance, and Monitoring

The complete project will take approximately two years to achieve the remedial action objectives.

7.0 Institutional Controls

Since the site is an industrially zoned property and the site contaminants are only in the site's groundwater, there are minimal risks of exposure from surface soils, which might require institutional controls such as fencing to restrict access. The zoning of the property would not allow the property use for residential purposes, childcare facilities, or schools.

The Town of Kirkwood Building Department should be notified to require organic vapor monitoring of the soil and groundwater conditions during excavation work completed in the area of the site affected by groundwater contamination. If future excavation work will encounter the water table, be completed in the former spill area, or be completed in the former oil/water separator area, a soil management plan should also be required due to the potential for contaminated soil to be handled.

8.0 Operation, Maintenance, and Monitoring Plan

Following the implementation of the remedial design, groundwater conditions will require monitoring to measure the progress of the groundwater cleanup and to monitor the effectiveness of the bioremediation process. To accomplish this monitoring, quarterly groundwater samples will be collected for the two years at which time the operation, maintenance and monitoring plan will be re-evaluated.

Analyses to be completed will include USEPA Target Compound List ("TCL") volatile organic compounds, Methane, Ethane, Ethene, inorganic carbon (Alkalinity), and field parameters including pH, temperature, dissolved oxygen, and oxidation – reduction potential ("ORP"). Sampling for these parameters will follow the procedures detailed in the Volume 1, Remedial Design Work Plan.