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Ashland Inc.

Corrective Measure Implementation Work Plan

Rensselaer, New York

March 2010

ARCADIS

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Corrective Measure Implementation Work Plan

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1. Introduction

1.1 General

This *Corrective Measure Implementation* (CMI) *Work Plan* describes the activities required to implement the corrective measure for the Ashland Inc. property (the "Site") located at 130 South Street, Rensselaer, New York. A site plan is provided as Figure 1.

This CMI report has been prepared by ARCADIS on behalf of Ashland Inc. (Ashland) in accordance with *Administrative Order on Consent, Docket No. II* RCRA-92-3008(h)-0201, between Ashland and the United States Environmental Protection Agency (USEPA) Region 2.

The CMI activities described herein comprise the selected remedy for the Site which consists of the following (see Figure 2 for sample locations):

- Installing and operating an enhanced bioattenuation remediation system.
- Monitoring performance of enhanced bioattenuation remediation system.
- Monitoring concentrations of benzene, toluene, ethyl benzene, and xylene (BTEX) in groundwater adjacent to the temporary monitoring well location PDI-11 for a period of 2 years.
- Monitoring groundwater and if necessary, evaluating additional vapor monitoring, at the former Volvo Service Center.
- Providing institutional and engineering controls.
- Removing the groundwater collection and treatment system.

1.2 Organization of Work Plan

The CMI Work Plan has been organized into the following sections:

Section	Purpose
Section 1 – Introduction	Provides a brief overview of the CMI activities and organization.
Section 2 – Program Management Plan	Presents the management strategy for performing the design, construction, operation and maintenance, and monitoring of the proposed corrective measure activities.

Section	Purpose
Section 3 – Corrective Measure Design	Presents a detailed description of the CMI activities.
Section 4 – Construction Quality Assurance Plan	Presents quality control procedures for the construction, evaluation, and documentation during the corrective measure activities.
Section 5 – Reports	Presents reports to be completed as a result of this CMI.

2. Program Management Plan

2.1 General

This section presents the management strategy for performing the design, construction, operation and maintenance, and monitoring of the proposed corrective measure activities at the Site. In a letter dated September 2, 2009, the United States Environmental Protection Agency (USEPA) provided approval for using the onsite enhanced bioattenuation remedial alternative proposed in the Revised Corrective Measures Study (CMS) Report (ARCADIS, 2009). After receiving approval of the Revised CMS Report, a Pre-Design Investigation (PDI) was conducted to gather data to support an in-situ enhanced reductive dechlorination (ERD) remedial system design. The results of the PDI are attached as Appendix A.

In an email dated September 21, 2009 to the USEPA, using a streamlined CMI Work Plan was proposed. A streamlined CMI Work Plan is designed to develop a remedial program appropriate in size and scope for the proposed remedy at the Site. In an email correspondence dated September 23, 2009, the USEPA approved the use of a streamlined CMI Work Plan.

The corrective measure proposed for the Site consists of onsite enhanced bioattenuation to be achieved through creation of an ERD in-situ reactive zone (IRZ) to address chlorinated volatile organic compounds (CVOCs) at the downgradient site property boundary at two locations along the southern end of the property. The IRZ areas are illustrated on Figure 3.

ERD is an engineered in-situ bioremediation technique that employs an easily degradable carbohydrate solution (e.g., corn syrup, molasses, etc.) injected into groundwater to provide excess organic carbon. The presence of excess organic carbon initiates a succession of biological events in the subsurface that drives the groundwater environment to anaerobic and strongly reducing (methanogenic) conditions. The zone in which this environment is established is termed the IRZ and enhances the rate of reductive dechlorination of CVOCs. The ERD technology relies on an active delivery method, typically reusable injection wells, where the organic carbon source is periodically injected under low pressure. Additional injections, natural dispersion, and advective groundwater transport also help maintain and propagate the IRZ. Furthermore, the ERD technology relies on a carbohydrate substrate that is easily degradable by naturally occurring bacteria. This allows microbial populations to flourish in a relatively short time frame, resulting in a highly

reducing groundwater environment and supporting CVOC degradation at rates sufficient to meet remedial goals. Additional detail can be found in *Appendix B – Technical Basis for Enhanced Reductive Dechlorination Remedy* of the CMS Report (ARCADIS, 2009).

Implementation of the proposed corrective measure for the Site generally consists of the following activities:

- Installing ten injection wells at select locations along the downgradient site property boundary creating the Northern and Southern IRZ Areas.

- Installing two additional groundwater monitoring wells in addition to the existing onsite and offsite groundwater monitoring wells. One monitoring well will provide a location for additional performance monitoring of the southern IRZ and the other will provide a location for monitoring concentrations of BTEX compounds between the two IRZ areas.

- Injecting carbohydrate solution at each of the ten proposed injection well locations and one existing injection well location creating an enhanced bioattenuation IRZ that addresses CVOCs currently migrating via groundwater to offsite areas.

- Performing monthly (12 times/year) carbohydrate solution injections per year for the first 2 years and nine injections per year during the following 8 years (3 to 10 years after initiation of the IRZs).

- Completing quarterly performance monitoring for the first 2 years and semi-annual performance monitoring the following 8 years (3 to 10 years after initiation) of the IRZ areas to monitor carbon substrate loading and progress of CVOC degradation.

- Performing semi-annual groundwater monitoring to monitor levels of BTEX compounds in groundwater at the newly installed monitoring well location MW-20.

- Continuing monitoring of VOC concentrations in groundwater adjacent to the former Volvo Service Center to evaluate the potential need for future soil vapor monitoring.

2.2 Project Disciplines and Personnel

The table below presents the personnel and responsibilities for this CMI.

Role	Contact	Responsibilities
Project Manager/Principal Geologist	George Thomas	Client Contact, resource coordination, reviews major deliverables, overall QA, and budget tracking.
Remedial Design/Senior Civil Engineer	Brad Koons	Review major deliverables for technical accuracy and overall QA.
Construction Management/ Staff Geologist	Katherine Potter	Task manager, budget tracking, schedule, QA, deliverables, client communications, and HASP.
Technical Support/ Environmental Engineer	Ally Auffermann	Technical support on deliverables, assist with budget tracking, cost estimates, work plans, reports, and designs.
Technical Support/ Environmental Scientist	Andrew Enigk	Cost estimates, work plan, and designs.
Health and Safety	Charles Webster	Senior review of HASP and addenda (as necessary) and advise overall health and safety requirements.
Data Management	Pat Foos	Manage electronic transfer with analytical laboratories, process analytical data, and manage database.
Data Validation	Melissa Hall	Perform validation of laboratory data and prepare Data Usability Summary Report (DUSR).

2.3 Qualifications

2.3.1 Engineer Qualifications

The qualifications of the key personnel for ARCADIS for this CMI are provided below:

Project Management:

George Thomas has more than 24 years of professional experience in managing and implementing site characterization/remediation programs. His experience covers all aspects of remedial programs for a wide variety of contaminant types and media from initial scoping/negotiations through site characterization, development of remedial alternatives, design (pump and treat systems, soil removal and capping, sheet pile installation, utility modifications) and site closure.

Remedial Design:

Brad Koons has more than 12 years of experience specializing in bioremediation of environmental contaminants. Mr. Koons has an extensive background in pilot testing, design, and operation of mass transfer and bioremediation-based soil and groundwater remediation systems, and has developed several new remediation techniques and approaches. He has authored numerous technical articles focusing on enhanced petroleum and chlorinated hydrocarbon bioremediation processes. Mr. Koons is a registered professional engineer in the state of Minnesota.

Construction Management:

Ms. Potter has more than 10 years of experience managing field crews, subcontractors, and coordinating with other consultants to oversee the drilling/installation of monitoring/recovery/injection wells, soil vapor points, and investigative soil borings and has extensive experience sampling and overseeing the sampling of groundwater, soil, air, and soil vapor. She has served as task manager on many projects over the past three years and brings a wide range of field and project experience to the team. Ms. Potter has acted as a consultant for Ashland for nearly three years and therefore brings intimate knowledge of the client's needs to this stage of the project. She is a registered professional geologist in Pennsylvania.

Technical Support:

Ally Auffermann has 4 years of experience specializing in bioremediation chlorinated solvents at in-situ remediation projects. She has experience in project cost estimates, feasibility studies, and engineering design of different remediation technologies, including soil-vapor extraction, in situ chemical oxidation, enhanced reductive dechlorination, and tracer studies. Ms. Auffermann has been involved in several large-scale remediation projects throughout the United States.

Health and Safety Support:

Mr. Webster has more than 16 years of experience in environmental health and safety (EHS) and is the Corporate Health and Safety Manager responsible for stewardship of the ARCADIS health and safety program. He provided guidance and training for initial rollout of Loss Prevention System throughout ARCADIS and currently manages all facets of corporate internal health and safety programs. He reviews health and safety plans for ARCADIS/ARCADIS Construction & Environment Services projects.

2.3.2 Contractor Qualifications

The contractor to be used for the well installations will be determined at a later date and will have extensive experience installing all varieties of environmental wells. ARCADIS or a contractor will perform the carbohydrate injection activities.

3. Corrective Measure Design

3.1 Design and Specifications

3.1.1 Site Preparation Activities

The CMI activities will be implemented by a qualified remedial Contractor with oversight provided by ARCADIS. Work activities to be conducted by the selected remedial Contractor in preparation for implementing the CMI activities include the following:

- Obtaining necessary access approvals and permits from the Department of Transportation (DOT) to allow installation of monitoring well location MW-21 in the DOT right-of-way (ROW) west of CSX property line and the Site. ARCADIS will prepare a letter requesting access to DOT property and will provide fees (as necessary) to acquire permits for drilling activities in the ROW.

- Determining proposed injection and monitoring well locations by measuring distance from each well to existing structures/features.

- Using flagged wooden stakes, flagged metal pins, and/or spray paint, as appropriate, to mark the injection and monitoring well locations.

- Reviewing available utility drawings to confirm location of subsurface utilities in the proposed work areas.

- Contacting Dig Safely New York to initiate a utility clearance request a minimum of three working days prior to the start of the CMI field activities.

- Conducting an onsite utility stake out via a private utility locator (e.g., Underground Services, Inc./SoftDig).

- Hand-clearing utilities to a depth of at least four feet below ground surface (bgs) at each proposed boring location.

- Mobilizing 55-gallon drums for storage of water and soil cuttings generated by the CMI activities, including soil cuttings from the well installations, well development and decontamination water.

- Constructing an equipment decontamination pad outside of the drilling area onsite. The decontamination pad will be constructed such that water will be collected within a lined polyethylene material that will slope to a collection sump which pumps decontamination fluids into a 55-gallon drum for appropriate offsite disposal by Ashland.

- Mobilizing labor, equipment, materials, and supplies necessary and incidental for implementing the CMI activities.

3.1.2 IRZ Installation

Based on the results of the *PDI Summary Report* dated July 9, 2009 and provided as Appendix A, it is proposed to construct two IRZs to promote onsite bioattenuation of CVOCs in groundwater at the Site. The IRZs will be installed along two select areas along the western property boundary and will be referred to as the Southern IRZ Area and the Northern IRZ Area (centrally located at the Site along the western property boundary).

Installation of Injection Wells

It is proposed to install 6 new injection wells (injection well locations IW-A2, IW-A3, IW-A4, IW-A5, IW-A6, and IW-A7) along the Southern IRZ Area and 4 injection wells (injection well locations IW-B2, IW-B3, IW-B4, and IW-B5) along the Northern IRZ Area using an all-terrain vehicle (ATV) drill rig equipped with 4.25-inch inside-diameter hollow-stem augers. These new injection points will supplement existing point IW-B1 along the Northern IRZ Area. It is also proposed to install injection well location IW-A4 to substitute the use of the existing injection well location IW-A1 which is located on CSX property limiting its accessibility. Using a split-spoon sampler, soil samples will be collected continuously beginning at the ground surface to approximately 12 feet below ground surface (bgs). The soil sample recovered from each sampling interval will be visually-characterized (for color, texture, and moisture content) and headspace screened using a photoionization detector (PID).

The injection wells will be installed with screens across the more permeable sand layer (as determined during the PDI), between 2 and 12 feet bgs. The wells will be constructed of 2 feet of 2-inch black steel riser with 10 feet of 2-inch 0.010 slot wire wrapped stainless steel screen (based on evaluation of the grain size distribution data during the PDI). The injection well construction details are presented on Figures 3A and 3B.

The injection wells will be developed by pumping water from each well using an inertial-type pump (e.g., a Waterra® or similar). Pumping will continue until the turbidity is reduced to 50 nephelometric turbidity units (NTU) or less, or until stable water quality parameters (pH, temperature, oxidation reduction potential, dissolved oxygen, and specific conductivity) are obtained or a maximum of ten well volumes are removed.

3.1.3 Injection Solution and Organic Carbon Loading

The selected remedy involves the injection of a carbohydrate reagent solution into the subsurface to stimulate bioattenuation of CVOCs via reductive dechlorination. The injection volume for each well is calculated using the following equation:

$$V_{inj} = \pi \times ROI^2 \times h \times \theta_m \qquad (1)$$

where:

V_{inj} = injection volume
ROI = radius of injection
h = length of the well screen
θ_m = mobile porosity of formation

A mobile porosity of 0.015 estimated from a tracer injection test conducted at the Site was used for the volume calculation. With a target ROI of 15 feet and a well screen length of 10 feet, the per-well injection volume required for effective treatment is approximately 800 gallons per well.

The frequency of solution injection is determined by the minimum time for the injected solution to flush through the injection zone, which is calculated using a groundwater velocity (V_{GW}) of 0.8 feet/day based on data reported in Appendix B of the CMS Report (ARCADIS, 2009), and the length of an injection zone through which the solution will travel (i.e., 2 x ROI = 30 feet):

$$t_{travel} = \frac{2 \times ROI}{V_{GW}} \qquad (2)$$

The travel time is approximately 38 days. Therefore, carbohydrate solution injections will initially be conducted once a month. A two percent (2%) vol/vol dilute molasses solution will initially be used as the carbohydrate reagent to provide subsurface organic carbon to support microbial reductive dechlorination.

Organic carbon loading, including injection volume, injection frequency and carbohydrate solution strength, will be assessed and refined throughout the course of system operation to optimize remedial performance. The following parameters will be observed in performance monitoring wells downgradient of the carbohydrate injection gallery and used to adjust organic carbon loading:

- Degradation of CVOCs and generation of daughter products.
- Total organic carbon (TOC) concentrations (to be maintained above the background levels).
- pH within the IRZ (to be maintained within the neutral pH range).
- Generation of methane gas (dissolved methane to be maintained above background levels).

In addition, if excessive gas generation occurs in any injection well, which may result in high back pressure and prohibit fluid injection, injection into that well may be skipped temporarily. The normal injection schedule will be resumed once the injection may be performed without high back pressure.

Ideally performance monitoring wells are placed approximately 100 days aquifer travel time downgradient of the injection gallery for observation of TOC and methane, which are not conservative. Due to access limitations imposed by the CSX rail lines located downgradient of the proposed southern IRZ, the performance monitoring well for that IRZ will be located approximately 175 days downgradient. Because the well will be located greater than 100 days downgradient of the IRZ, degradation of CVOCs and generation of daughter products will be used as the primary performance criterion and TOC, pH, and methane as secondary parameters.

Injection of Carbohydrate Solution

After installation of the injection wells, a manifold system will be utilized to inject the carbohydrate solution into multiple injection wells simultaneously. It is proposed to set up the pump and manifold system for two injection events per site visit, one at the Southern IRZ Area consisting of six injection wells (proposed injection well locations IW-A2, IW-A3, IW-A4, IW-A5, IW-A6, and IW-A7) and one at the Northern area consisting of five injection wells (IW-B1, IW-B2, IW-B3, IW-B4, and IW-B5). A process

instrumentation diagram of the carbohydrate injection manifold setup is attached as Figure 4.

Based on groundwater analytical results, the injection well locations were distributed along the property line to intersect approximately 99% of the known CVOC concentrations leaving the Site as indicated in the PDI provided as Appendix A. Operation of the IRZs will result in groundwater quality improvements at offsite groundwater sampling locations with concentrations of CVOCs exceeding ambient groundwater quality standards and guidance values presented in the NYSDEC Division of Water, Technical and Operational Guidance Series (TOGS) document titled, "Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (TOGS 1.1.1)," dated June 1998, as revised by an April 2000 addendum.

3.1.4 Air Monitoring

Air monitoring for total organic vapors (TOV) will be performed utilizing a portable photo-ionization detector during well drilling activities in accordance with the existing Health and Safety Plan.

3.1.5 Decontamination

The Contractor performing the drilling activities will decontaminate the drill rig prior to the start of drilling activities and before leaving the site. All down-hole equipment will be decontaminated between each boring. The decontamination activities will be conducted within a lined equipment decontamination area onsite as described above in Section 3.1.1.

Down-hole equipment decontamination will be conducted using a high-pressure, low-volume hot-water/steam wash. The split-spoon sampler used to collect soil characterization samples will be washed with soap (i.e., Alconox) and water in a five-gallon bucket using a scrub brush after installation of each well. Decontamination activities will be performed until no visible soils or other debris is present on the equipment surfaces (as determined by the onsite representative for Ashland). Water generated by the equipment decontamination activities will be containerized for offsite treatment/disposal by Ashland. Solid wastes generated by the decontamination activities will be containerized for offsite disposal with the cuttings accumulated from the soil borings.

3.2 Waste Handling/Offsite Disposal.

The following waste streams are anticipated as a result of the corrective measure activities:

- Soil cutting from well installation activities.
- Materials used to construct decontamination areas.
- Decontamination liquids.
- Disposable sampling equipment.
- Personnel protective equipment.
- Well development/purge liquids.
- Spilled or remnant carbohydrate (molasses) and/or carbohydrate solution.

The approach for handling the waste streams to be generated by the CMI activities is summarized below.

The soil cuttings generated as a result of installing the injection wells and monitoring wells will be containerized into DOT-approved steel 55-gallon drums for subsequent characterization, offsite transportation, and disposal by Ashland.

The waters generated from equipment decontamination wash waters and well development will be containerized within an onsite storage tank or DOT-approved steel 55-gallon drums for subsequent characterization, offsite transportation, and disposal by Ashland.

Spilled or remnant carbohydrate (molasses) and/or carbohydrate solution from the injection activities shall be handled in accordance with the requirements indicated in the addendum to the Health and Safety Plan.

All waste generated will be staged onsite in a secure location as determined by Ashland's onsite representative.

3.3 Operation and Maintenance

O&M activities will consist of periodic injection of the carbohydrate solution. The schedule for injection will vary over time as outlined below. In addition to the O&M activities, a visual observation of the site perimeter fencing will be performed to maintain site engineering controls /site security.

Periodic injections will be performed monthly for the first two years after the installation of the IRZ injections. Injection frequency may be modified within this time frame based on performance monitoring results as discussed in Section 3.1.2. O&M activities will consist of mobilizing /demobilizing personnel, equipment, and materials necessary to perform injection activities consistent with the initial IRZ injection activities described above in Section 3.1.2.

For the purposes of this Work Plan, it is assumed that the performance monitoring results will promote reducing the O&M activities to approximately every 45 days or 9 times per year for an additional eight years (3 to 10 years after initial IRZ injections), depending on the results of performance monitoring. O&M activities will consist of mobilizing /demobilizing personnel, equipment, and materials necessary to perform injection activities consistent with the initial IRZ injection activities described above in Section 3.1.2. During each visit, injections will be performed on all injection well locations within the Northern and Southern IRZ Areas.

Additional O&M activities will include performing a visual observation of the site perimeter fencing. As part of the remedy for the Site, engineering controls (i.e., perimeter fencing) will be maintained to reduce potential exposure to VOCs at the Site. A representative of Ashland will perform a thorough review of the fencing and gates and record any areas where the structural integrity has been compromised. Arrangements will be made to repair compromised areas while onsite or as soon as a qualified fencing repair company is contracted to perform the repair(s).

3.4 IRZ Performance Monitoring

Prior to the IRZ performance monitoring, an additional groundwater well location MW-21 is proposed to be installed southwest of the Southern IRZ Area to allow for performance monitoring approximately 80 feet from downgradient. The well will be installed using the same ATV drill rig and equipment expected to be onsite for the installation of the IRZ injection wells. The well will be installed such that the screen interval straddles the water table at that location. The water table is expected to be consistent with onsite conditions, therefore, ARCADIS proposes to install the monitoring well to a depth of 12 feet bgs and will be constructed of 2-inch diameter schedule 40 polyvinyl-chloride (PVC) pipe with 10 feet of 0.010 inch slot screen and 2 feet of solid PVC riser. An example of the well construction details for the monitoring wells at the Site are presented on Figure 5. The actual well construction details will be refined during monitoring well installation.

The monitoring well will be developed by pumping water from the well using an inertial-type pump (e.g., a Waterra® or similar). Pumping will continue until the turbidity is reduced to 50 nephelometric turbidity units (NTU) or less, or until stable water quality parameters (pH, temperature, oxidation reduction potential, dissolved oxygen, and specific conductivity) are obtained or a maximum of ten well volumes are removed.

Performance monitoring downgradient from the IRZ treatment areas will be performed quarterly for the first two years starting at the time of installation/activation of the IRZs. Groundwater samples will be collected from seven monitoring well locations including downgradient wells IP-1, IMP-3, MW-16, MW-17, MW-18, and MW-21 and upgradient well MW-13.

The groundwater samples will be collected using low-flow sampling methods to minimized turbidity in the samples. Each well will be purged using a peristaltic pump at a flow rate between 200 and 300 milliliters per minute (mL/min). The groundwater samples will be collected from each well after 3 to 5 well volumes of water have been purged from each well and/or the water quality field parameters (including pH, ORP, temperature, turbidity and conductivity) stabilize (i.e., within +/- 0.1 for pH, 10% for dissolved oxygen, 3% for conductivity, and 10 mV for ORP). The water quality field parameters will be monitored and recorded approximately every five minutes.

Following collection, each sample will be packed for shipment in a cooler with water ice under appropriate chain-of-custody protocol and transported to TestAmerica, Inc. located in Burlington, Vermont for analysis by the following:

- USEPA SW-846 Method 8260 for VOCs.
- USEPA SW-846 Method 415.2 for total organic carbon (TOC).
- Robert S. Kerr (RSK) 175 Standard Operating Procedure (SOP) for ethene, ethane, and methane.

Once per year, additional samples will be collected from the same wells for analysis for the following:

- USEPA SW-846 Method 300 for nitrate and sulfate.
- USEPA SW-846 Method 6020 for total iron, dissolved iron, total manganese, and dissolved manganese.

The samples will be analyzed on a standard turnaround time of 10 to 15 working days. Analytical results will be reported using NYSDEC 2000 Analytical Services Protocol (ASP) Category B data deliverables. Additional required quality assurance/quality control (QA/QC) samples (including a field duplicate, matrix spike, matrix spike duplicate, and trip blank sample) will be collected for laboratory analyses at a frequency of 1 set of QA/QC samples per 20 lab samples for each analysis. Validation will be performed on the analytical results and Data Usability Summary Reports (DUSRs) prepared to summarize the review.

For this work plan, quarterly performance monitoring has been proposed for the first two years from activation and semi-annual for the following eight years (years 3 -10 from activation of the IRZs). However, ongoing sampling frequency may change based on the performance results. It is anticipated that the quarterly monitoring will decrease to semi-annual monitoring using the same sampling activities described above for the quarterly sampling. If a decrease in sampling frequency is believed justified due to the IRZ VOC destruction performance, USEPA will be notified prior to implementation.

The network of onsite and offsite IRZ performance monitoring wells is being proposed as a substitute for the existing groundwater monitoring network that was part of the RCRA Facility Investigation (RFI) performed in 2002. The IRZ performance monitoring well network has been selected to provide an assessment of the overall effectiveness of the site-wide remedy. The monitoring will continue until the risk-based groundwater quality criteria presented in TOGS 1.1.1 are achieved or it can be reasonably demonstrated that groundwater concentrations will decrease to risk-based criteria through natural mechanisms.

Details of well locations, laboratory analyses, sampling schedule, and QA/QC sample frequency are provided on Table 1.

3.5 Groundwater Monitoring For BTEX Compounds

In addition to the IRZ Performance Monitoring, an additional groundwater well (groundwater well location MW-20) will be installed onsite to monitor the presence of BTEX compounds in groundwater localized between the Northern IRZ Area and Southern IRZ Area as recommended in the PDI.

Monitoring well MW-20 will be installed onsite adjacent to the temporary monitoring well location PDI-11 to a depth of approximately 12 feet bgs and will be constructed of 2-inch diameter schedule 40 polyvinyl-chloride (PVC) pipe with 10 feet of 0.010 inch

slot screen and 2 feet of solid PVC riser. An example of the well construction details for the monitoring wells at the Site are presented on Figures 5A and 5B. The well will be installed using the same ATV drill rig and equipment expected to be onsite for the installation of the IRZ injection wells. The monitoring well will be developed in the same manner employed at the monitoring well location MW-21 described above in Section 3.4.

Monitoring well location MW-20 will be sampled semi-annually for the first 2 years of IRZ operation. At that time a recommendation will be made regarding the anomalous BTEX detected in this area.. Following collection, the sample will be packed for shipment in a cooler with water ice under appropriate chain-of-custody protocol and transported to TestAmerica, Inc. located in Burlington, Vermont for analysis for USEPA SW-846 Method 8260 for VOCs.

Monitoring well location MW-20 will be monitored due to concentrations of BTEX compounds exceeding groundwater quality standards and guidance values presented in TOGS 1.1.1. Recommendations on the need for a corrective action to address BTEX in groundwater will be made after determining constituent concentration trends in monitoring well location MW-20. Evaluations of the alternatives for this location are further discussed in the PDI provided as Appendix A of the work plan.

3.6 Groundwater Monitoring and, if necessary, Evaluation of Additional Vapor Monitoring at the Former Volvo Service Center

The Supplemental RFI Work Plan addressing potential soil vapor concerns at the Former Volvo Service Center (Service Center) located downgradient of the site was submitted to the USEPA on March 12, 2007. USEPA responded with conditional approval of the proposed Work Plan in a letter to URS dated March 22, 2007. URS updated the Work Plan addressing USEPA concerns in a response returned to USEPA on March 23, 2007. Soil vapor samples were collected in April 2007 and an Offsite Indoor Air Sampling Summary report was submitted to USEPA by URS on May 17, 2007. The results of these investigations indicated that site-related VOC-impacted groundwater originating from the Ashland site does not currently pose a vapor intrusion risk to offsite structures (including the former Service Center) and no immediate actions are necessary to protect human health. These final findings were presented to the USEPA and New York State Department of Health [NYSDOH (referred to hereinafter as the “Agencies”] prior to the final CMS report such that the Agencies concurred with these conclusions in a letter dated June 20, 2007.

The IRZ is designated to reduce the impacts to groundwater in the downgradient direction, which will include the area under/near the Service Center. Future activities regarding the Service Center will comprise:

- Groundwater monitoring near the former Service Center (i.e., monitoring well location IMP-3). The resulting data will be evaluated for changes in groundwater quality. If the groundwater quality remains the same or shows decreasing concentrations of site-related VOCs, additional vapor monitoring will not be needed in the building as long as building use does not change. If concentrations of site related VOCs show an increasing trend, the Agencies will be notified and an assessment made in conjunction with the Agencies as to whether additional vapor monitoring will need to be implemented.

- Notifying the Agencies if Ashland becomes aware of a change in used of the former Service Center building. If Ashland becomes aware of a property use change, an evaluation will be completed to determine whether the building use change (e.g., office use rather than a garage) could result in an exceedance of risk-based criteria. If this were the case, Ashland would notify the Agencies and an assessment made in conjunction with the Agencies as to whether additional vapor monitoring will need to be implemented.

3.7 Institutional and Engineering Controls

Institutional and engineering controls will be used to reduce the potential for exposure to VOCs at the Site. Engineering controls are already in place at the Site and consist of fencing at the site Perimeter. The perimeter fencing will be inspected and maintained as discussed in Section 3.3 above.

Institutional controls will include a deed restriction limiting future use of the property to industrial purposes and restricting the use of groundwater. The deed restriction will be prepared by Ashland concurrent with initiation of the IRZ development.

3.8 Removing Groundwater Collection and Treatment System

Currently, an inactive groundwater collection and treatment system remains onsite. The system was shutdown in advance of the proposed remedy for the Site due to the system's potential for reducing the effectiveness of the IRZs. The USEPA concurred with the shut-down of the groundwater collection and treatment system in a letter to Ashland dated August 7, 2008.

Ashland is proposing removal of the treatment system from the site as part of this remedy. General removal activities will consist of the following:

- Coordinating acquisition of a subcontractor(s) to assist with decommissioning.
- Coordinating the disconnection of three phase power used to operate the remediation system building and components.
- Obtaining required permits and verifying discharge line abandonment procedures.
- Removing system components from within and demolishing the building. Above ground piping, wire conduits, insulation, and building materials will be removed and placed into a roll-off container for subsequent off-site disposal by Ashland as construction and demolition debris. Granular activated carbon will be placed in DOT-approved 55-gallon drums for subsequent offsite transportation and disposal.

3.9 Cost Estimate

Costs to perform the activities described in this work plan are presented in Table 2.

3.10 Project Schedule

The proposed schedule for implementation of this corrective measure includes the following elements and timetable:

- Agencies review and approval of the CMI Work Plan.
- Pre-CMI Observation (as described in Section 4.6.1).
- Injection and monitoring well installation.
- IRZs installation (anticipated for Spring of 2010 to take advantage of warmer temperatures and avoid temperatures promoting freezing conditions).
- IRZ performance and groundwater monitoring programs.
- Groundwater collection and treatment system removal.

3.11 Construction Quality Assurance (CQA) Objectives

This section presents the objectives of the Construction Quality Assurance (CQA) for the corrective measure activities to be performed at the Site. The primary component for construction quality assurance will be the development of a Construction Quality Assurance Plan (CQAP) which is presented as Section 4 of this work plan. The CQAP will be developed with the appropriate components needed to perform this corrective measure which is limited in size and scope. In support of this CMI work plan, the CQAP shall address the following:

- Responsibility and authority of all organizations and key personnel involved.
- Personnel qualifications.
- Construction oversight activities.
- Documentation.
- Project Meetings.
- Reports.

3.12 Health and Safety Plan

The Health and Safety Plan (HASP) prepared for previous remedial activities at the Site provides a baseline for the work to be implemented for this corrective measure. An addendum to the HASP addressing work tasks associated with this corrective measure will be prepared and submitted to USEPA.

4. Construction Quality Assurance Plan

4.1 Introduction

This CQAP has been streamlined and incorporated into this Work Plan due to the limited size and scope of the proposed remedy at the Site. This CQAP has been developed to provide quality control procedures for the construction, evaluation, and documentation during the corrective measure activities.

4.2 Definition of Terms

The following terms and abbreviations are used throughout this CQAP. The definition of each term or abbreviation will be consistent throughout the text of this plan.

- Engineer: Consulting engineering firm and construction management responsible for the design, construction oversight, and potential construction aspects of the project. The Engineer's duties include reviewing and approving modifications to the CMI Work Plan, providing a remedial design and construction oversight team during implementation of the CMI activities, potentially performing certain construction activities, and documenting that all activities are conducted in general accordance with this CQAP and the CMI Work Plan. For this project, the Engineer is ARCADIS.

- Contractor: The person or persons selected by the Engineer to perform select corrective measure activities at the Site. A contractor will be selected at a later date that will install the injection and monitoring wells and perform the carbohydrate injection activities.

4.3 Responsibility and Authority

4.3.1 Engineer

Ashland has retained the services of an ARCADIS who will be responsible for overseeing and documenting the activities associated with the CMI activities in general conformance with the CMI Work Plan and associated documents.

4.3.2 CQA Management Organization

The CQA personnel (provided by the Engineer) necessary for this project are:

- CQA Project Manager - The Project Manager will serve as the official representative of the Engineer, and will have the ultimate technical responsibility for the work performed. The Project Manager will be responsible for overall coordination of QA/QC activities.

- CQA Geologist - The CQA Geologist will be an onsite representative of the Engineer, reporting to the Project Manager, and will be responsible for observation, air monitoring, and documentation of daily construction activities.

- CQA Surveyor - The CQA Surveyor will be on site on an as-needed basis to survey sample locations.

The Engineer may provide some or all of the above personnel; other personnel may be retained by Ashland or ARCADIS.

4.3.3 CQA Personnel Qualifications

In general, oversight and/or documentation of construction materials installation and associated procedures will be performed by a person or persons familiar with construction procedures and materials. The project personnel will be under the supervision of the Project Manager. Representatives of the Contractor will be familiar with the use of the equipment and methodology needed to sample and test various matrices.

Specific qualifications for personnel with daily project involvement follow below.

4.3.4 CQA Project Manager

The Project Manager will have past experience in a position of significant responsibility for construction projects similar to the CMI activities described in the CMI Work Plan. The Project Manager should be knowledgeable of the project requirements and objectives and be familiar with the CMI Work Plan.

The Project Manager will have the following responsibilities in the implementation of the procedures in the CQAP:

- Serve as the official representative of the Engineer.
- Maintain ultimate responsibility for the implementation of the procedures in the CQAP.
- Direct and supervise the preparation, appropriate review, and modifications of the CMI Work Plan.
- Review design documentation, including the CMI Work Plan.
- Review modifications to the CMI Work Plan as they occur during construction.
- Serve as the primary contact person for the Engineer. Maintain contact with Ashland and Contractor regarding conformance with the requirements in this CQAP.
- Provide overall coordination of the activities of the CQA Geologist.
- Provide assistance to the CQA Geologist in the review of shop drawings and other submittals from contractors and subcontractors.
- Perform periodic site visits (as deemed necessary) to review progress and QA/QC procedures.
- Determine acceptance of any installed portion of work to permit further construction.

4.3.5 CQA Geologist

The CQA Geologist should demonstrate knowledge of construction methodologies and applicable test methods (if applicable) through a combination of formal education, training, and experience.

The CQA Geologist will have the following responsibilities in the implementation of the procedures in the CQAP:

- Review daily construction reports with the Contractor.
- Serve as the daily contact person for the Engineer. Maintain routine contact with Ashland and the Contractor regarding conformance with quality control requirements.
- As appropriate (and in conjunction with the staff of the Engineer), review shop drawings and other submittals from the Contractor for conformance with the CMI Work Plan and take appropriate action after review.
- Perform regular site walkthrough to review progress and QA/QC procedures.

4.3.6 CQA Surveyor

The CQA Surveyor will survey locations of the injection wells and monitoring wells after installation. For verification, the survey activities will be conducted by persons practiced in land surveying techniques, under the direction of a New York State certified Professional Land Surveyor.

4.3.7 Contractor Qualifications

The Contractor will be trained and experienced in the construction of various remedial measures. The Contractor will demonstrate that the superintendent, field crew foreman, and any subcontractors have experience in remedial projects and materials associated with the CMI activities.

4.4 Organization and Documentation Requirements

Overall responsibility for carrying out the provisions of this CQAP will fall upon the Engineer. The Engineer will be responsible for documenting, in accordance with this CQAP, that the CMI activities are performed consistent with the CMI Work Plan. The Project Manager will maintain a copy of the CMI Work Plan; a copy of this CQAP; and a file of completed reports, data sheets, forms, and checklists submitted to and/or originated by the CQA Geologist.

The CQA Geologist will report to the Project Manager. The CQA Geologist will be responsible for oversight of the work performed by the Contractor; completing data sheets, forms, and checklists; and submitting to the Project Manager on a timely basis. The CQA Geologist will also be responsible for the submittal of reports and other documents described throughout this CQAP to the Project Manager on a timely basis, in addition to other project-related responsibilities.

The Contractor will discuss all matters relating to the CQAP with the Project Manager.

4.5 Documentation

The documentation of CQA activities will support a determination of whether construction activities have been carried out in accordance with the CMI Work Plan. The documentation process includes recognition of construction tasks that should be observed and documented; assignment of responsibilities for the oversight and documentation of these tasks; and finally, the completion of the required reports, data sheets, forms, and checklists to provide an accurate record of the work performed during construction.

The CQA Geologist will provide the Project Manager with completed and signed daily reports and data sheets (as warranted), as described below, to document that the requirements of this CQAP have been satisfied.

4.6 Project Meetings

A brief description of the site meetings and reviews to be conducted is provided below.

4.6.1 Pre-CMI Observation

The pre-CMI Observation will be completed by Ashland, the Engineer, and the Contractor to verify existing site conditions, locate onsite utilities, and mark injection/ monitoring well locations. Documentation of the existing site conditions will be conducted via photographic survey and/or video survey before commencement of the work. The Contractor is responsible for supplying the equipment necessary to conduct the survey.

4.6.2 Daily Site Safety/Coordination Meetings

Daily meetings shall be attended by the Engineer, the Contractor, Ashland (as necessary), and other parties to be onsite during the day to discuss day-to-day

operations, daily schedule, health and safety issues, coordination issues, and general project status.

4.7 Documentation

4.7.1 Daily Activity Reports

The CQA Geologist will complete a daily summary report of each day's construction activities. The daily construction report will contain, at a minimum, the following information:

- Date, project name, location, and the number and names of persons on site.
- Time work starts and ends, in addition to the time of work stoppages related to unforeseen conditions, inclement weather, or insufficient equipment or personnel.
- General information on weather conditions. A temporary weather monitoring station will be established to record temperature, humidity, wind direction and speed, etc.
- Contractor's work force, equipment, and materials delivered to or removed from the job site.
- Chronological description of work in progress, including notices to or requests from the Contractor.
- Results of air monitoring.
- Problem/deficiency identification and documentation describing corrective actions taken for field problems and non-conformance with this plan.
- A listing of any samples collected, marked, and delivered to the CQA Laboratory.
- A record of communications with other onsite parties, outside companies, or regulatory agencies, regarding the day's construction activities.
- A record of calibrations or standardization performed on air monitoring equipment, including actions related to and results of recalibrations.

4.7.2 Problem/Deficiency Identification and Corrective Action Documentation

Daily construction reports prepared by the CQA Geologist will include documentation of problems and/or deficiencies noted during construction (e.g., when construction material or activity is observed or tested that does not meet the requirements set forth in this plan), and corrective action employed by the Contractor to address the problems or deficiencies. The documentation reports will be cross-referenced to the reports, data sheets, forms, and checklists that contain data or observations leading to the determination of a problem or deficiency. Problem and deficiency identification and corrective action documentation may include the following information:

- A description of the problem or deficiency, including reference to supplemental data or observations related to the determination of the problem or deficiency.

- Location of the problem or deficiency, including how and when the problem or deficiency was discovered.

- The corrective action taken for resolving the problem or deficiency. If the corrective action has already been implemented, observations and documentation showing that the problem or deficiency was resolved should be included. If the problem or deficiency has not been resolved by the end of the day upon which it was discovered, the documentation will state that the deficiency was unresolved at the end of the day.

If the problem or deficiency has not been resolved, then the Engineer and Contractor will discuss the corrective actions necessary to resolve the problem or deficiency as soon as possible.

4.7.3 Photographic Documentation

The CQA Geologist will document observations, problems, deficiencies, and work in progress. Photographs will be in color print format and will be filed in chronological order in a computer storage system.

The following information will be documented in the daily report or a logbook for each photograph:

- Date and time.
- Location where photograph was taken.
- Description of the subject matter.

4.8 Site Preparation/Mobilization

4.8.1 General

This section describes the activities that shall take place prior to the start of work activities at the Site including: 1) material staging and decontamination area construction and 2) hand clearing utilities.

4.8.2 Material Staging and Decontamination Areas

Prior to the start of Phase 1 Area construction activities, the Contractor shall construct remedial support areas including, but not limited to, material staging areas and equipment/personnel decontamination areas. The Contractor shall be responsible for submitting to the Engineer a figure indicating the proposed locations of material staging and decontamination areas for approval prior to beginning Phase 1 Area construction.

4.8.3 CQA Observations

The CQA Geologist(s) will observe that the material staging and decontamination areas are constructed in accordance with the Remedial Design, and are sloped and equipped with a sump to collect liquids from the staged materials.

4.9 Hand Clearing Utilities

Prior to the installation of the injection and monitoring wells, the Contractor will hand clear utilities at each boring location as specified in the CMI Work Plan. Utilities shall be cleared to a depth of four feet bgs.

4.9.1 CQA Observations

The CQA Geologist(s) will document that each boring location is hand cleared in accordance with the CMI Work Plan and record the methodology used to hand clear the utilities.

4.10 Well Installation

4.10.1 General

Well installation shall be performed by the Contractor in accordance with the CMI Work Plan. All removed soil, debris, and water will be handled in accordance with the Waste Management Plan.

4.10.2 Injection and Monitoring Well Installation

The Contractor will be required to install injection and monitoring wells at the locations specified in the CMI Work Plan or as directed by the Engineer.

4.10.3 CQA Observations

The CQA Geologist(s) will document the installation of the wells in accordance with the CMI Work Plan. Nonconformance will be reported to the CQA Project Manager.

4.11 Decontamination Activities

4.11.1 General

The Contractor will perform decontamination activities in accordance with the CMI Work Plan. The Contractor will decontaminate the drill rig prior to the start of drilling activities and before leaving the site. All down-hole equipment will be decontaminated between each boring. The decontamination activities will be conducted within the lined equipment decontamination area.

4.11.2 Decontamination Activities

As part of drilling and injection activities, the Contractor shall provide a personnel decontamination area (as specified in the Health and Safety Plan [HASP]). The personnel decontamination area (within the contamination reduction zone) shall include those facilities necessary to decontaminate personnel upon exit of the work area (exclusion zone), in accordance with the Contractor's HASP, and in accordance with local, state, and federal laws and regulations.

Visual observation of decontaminated equipment shall be performed by the Contractor. This observation shall occur while the equipment is positioned in the Equipment

Decontamination Area. Any visible soils or other debris shall be promptly removed and disposed in a manner consistent with the CMI Work Plan.

Unless otherwise directed by Ashland/CQA Geologist, any equipment to be taken offsite shall be subject to final visual observation and cleaning (if necessary) at a designated Equipment Decontamination Area. In general, this area will consist of an impermeable barrier which shall be sloped to a collection sump. The Equipment Decontamination Area(s) shall be constructed in accordance with the CMI Work Plan. Precautions shall be taken to limit contact between the equipment, personnel performing the cleaning activities, and any cleaning liquids that may accumulate in the cleaning area. The Contractor shall be responsible for constructing and maintaining the cleaning area to accommodate all equipment, and migration scenarios. The Contractor shall dismantle and properly dispose all materials associated with the cleaning area and shall restore the area to its original conditions.

The extent and method of cleaning shall be at the discretion of the Contractor; however, equipment and materials shall be observed by the CQA Geologist prior to its departure from the Equipment Decontamination Area. In addition, the CQA Geologist shall require additional decontamination if deemed necessary.

Wash water, solids, and other materials generated during equipment cleaning shall not contact native soils, and shall be collected by the Contractor and placed into designated containers. Characterization and proper disposal of collected wash water, solids, and other materials shall be performed by Ashland.

4.11.3 CQA Observations

The CQA Geologist(s) will observe decontamination activities to document that the following activities are completed in accordance with the CMI Work Plan and HASP, including (but not limited to):

- Project equipment (including boring equipment, pumps, hand tools, etc.) that comes in contact with subsurface soils at the Site is decontaminated prior to demobilization from the site and prior to handling non-impacted material.

- No visible soil, debris, or stains are present on the equipment surfaces (to the satisfaction of the Engineer).

- Equipment, such as pumps, is flushed using clean water and appropriate cleaning agents, as necessary (to the satisfaction of the CQA Geologist).

- Solids and other materials generated during equipment cleaning requiring offsite treatment/disposal are collected and placed into appropriate waste containers for characterization and offsite disposal by Ashland.

4.12 Waste Handling, Treatment, and Disposal

The Contractor shall arrange for proper handling of waste materials while onsite including, but not limited to, soil, water, debris, and miscellaneous wastes generated during the work activities in accordance with the CMI Work Plan and all applicable federal, state, and local regulations.

4.12.1 CQA Observations

The CQA Observer(s) will observe corrective measure implementation at the Site to document that activities are completed in accordance with the above. Waste materials characterization and offsite disposal will be performed by Ashland.

4.13 Carbohydrate Injection

4.13.1 General

The Contractor will perform periodic injection of the carbohydrate solution in accordance with the CMI Work Plan.

4.13.2 Carbohydrate injection activities

The Contractor will inject solutions with a centrifugal pump (or equivalent) into groundwater using dedicated wells at the Site in accordance with the CMI Work Plan or as directed by the Engineer.

4.13.3 CQA Observations

The CQA Geologist(s) will document the carbohydrate injection activities in accordance with the CMI Work Plan and the HASP. Nonconformance will be reported to the CQA Project Manager.

5. Reports

5.1 CMI Certification Report

An Engineering Certification Report will be prepared at the end of construction. At a minimum, the report will contain the following information:

- Drawings showing the surveyed locations of the injection wells and monitoring wells.
- A summary of field activities and tests performed, laboratory samples collected, and test results reported.
- A summary of problems and deficiencies encountered during construction, including recurring problems and/or deficiencies discovered.
- Documentation indicating that acceptance criteria were met, including a comparison of documented procedure data with the Remedial Design.

5.2 Annual Reports

Annual reports will be prepared and at a minimum contain:

- A summary of quarterly performance monitoring activities, field testing results, laboratory samples collected, and validated laboratory analytical results.

A summary of the annual groundwater monitoring activities, field testing results, laboratory samples collected, and validated laboratory analytical results.

6. Reference

ARCADIS, 2009. *Revised Draft Corrective Measures Study Report*. Prepared for Ashland by ARCADIS. March 2009.

ARCADIS

TABLES

Table 1. IRZ Performance and BTEX Monitoring, Corrective Measure Implementation Work Plan, Ashland Inc., Rensselaer, New York

Analyte / Parameter	pH	VOCs	Total Organic Carbon	Ethene	Ethane	Methane	Nitrate	Sulfate	Total iron	Dissolved Iron	Total Manganese	Dissolved Manganese
Analytical Method / Instrument	**--**	**EPA 8260**	**EPA 415.2**	**RSK 175 SOP**	**RSK 175 SOP**	**RSK 175 SOP**	**EPA 300.0**	**EPA 300.0**	**EPA 6020**	**EPA 6020**	**EPA 6020**	**EPA 6020**
IP-1	X	X	X	X	X	X	X	X	X	X	X	X
IMP-3	X	X	X	X	X	X	X	X	X	X	X	X
MW-13	X	X	X	X	X	X	X	X	X	X	X	X
MW-16	X	X	X	X	X	X	X	X	X	X	X	X
MW-17	X	X	X	X	X	X	X	X	X	X	X	X
MW-18	X	X	X	X	X	X	X	X	X	X	X	X
MW-20	-	X*	-	-	-	-	-	-	-	-	-	-
MW-21	X	X	X	X	X	X	X	X	X	X	X	X
# Samples/Event	8	10	8	8	8	8	8	8	8	8	8	8
Subtotal # of samples Annually	32	40	32	32	32	32	8	8	8	8	8	8
Duplicate	-	4	4	4	4	4	2	2	2	2	2	2
MS/MSD	-	4	4	4	4	4	2	2	2	2	2	2
Trip blank	-	4	4	4	4	4	2	2	2	2	2	2
Total QA/QC samples	-	12	12	12	12	12	6	6	6	6	6	6
Total Samples Annually	32	52	44	44	44	44	14	14	14	14	14	14

Notes:

1. Samples will be analyzed by Test America (TA) located in Burlington, Vermont.
2. X indicates sample to be collected.
3. No shading indicates analytes/parameters to be sampled quarterly (4 times/year).
4. Shading indicates analytes/parameters to be sampled annually.
5. Quality assurance/Quality control (QAQC) samples include duplicate, matrix spike, matrix spike duplicate, and trip blank samples to be collected once per 20 samples for each parameter.
6. MS/MSD = matrix spike and matrix spike duplicate.
7. VOC=volatile organic compounds.
8. pH to be recorded in the field.
9. * = semi-annual sampling (spring/fall) to monitor BTEX concentrations at MW-20.
10. BTEX = benzene, toluene, ethylbenzene, and xylenes.

Table 2. Projected Costs for Five Years of IRZ Operation, Ashland Inc., Rensselaer, New York

Item	Quantity	Units	Unit Cost	Capital Cost	Annual O&M Cost	Total Cost
I. GENERAL ACTIONS/PREPARATION						
1. Permitting	1	LS	$1,000	$1,000		
2. Engineering Controls (Deed Restriction)	1	LS	$5,000	$5,000		
3. Removal of Existing Groundwater Treatment System	1	LS	$10,000	$10,000		
Subtotal:				$16,000		
II. IRZ IMPLEMENTATION WITH MOLASSES						
1. Full Scale IRZ Injection and Monitoring Well Installation/IDW	1	LS	$45,178	$46,000		
2. Equipment for IRZ Injection	1	LS	$41,300	$42,000		
Subtotal:				$88,000		
III. IRZ INJECTIONS, MONITORING & REPORTING						
1. IRZ w/ Molasses Injection - Years 1 - 2	2	Years			$92,000	$184,000
2. IRZ w/ Molasses Injection - Years 3 - 10	8	Years			$70,200	$561,600
3. Performance Monitoring & Reporting - Years 1 - 2	2	Years			$27,000	$54,000
4. Performance Monitoring & Reporting - Years 3 - 10	8	Years			$18,000	$144,000
5. Engineering Controls (Inspection and Maintenance)	10	Years			$3,000	$30,000
6. Monitoring of Volve Garage	10	Years			$2,500	$25,000
Subtotal:						$998,600
SUBTOTAL (I, II, and III)				$104,000		$998,600
IV. IMPLEMENTATION COSTS						
1. Construction Management				$28,000		
2. Engineering & Design				$31,000		
3. Cost Contingency 15% of Capital Costs				$15,600		
4. O&M Contingency 15% of O&M Costs						$149,800
5. Engineering, Administration, & Legal 10% of O&M Costs						$99,900
Subtotal:				$74,600		$249,700
A. TOTAL CAPITAL COSTS				$178,600		
B. TOTAL ANNUAL COSTS						$1,248,300
TOTAL CAPITAL AND ANNUAL COSTS (A + B)						$1,427,000

Notes:
LS - Lump Sum.
Permitting would be required for construction and molasses injection.
Handling and disposal costs based on the IDW being classified as non-hazardous waste.
All well installation and sampling assumed to be conducted in Level D PPE.

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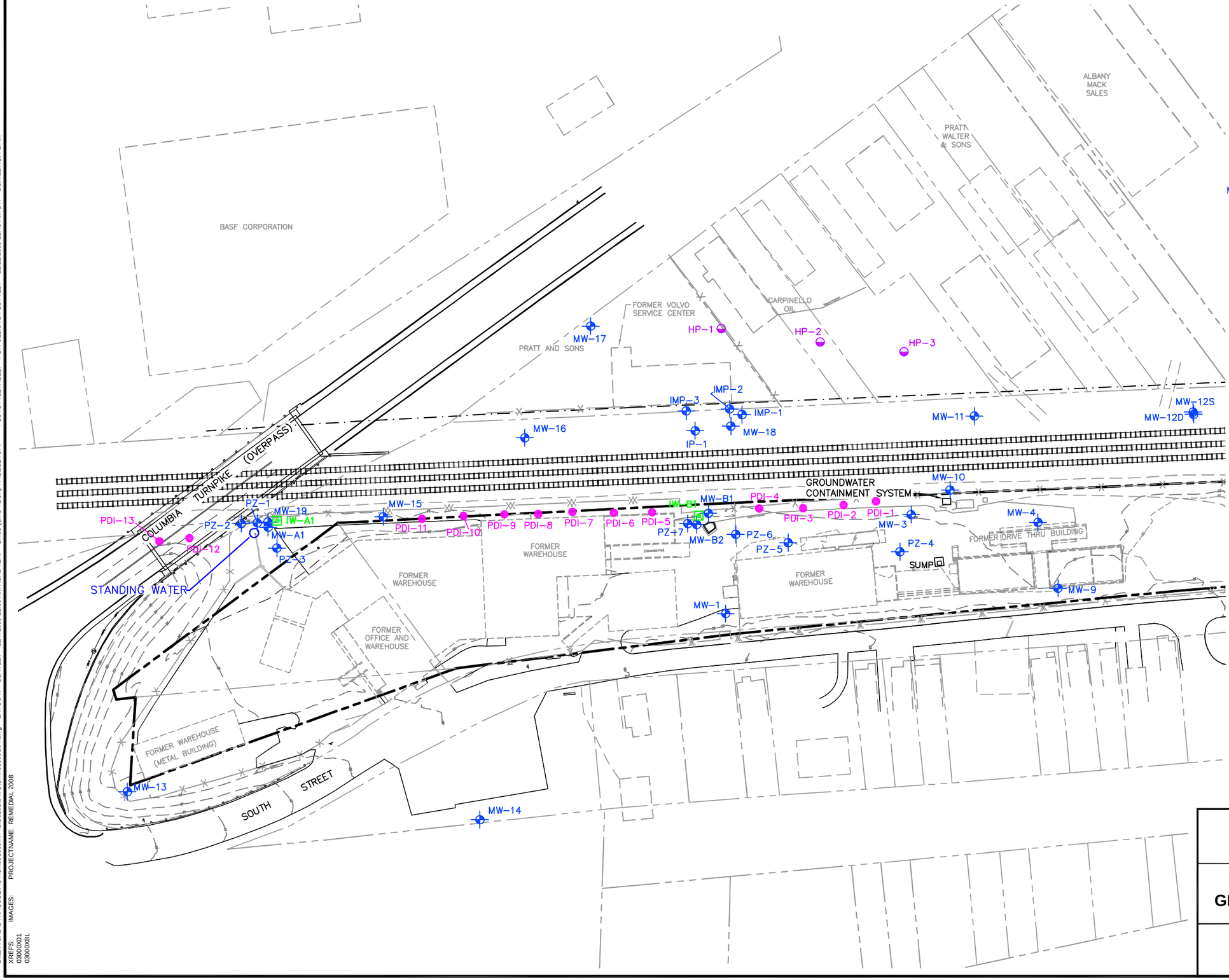
FIGURES



LEGEND:

- MW-1/PZ-1/GP-18/IMP-1/IP-1 — PERMANENT GROUNDWATER SAMPLING LOCATION
- HP-3 — TEMPORARY GROUNDWATER SAMPLING LOCATION
- IW-B1 — INJECTION WELL LOCATION
- ASHLAND PROPERTY BOUNDARY
- OTHER PROPERTY LINE
- FORMER BUILDINGS AND STRUCTURES
- PDI SOIL BORING AND TEMPORARY WELL LOCATION

NOTES:

1. PDI LOCATIONS 1 THROUGH 13 WERE FIELD LOCATED WITH MULTIPLE TIE-OFFS TO EXISTING POINTS (WELLS, STRUCTURES, ETC.).
2. LOCATIONS AND TOPOGRAPHY EAST OF CSX RAILROAD PROPERTY AND WEST OF AND INCLUDING SOUTH STREET, SURVEYED BY THEW ASSOCIATES PE-LS, PLLC (OCTOBER 2008). REFERENCED HORIZONTALLY TO THE NORTH AMERICAN DATUM OF 1983 (NAD83) AND PROJECTED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (EAST ZONE). VERTICAL REFERENCE TO NGVD 1929. ASHLAND PROPERTY BOUNDARY ESTABLISHED BY THEW ASSOCIATES SURVEY AND DEED RESEARCH (OCTOBER 2008). OTHER PROPERTY LINES AND MAP FEATURES ARE FROM RENSSELAER COUNTY TAX MAPPING AND NEW YORK STATE CLEARING-HOUSE AERIAL PHOTOGRAPHY.

0 100' 200'

GRAPHIC SCALE

ASHLAND INC.
RENSSELAER, NEW YORK
CMI WORK PLAN

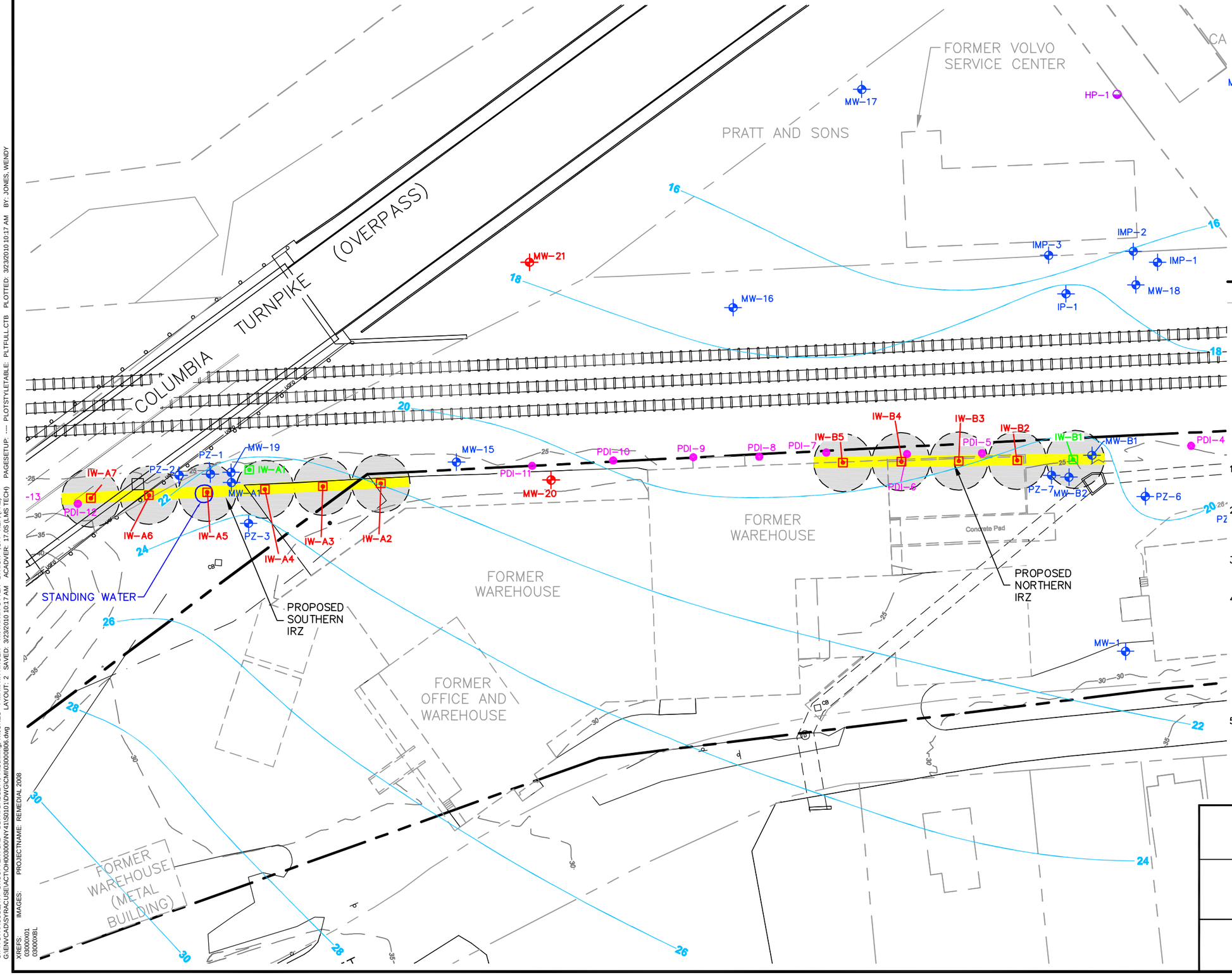
SITE MAP WITH GROUNDWATER SAMPLE LOCATIONS

ARCADIS

FIGURE 1

CITY: SYRACUSE, NY GROUP: ENVCAD DB: R. BASSETT, R. ALLEN, P. LISTER PM: M. KITTINGER TM/TR: K. POTTER LYR:ON=*;OFF=REF,(FRZ)
G:\ENVCAD\SYRACUSE\ACTIVE\4003000\NY41\SG101\DWG\CMI\03000B04.dwg LAYOUT: 1SAVED: 12/7/2009 11:06 AM ACADVER: 17.0S (LMS TECH) PAGESETUP: ---PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 12/11/2009 11:43 AM BY: SCHILLING, ADAM
XREFS: 03000X01 03000XBL IMAGES: PROJECTNAME: REMEDIAL 2008

CITY: SYRACUSE, NY GROUP: ENVCAD DB: R. BASSETT; A.Schilling, W.JONES PM: M. KITTINGER TM/TR: K. POTTER LYR:ON=*;OFF=REF; (FRZ)
G:\ENVCAD\SYRACUSE\ACTIVE\03000\NY41\S0101\DWG\CMI\03000B06.dwg LAYOUT: 2 SAVED: 3/23/2010 10:17 AM ACADVER: 17.0S (LMS TECH)
XREFS: 03000X01 03000XBL IMAGES: PROJECTNAME: REMEDIAL 2008 PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 3/23/2010 10:17 AM BY: JONES, WENDY



LEGEND:

- MW-1/PZ-1/GP-18/IMP-1/IP-1 — PERMANENT GROUNDWATER SAMPLING LOCATION
- HP-3 — TEMPORARY GROUNDWATER SAMPLING LOCATION
- PDI SOIL BORING AND TEMPORARY WELL LOCATION
- PROPOSED GROUNDWATER SAMPLING LOCATION
- IW-B1 — INJECTION WELL LOCATION
- PROPOSED CMI INJECTION WELL LOCATION
- ASHLAND PROPERTY BOUNDARY
- OTHER PROPERTY LINE
- FORMER BUILDINGS AND STRUCTURES
- PROPOSED EXTENT OF IN-SITU REACTIVE ZONE (IRZ)
- LATERAL EXTENT OF INFLUENCE (30 FEET)
- 20 — GROUNDWATER ELEVATION CONTOURS FROM SEPTEMBER 23, 2009

NOTES:

1. PDI LOCATIONS 1 THROUGH 13 WERE FIELD LOCATED WITH MULTIPLE TIE-OFFS TO EXISTING POINTS (WELLS, STRUCTURES, ETC.).
2. PROPOSED PDI LOCATIONS PDI-14 THROUGH PDI-23 AND PROPOSED MONITORING WELL LOCATIONS MW-20 AND MW-21 WILL BE FIELD LOCATED WITH MULTIPLE TIE-OFFS TO EXISTING POINTS (WELLS, STRUCTURES, ETC.).
3. PROPOSED PDI LOCATIONS IW-A6 AND IW-A7 AND PROPOSED MONITORING WELL LOCATION MW-21 WILL BE INSTALLED UNDER THE COLUMBIA TURNPIKE OVERPASS.
4. LOCATIONS AND TOPOGRAPHY EAST OF CSX RAILROAD PROPERTY AND WEST OF AND INCLUDING SOUTH STREET, SURVEYED BY THEW ASSOCIATES PE-LS, PLLC (OCTOBER 2008). REFERENCED HORIZONTALLY TO THE NORTH AMERICAN DATUM OF 1983 (NAD83) AND PROJECTED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (EAST ZONE). VERTICAL REFERENCE TO NGVD 1929. ASHLAND PROPERTY BOUNDARY ESTABLISHED BY THEW ASSOCIATES SURVEY AND DEED RESEARCH (OCTOBER 2008). OTHER PROPERTY LINES AND MAP FEATURES ARE FROM RENSSELAER COUNTY TAX MAPPING AND NEW YORK STATE CLEARING-HOUSE AERIAL PHOTOGRAPHY.
5. GROUNDWATER ELEVATION CONTOURS FROM THE FOURTH QUARTER PROGRESS REPORT SUBMITTED 11/10/09.

0 50' 100'

GRAPHIC SCALE

ASHLAND INC.
RENSSELAER, NEW YORK
CMI WORK PLAN

PROPOSED IRZ LOCATIONS

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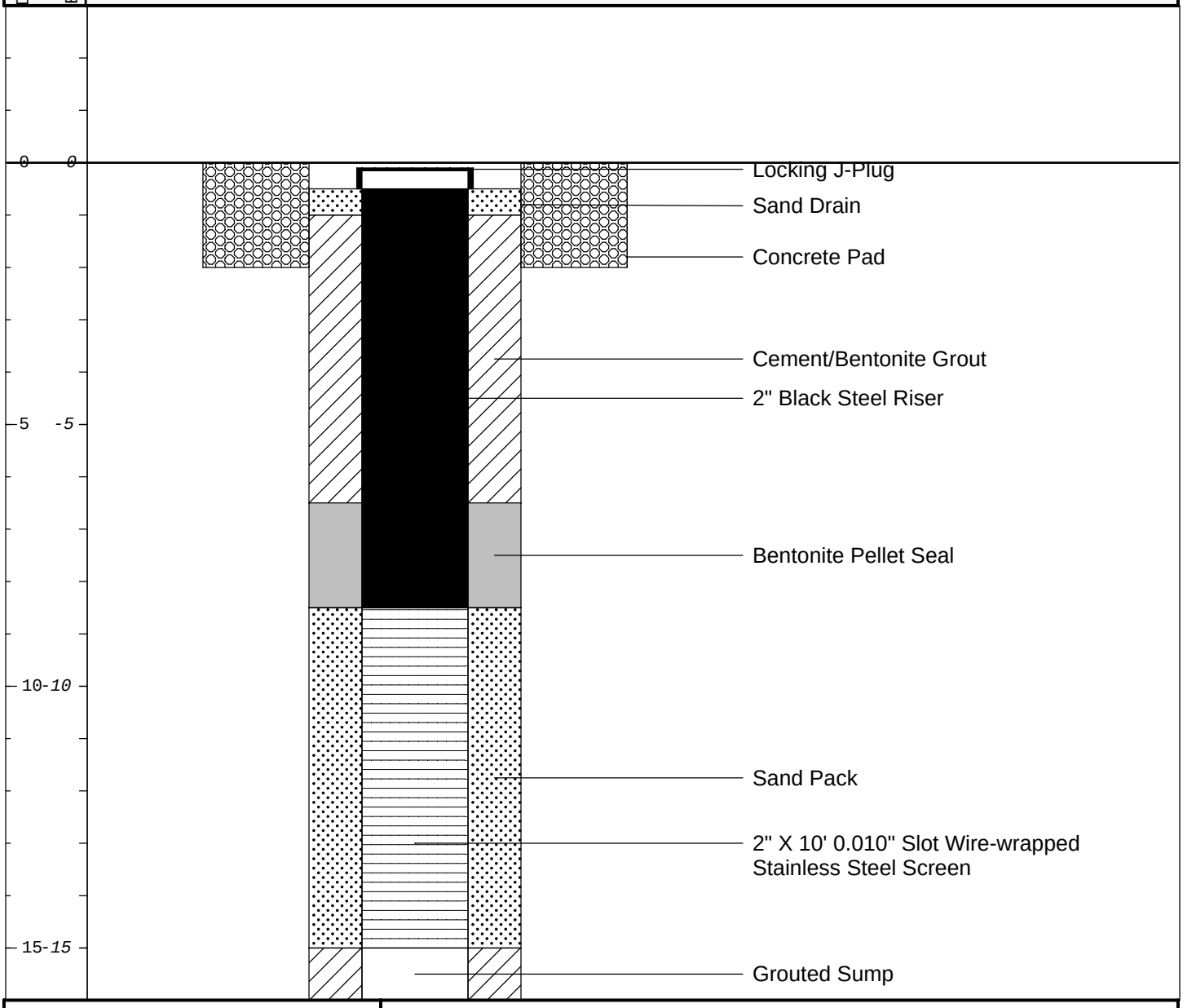
FIGURE
2

Date Start/Finish: TBD **Drilling Company:** Parrott-Wolff **Driller's Name:** Joe Smith **Drilling Method:** Hollow Stem Auger **Bit Size:** 8.25" OD **Auger Size:** 4.25" ID **Rig Type:** CME-75 **Sampling Method:** 2" X 2' Split Spoon	**Northing:** NA **Easting:** NA **Casing Elevation:** NA **Borehole Depth:** 12' below grade **Surface Elevation:** NA **Descriptions By:** Katherine Potter	**Well ID:** **Well Schematic** **Client:** Ashland Inc. **Location:** 130 South Street Rensselaer, NY

Flushmount Injection Well



Remarks: Not to scale. Generalized schematic. Actual wells will be screened from 2 to 12' below grade.
NA = Not Applicable/Not Available
TBD = To Be Determined
OD = Outer Diameter
ID = Inner Diameter

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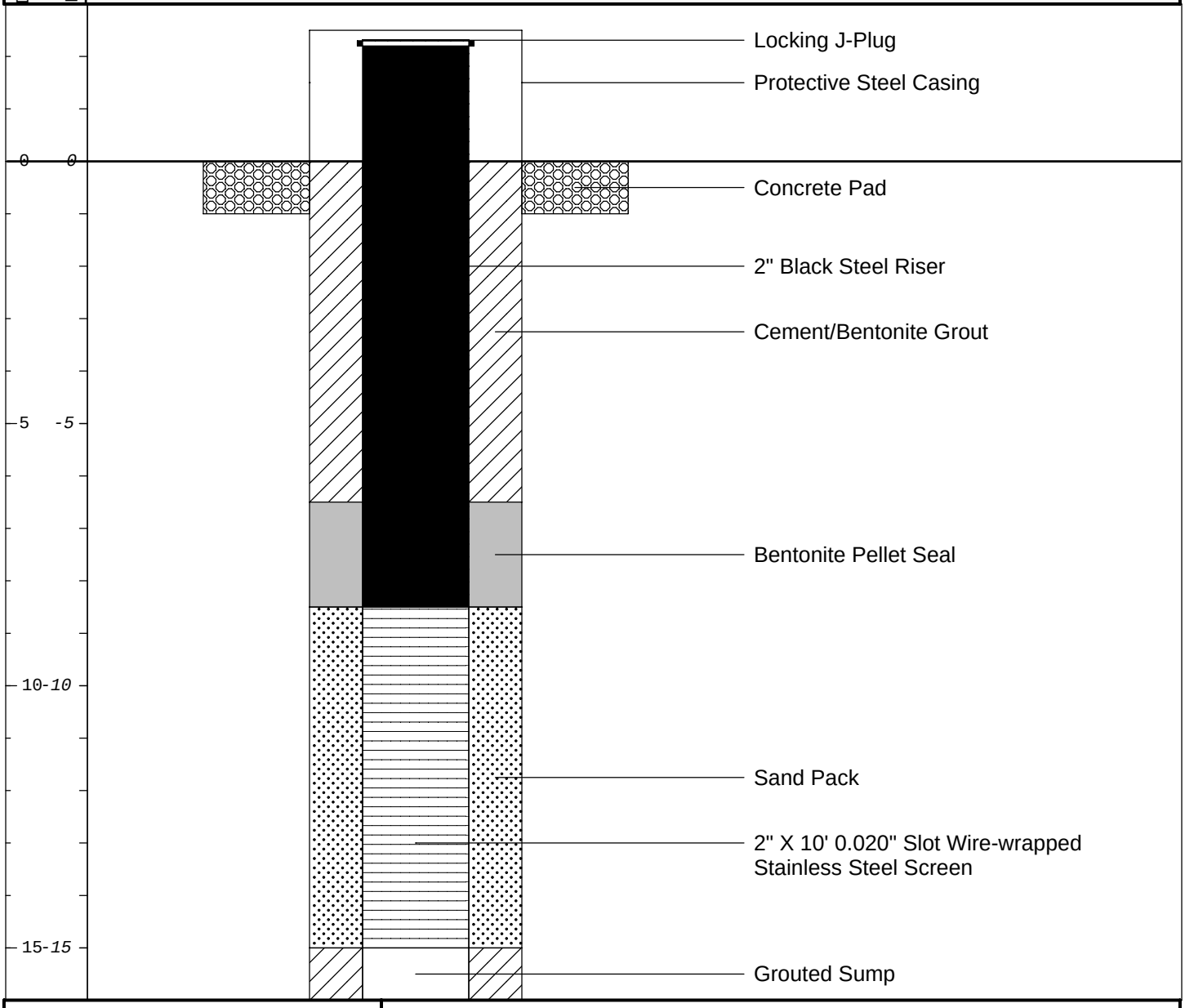
Infrastructure, environment, buildings

CMI WORK PLAN
ASHLAND INC.
RENSSELEAR, NEW YORK

Figure 3A

Date Start/Finish: TBD **Drilling Company:** Parrott-Wolff **Driller's Name:** Joe Smith **Drilling Method:** Hollow Stem Auger **Bit Size:** 8.25" OD **Auger Size:** 4.25" ID **Rig Type:** CME-75 **Sampling Method:** 2" X 2' Split Spoon	**Northing:** NA **Easting:** NA **Casing Elevation:** NA **Borehole Depth:** 12' below grade **Surface Elevation:** NA **Descriptions By:** Katherine Potter	**Well ID:** **Well Schematic** **Client:** Ashland Inc. **Location:** 130 South Street Rensselaer, NY

Stickup Injection Well



Remarks: Not to scale. Generalized schematic. Actual wells will be screened from 2 to 12' below grade.
NA = Not Applicable/Not Available
TBD = To Be Determined
OD = Outer Diameter
ID = Inner Diameter

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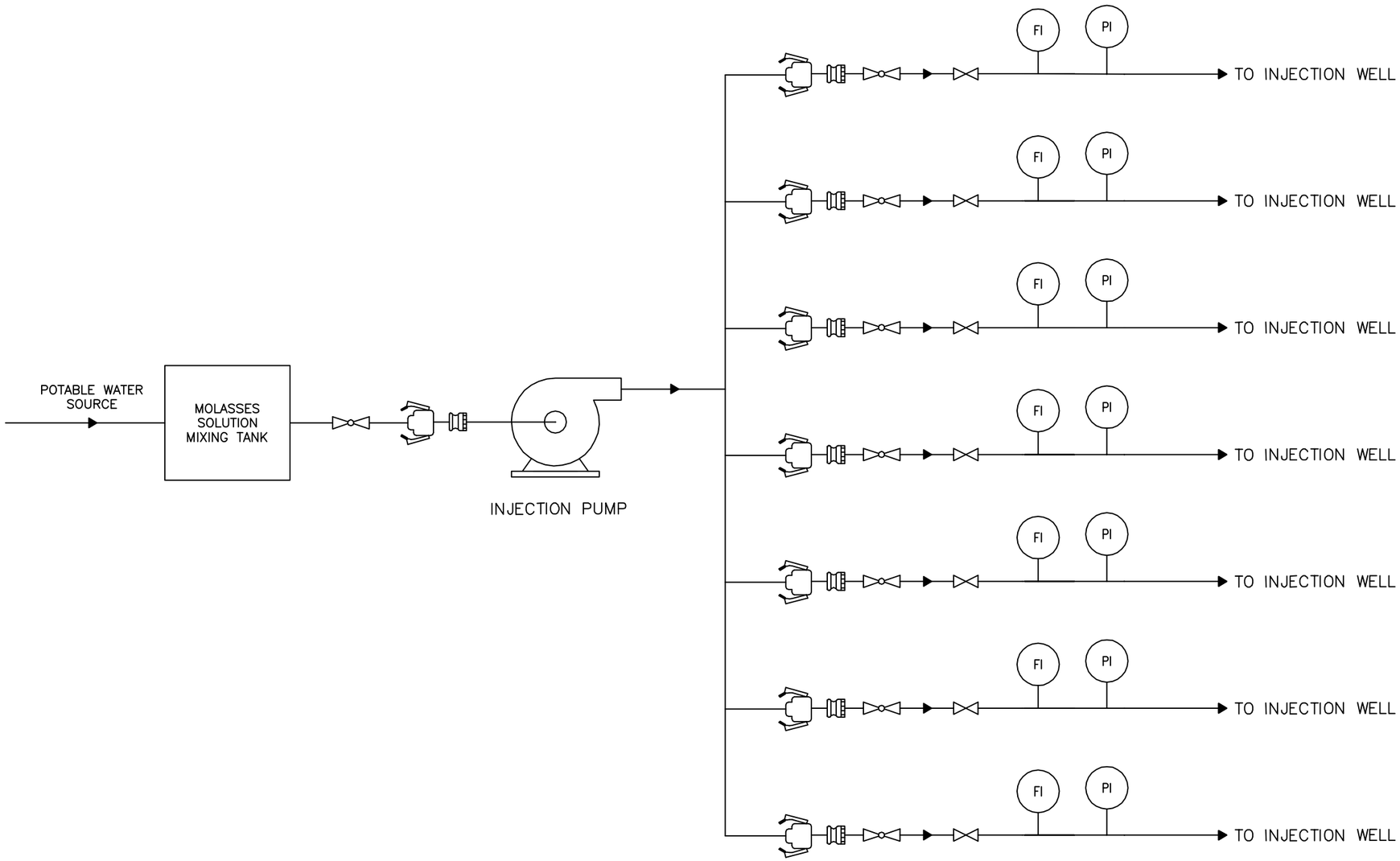
Figure 3B



ASHLAND INC.
RENSSELAER, NEW YORK
CMI WORK PLAN

PROCESS & INSTUMENTATION DIAGRAM - CARBOHYDRATE INJECTION SETUP

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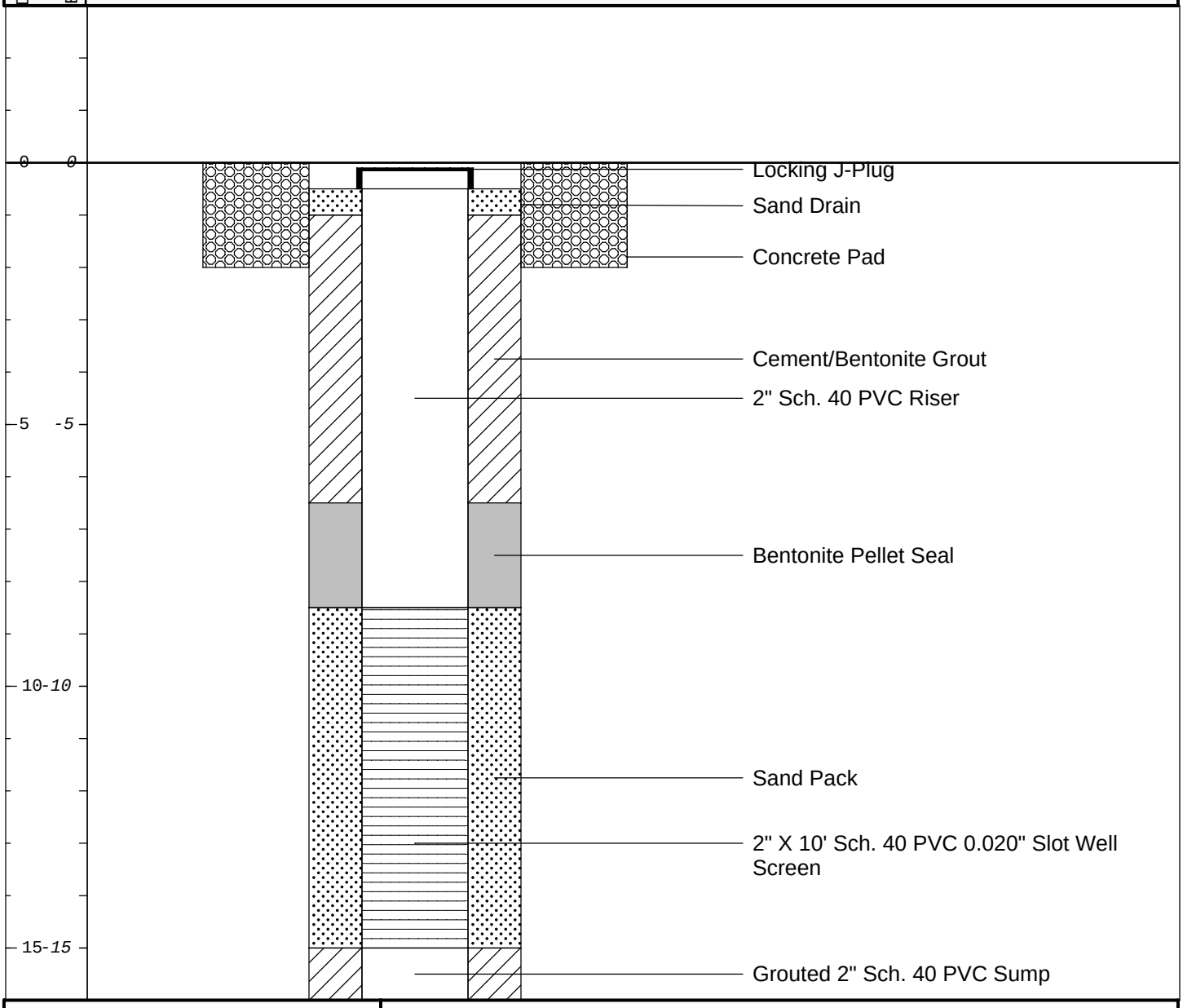
FIGURE
4

CITY: SYRACUSE, NY GROUP: ENVCAD DB: R. BASSETT, P. LISTER A.Schilling PM: M. KITTINGER TM/TR: K. POTTER LYR:ON=*;OFF=REF; (FRZ)
G:\ENVCAD\SYRACUSE\ACTIO\H003000\NY41\SI0101\DWG\CMI\I03000N01.dwg LAYOUT: 4SAVED: 12/8/2009 3:58 PM ACADVER: 17.0S (LMS TECH) PAGESETUP: ---PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 12/11/2009 11:41 AM BY: SCHILLING, ADAM
XREFS: IMAGES: PROJECTNAME: REMEDIAL 2008
03000XBL

Date Start/Finish: TBD **Drilling Company:** Parrott-Wolff **Driller's Name:** Joe Smith **Drilling Method:** Hollow Stem Auger **Bit Size:** 8.25" OD **Auger Size:** 4.25" ID **Rig Type:** CME-75 **Sampling Method:** 2" X 2' Split Spoon	**Northing:** NA **Easting:** NA **Casing Elevation:** NA **Borehole Depth:** 12' below grade **Surface Elevation:** NA **Descriptions By:** Katherine Potter	**Well ID:** **Well Schematic** **Client:** Ashland Inc. **Location:** 130 South Street Rensselaer, NY

Flushmount Monitoring Well



Remarks: Not to scale. Generalized schematic. Actual wells will be screened from 2 to 12' below grade.
NA = Not Applicable/Not Available
TBD = To Be Determined
OD = Outer Diameter
ID = Inner Diameter

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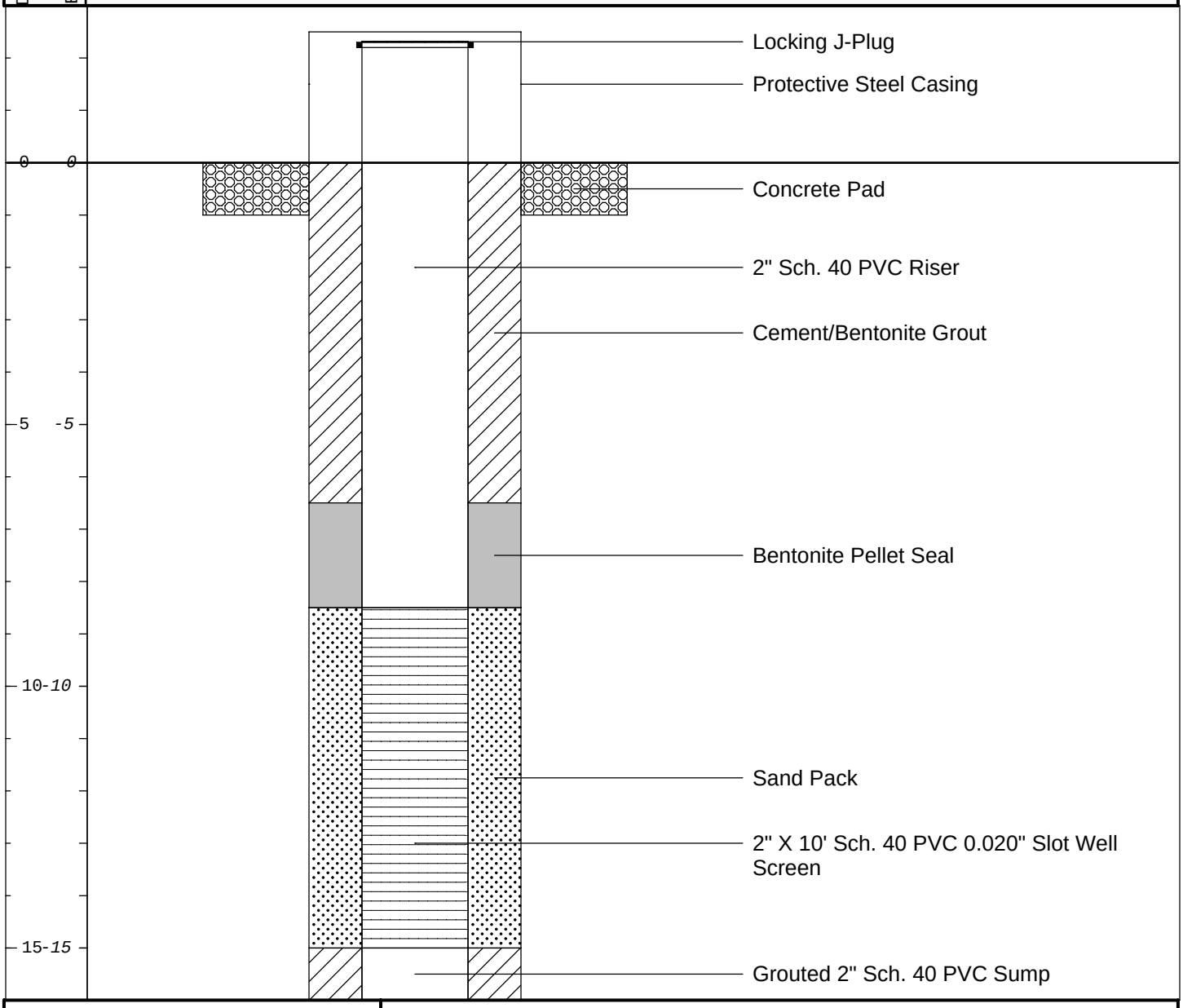
ASHLAND INC.
RENSSELEAR, NEW YORK

Figure 5A

Date Start/Finish: TBD **Drilling Company:** Parrott-Wolff **Driller's Name:** Joe Smith **Drilling Method:** Hollow Stem Auger **Bit Size:** 8.25" OD **Auger Size:** 4.25" ID **Rig Type:** CME-75 **Sampling Method:** 2" and 3" OD x 2'	**Northing:** NA **Easting:** NA **Casing Elevation:** NA **Borehole Depth:** 12' below grade **Surface Elevation:** NA **Descriptions By:** Katherine Potter	**Well ID:** **Well Schematic** **Client:** Ashland Inc. **Location:** 130 South Street Rensselaer, NY

Stickup Monitoring Well



ARCADIS
Infrastructure, environment, buildings

Remarks: Not to scale. Generalized schematic. Actual wells will be screened from 2 to 12' below grade.
NA = Not Applicable/Not Available
TBD = To Be Determined
OD = Outer Diameter
ID = Inner Diameter

CMI WORK PLAN
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Figure 5B

APPENDICES

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Appendix A

Pre-Design Investigation Report

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Infrastructure, environment, buildings

Imagine the result

Ashland Inc.

Appendix A

Pre-Design Investigation Summary Report

Rensselaer, New York

March 2010

ARCADIS

Brad Koons, P.E.
Senior Engineer

George Thomas
Principal Geologist

Katherine Potter
Staff Geologist

Appendix A

Pre-Design Investigation Summary Report

Rensselaer, New York

Prepared for:
Ashland Inc.

Prepared by:
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Our Ref.:
OH003000.NY41

Date:
March 2010

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2.5 Water Sample Collection 3

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Figure A-3 Proposed IRZ Locations

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B Groundwater Sampling Logs

C Grain Size Curves

1. Rensselaer Pre-Design Investigation

This appendix provides a summary of the results of the Pre-Design Investigation (PDI) to USEPA completed at the Ashland Inc (Ashland) site in Rensselaer, New York (the site). This work was completed as part of the Resource Conservation and Recovery Act (RCRA) Facility Investigation under Administrative Order on Consent Docket No. II RCRA-92-3008(h)-0210.

On behalf of Ashland, ARCADIS conducted the PDI at the site to gather data to support an *in situ* enhanced reductive dechlorination (ERD) remedial system design. The objective of the PDI was to determine the lateral extent of groundwater impacts along the downgradient (western) property boundary to form a basis for ERD injection well placement and to get more detailed information about the permeability of the subsurface for injection design. The goal of the ERD system will be to effectively treat groundwater as it is leaving the site.

The PDI included the installation of 13 temporary wells (PDI-1 through PDI-13 on Figure A-1) at approximately 40 foot spacing along the western property boundary where the *in situ* reactive zone (IRZ) is proposed to be installed. The objective of the well installation/sampling activities was to delineate the horizontal extent of volatile organic compounds (VOCs) in groundwater along this downgradient property line and to use soil observations and geotechnical data in the overall ERD system design.

The temporary wells were installed along a line generally parallel to the western property boundary from approximately 40 feet south of MW-3 on the north end to approximately 25 feet north of GP-33. GP-33 is a historical geoprobe location that had no VOC detections located just south of the Columbia Turnpike Bridge overpass. Groundwater samples obtained from the temporary wells were used to determine the presence/absence of chlorinated VOCs which are the target of the proposed ERD remedial system.

2. Summary of Activities

The following sections detail the activities connected with the PDI during the fieldwork completed in March 2009.

2.1 Utility Clearance

Three lines of evidence were used in locating utilities near the proposed PDI locations as follows:

1) Dig Safely New York utility locate system was contacted and a field meeting was conducted with the appropriate utilities.

2) Underground utilities in the vicinity of the drilling areas were delineated by an independent utility locator service (Underground Services, Inc./SoftDig).

3) Hand clearing to approximately 4 feet below ground surface (bgs) to clear each subsurface location.

2.2 Soil Borings

As shown on Figure A-1, a total of 13 soil borings were advanced which were converted to temporary monitoring wells, between March 11 and March 17, 2009. Soil borings were advanced using direct push technology and equipment (the tractor-mounted AMS 2 probe with a 4-foot Dual Tube push soil sampler). Soil samples were collected continuously at all locations except PDI-12 from the ground surface to a depth of approximately 20 feet bgs

The top of a massive gray silty clay unit was variably encountered at depths ranging from 6 to 15 feet bgs and extended to the bottom of nearly all PDI borings as shown in the attached boring logs (Attachment A). Each soil sample was visually characterized for soil type, grain size, moisture, staining, odors, or other indications of the potential presence of VOCs and placed in a container for headspace screening using a photoionization detector (PID).

2.3 Soil Sampling for VOCs and Geotechnical Testing

Soil samples were selected for laboratory analyses from three borings based on field observations and PID readings. A total of five soil samples were submitted for analysis,

one for VOCs and four for geotechnical testing. Table A-1 presents a summary of sample analysis. Soil samples selected for analysis were submitted to TestAmerica, Inc. in South Burlington, Vermont.

The one sample analyzed for VOCs was added to the scope of work due to elevated (relative to background) field PID readings, strong petroleum-type odors, and a rainbow sheen on the purge water from groundwater development at PDI-11 (0-2 feet bgs). VOCs were analyzed using the USEPA SW-846 Method 8260B.

Four representative soil samples were collected for analysis of geotechnical parameters to assist in determining the injection rate for the Corrective Measures Implementation (CMI). The samples were selected from the most permeable unit and from the least permeable unit to get the range of conductivity present in the screened intervals. Samples were collected based on visual characterization of the samples within the screened interval for borings PDI-7 and PDI-11 as shown in Table A-1. All soil samples were analyzed for total organic carbon (TOC) using the Lloyd Kahn method. Two of the four soil samples selected from the permeable unit were tested for grain size using the ASTM D422 method.

2.4 Temporary Monitoring Well Installation

Upon completion of the boring, each of the 13 soil borings were converted to temporary monitoring wells by installing a 1-inch diameter PVC riser with a 10-foot length of 0.010-inch slotted screen into the existing borehole with natural backfill. The screened section was installed from 2 to 12 feet bgs for all the wells with the exception of PDI-6, PDI-8, PDI-11 and PDI-13 in which the screened section was installed from 2.5 to 12.5 feet bgs. These temporary points were installed slightly deeper so that the base of the screen would intersect a sand layer found at that depth at these locations.

The temporary wells were developed after completion to remove fine sediments within the screened interval using a peristaltic pump to remove approximately 5 gallons of water from each well. Each location was marked in the field and physically located using measurements from existing structures/features. These measurements were used to update the PDI locations on the site map.

2.5 Water Sample Collection

Groundwater samples were collected from each well from March 12 to March 17, 2009. The groundwater samples were collected from the wells after 3 to 5 well volumes of

water had been purged from the well, and the water quality parameters were close to stability (+/- 0.1 for pH, 10% for dissolved oxygen, 3% for conductivity, and 10 mV for ORP). Water quality parameters including pH, ORP, temperature, turbidity and conductivity were measured every 5 minutes and recorded within the field logs (sampling logs are provided as Attachment B).

Upon collection, each sample was packed for shipment in a cooler with water ice under appropriate chain-of-custody protocol and transported to TestAmerica, Inc. in Burlington, Vermont for analysis of volatile organic compounds by SW-846 Method 8260B.

Following groundwater sampling, the temporary wells were decommissioned by pulling the PVC casing and backfilling the borehole with bentonite grout.

2.6 Investigation Derived Waste

Soil cuttings, drilling fluids, purge water, decontamination fluids, and PPE generated by the investigation activities were containerized in 55-gallon drums for subsequent characterization and offsite transport and disposal by Ashland Environmental Services.

3. Discussion of Investigation Results

The subsurface materials encountered at the majority of locations across the western property boundary consist primarily of fill materials composed of fine to coarse sand, gravel and silt ranging in thickness from four to approximately 8.5 feet. The geology below the fill layer is quite heterogeneous, which is consistent with the results of previous subsurface investigations in the area.

The material below the fill consists variably of a brown silty clay, clayey silt, or silt layer that ranges in thickness from less than one foot to a maximum of approximately six feet and is variously interbedded with sand that can be as much as several feet thick, but more often is less than 0.5 feet thick, particularly north of PDI-8. Sand seams are more common and thicker in the borings from PDI-7 to PDI-13 in the brown silt and clay layer. These materials are underlain by a lower permeability (based on field observations) gray clay and silt which grades to silty clay to the south. This unit is occasionally interbedded with thin sand lenses or a mix of sand, silt and clay to the total depth of borings (20 feet below grade).

Groundwater and soil data from the PDI are included as Tables A-2 and A-3, respectively. Grain size curves are provided in Attachment C. Groundwater data are also posted on Figure A-2. The groundwater data suggest that the extent of the central chlorinated VOC plume extends to the north somewhere between PDI-4 and PDI-3 and extends south of PDI-8. The southern plume is present from beyond PDI-11 to the north and extends south beyond PDI-12.

Petroleum hydrocarbon constituents were detected in the vicinity of PDI-11 in both soil and groundwater as indicated by the concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX) detected at this location, which are above groundwater standards as seen on Table A-2 and Figure A-2. BTEX concentrations in soil do not exceed the soil cleanup objectives as referenced in the NYSDEC Part 375-6.5 soil cleanup objectives (December 14, 2006) for the protection of groundwater, human health, and ecology at this location. The lack of BTEX at other PDI borings or in downgradient monitoring wells indicates that the presence of hydrocarbons in groundwater is localized. The presence of elevated BTEX concentrations in both groundwater and shallow soil suggests a potential surface release of gasoline that migrated through the vadose zone to the water table, which is relatively shallow at the site (generally less than 4 feet bgs in this area). The localized nature of the impact and lack of BTEX observations downgradient indicate that a limited volume of material was released.

4. Recommendations for Full-Scale Remedial System Design

To mitigate the off-site migration of dissolved CVOCs, an *in situ* ERD remedial system, utilizing injection wells for organic carbon introduction into the groundwater, was proposed in the March 2009 Draft Revised CMS. Two injection well *in situ* reactive zones (IRZs), one in the central area and one in the southern area of the site, will be installed to enhance bioattenuation of CVOCs.

Based on the PDI results, the injection well IRZ in the southern area (the Southern IRZ) as shown on Figure A-3, would be installed between 15 feet south of PDI-12 and approximately 25 feet south of MW-15. Assuming a 30-foot spacing between injection points, per the proposed design, a total of six injection wells are proposed to be installed along the Southern IRZ. The IRZ to be installed in the central portion of the site (the Northern IRZ), as shown on Figure A-3, would be installed between 15 feet south of PDI-7 and 15 feet north of IW-B1. Again, assuming a 30-foot spacing between injection points, per the proposed design, a total of 5 injection wells are proposed to be installed along the Northern IRZ. Based on the PDI results, the two IRZ lines combined are estimated to capture more than 99% of CVOC migrating off-site.

The injection wells would screen across the more permeable sand layer, which is generally found between 2 and 12 feet below grade. The injection well screens will be stainless steel 0.010-inch slot, based on grainsize data provided as Attachment C of this report.

Additionally, a shallow water table monitoring well is proposed for installation at PDI-11 location and screened between 2 and 12 feet bgs to monitor BTEX concentrations in groundwater at this location. Recommendations on the need for a corrective action to address BTEX in groundwater will be made after determining contaminant concentration trends in the new monitoring well.

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Tables

Table 1. Samples Collected, Ashland Inc., Rensselaer, New York

Sample ID.	No. of Samples	Date Sampled	Media	Analysis	Method
Ground Water Samples					
PDI-1	1	3/12/2009	Ground Water	VOCs	8260B
PDI-2	1	3/13/2009	Ground Water	VOCs	8260B
PDI-3	1	3/13/2009	Ground Water	VOCs	8260B
PDI-4	1	3/13/2009	Ground Water	VOCs	8260B
PDI-5	1	3/13/2009	Ground Water	VOCs	8260B
PDI-6	1	3/16/2009	Ground Water	VOCs	8260B
PDI-7	1	3/16/2009	Ground Water	VOCs	8260B
PDI-8	1	3/16/2009	Ground Water	VOCs	8260B
PDI-9	1	3/16/2009	Ground Water	VOCs	8260B
PDI-10	1	3/17/2009	Ground Water	VOCs	8260B
PDI-11	1	3/17/2009	Ground Water	VOCs	8260B
PDI-12	1	3/17/2009	Ground Water	VOCs	8260B
PDI-13	1	3/17/2009	Ground Water	VOCs	8260B
Soil Sample					
PDI-11 (0-2')	1	3/16/2009	Soil	VOCs	8260B
Geotechnical Samples					
PDI-7 (8-9')	1	3/13/2009	Soil	TOC	Lloyd Kahn
PDI-7 (8-9')	1	3/13/2009	Soil	Grain Size	ASTM D422
PDI-7 (9-12')	1	3/13/2009	Soil	TOC	Lloyd Kahn
PDI-11 (8-12')	1	3/16/2009	Soil	TOC	Lloyd Kahn
PDI-11(8-12')	1	3/16/2009	Soil	Grain Size	ASTM D422
PDI-11(12-14')	1	3/16/2009	Soil	TOC	Lloyd Kahn

Table 2. Summary of PDI Groundwater Sample Analytical Results, Ashland Inc., Rensselaer, New York

Location ID: / Date Collected:	NYSDEC TOGS 1.1.1 Water Guidance Values or Standards	PDI-1 03/12/09	PDI-2 03/13/09	PDI-3 03/13/09	PDI-4 03/13/09	PDI-5 03/13/09	PDI-6 03/16/09	PDI-7 03/16/09	PDI-8 03/16/09	PDI-9 03/16/09
Volatile Organics										
1,1,1-Trichloroethane	5	1.0 U	**2.6**	1.0 U	1.0 U	1.0 U	200 U	4.3 U	1.0 U	1.0 U
1,1-Dichloroethane	5	1.0 U	**1.9**	1.0 U	1.0 U	1.0 U	200 U	4.3 U	1.0 U	1.0 U
Acetone	50	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	1,000 U	22 U	5.0 U	5.0 U
Benzene	1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	200 U	4.3 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	5	1.0 U	**2.2**	1.0 U	**8.5**	**6.4**	**9,500**	**12**	**8.6**	1.0 U
Ethylbenzene	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	200 U	4.3 U	1.0 U	1.0 U
Tetrachloroethene	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	200 U	**5.4**	**1.9**	1.0 U
Toluene	5	1.0 U	1.0 U	1.0 U	1.0 U	**1.0**	200 U	4.3 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**230**	4.3 U	1.0 U	1.0 U
Trichloroethene	5	1.0 U	1.0 U	**1.0**	**5.0**	1.0 U	200 U	**160**	**28**	**3.2**
Vinyl Chloride	2	1.0 U	**2.0**	1.0 U	1.0 U	**5.7**	**2,700**	4.3 U	1.0 U	1.0 U
Xylenes (total)	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	200 U	4.3 U	1.0 U	1.0 U
Total VOCs	- -	ND	**8.7**	**1.0**	**14**	**13**	**12,000**	**180**	**39**	**3.2**

Location ID: / Date Collected:	NYSDEC TOGS 1.1.1 Water Guidance Values or Standards	PDI-10 03/17/09	PDI-11 03/17/09	PDI-12 03/17/09	PDI-13 03/17/09
Volatile Organics					
1,1,1-Trichloroethane	5	1.0 U	260 U [280 U]	68 U	1.0 U
1,1-Dichloroethane	5	1.0 U	260 U [280 U]	68 U	1.0 U
Acetone	50	**5.2**	1,300 U [1,400 U]	340 U	**18**
Benzene	1	1.0 U	**760 [660]**	68 U	1.0 U
cis-1,2-Dichloroethene	5	1.0 U	260 U [280 U]	**2,600**	1.0 U
Ethylbenzene	5	1.0 U	**1,200 [1,100]**	68 U	1.0 U
Tetrachloroethene	5	**1.0**	260 U [280 U]	68 U	1.0 U
Toluene	5	1.0 U	**7,100 [6,000]**	68 U	1.0 U
trans-1,2-Dichloroethene	5	1.0 U	260 U [280 U]	68 U	1.0 U
Trichloroethene	5	1.0 U	260 U [280 U]	**480**	1.0 U
Vinyl Chloride	2	1.0 U	260 U [280 U]	**430**	1.0 U
Xylenes (total)	5	**1.5**	**11,000 [11,000]**	68 U	1.0 U
Total VOCs	- -	**7.7**	**20,000 [19,000]**	**3,500**	**18**

See Notes on Page 2.

Table 2. Summary of PDI Groundwater Sample Analytical Results, Ashland Inc., Rensselaer, New York

Notes:

All results are in micrograms per liter (ug/L).

Results in brackets represent duplicate samples.

Detections are bolded.

Shaded cells exceed referenced criteria.

NYSDEC TOGS 1.1.1 Water Guidance Values or Standards = New York State Department of Environmental Conservation Technical and Operational Guidance Series (TOGS), June 1998 and its addenda (January 1999 Errata Sheet, April 2000 Addendum, and June 2004 Addendum).

Lab Qualifiers	Definition
ND	None detected.
U	Undetected; result is less than the project quantitation limit or if estimated results (J flags) are to be reported, less than the MDL.

Table 3. Summary of PDI Soil Sample Analytical Results, Ashland Inc., Rensselaer, New York

Location ID: Sample Depth (Feet): Date Collected:	Restricted Use SCOs Industrial	Units	PDI-7 8 - 9 03/13/09	PDI-7 9 - 12 03/13/09	PDI-11 0 - 2 03/16/09	PDI-11 8 - 12 03/16/09	PDI-11 12 - 14 03/16/09
Volatile Organics							
Ethylbenzene	780	mg/kg	NA	NA	**82**	NA	NA
Toluene	1,000	mg/kg	NA	NA	**300**	NA	NA
Xylenes (total)	1,000	mg/kg	NA	NA	**880**	NA	NA
Total VOCs	- -	mg/kg	NA	NA	**1,300**	NA	NA
Miscellaneous							
Total Organic Carbon	- -	mg/kg	1,240 U	**1,580**	NA	**2,370**	**3,620**
Percent Solids							
Percent Solids	- -	%	80.4	78	62.3	84.1	80.6

Notes:

NA = Not Analyzed.

Criteria are compared to the soil cleanup objectives as referenced in the NYSDEC Part 375-6.5 soil cleanup objectives (SCOs) for the protection of groundwater, human health, and ecology. December 14, 2006.

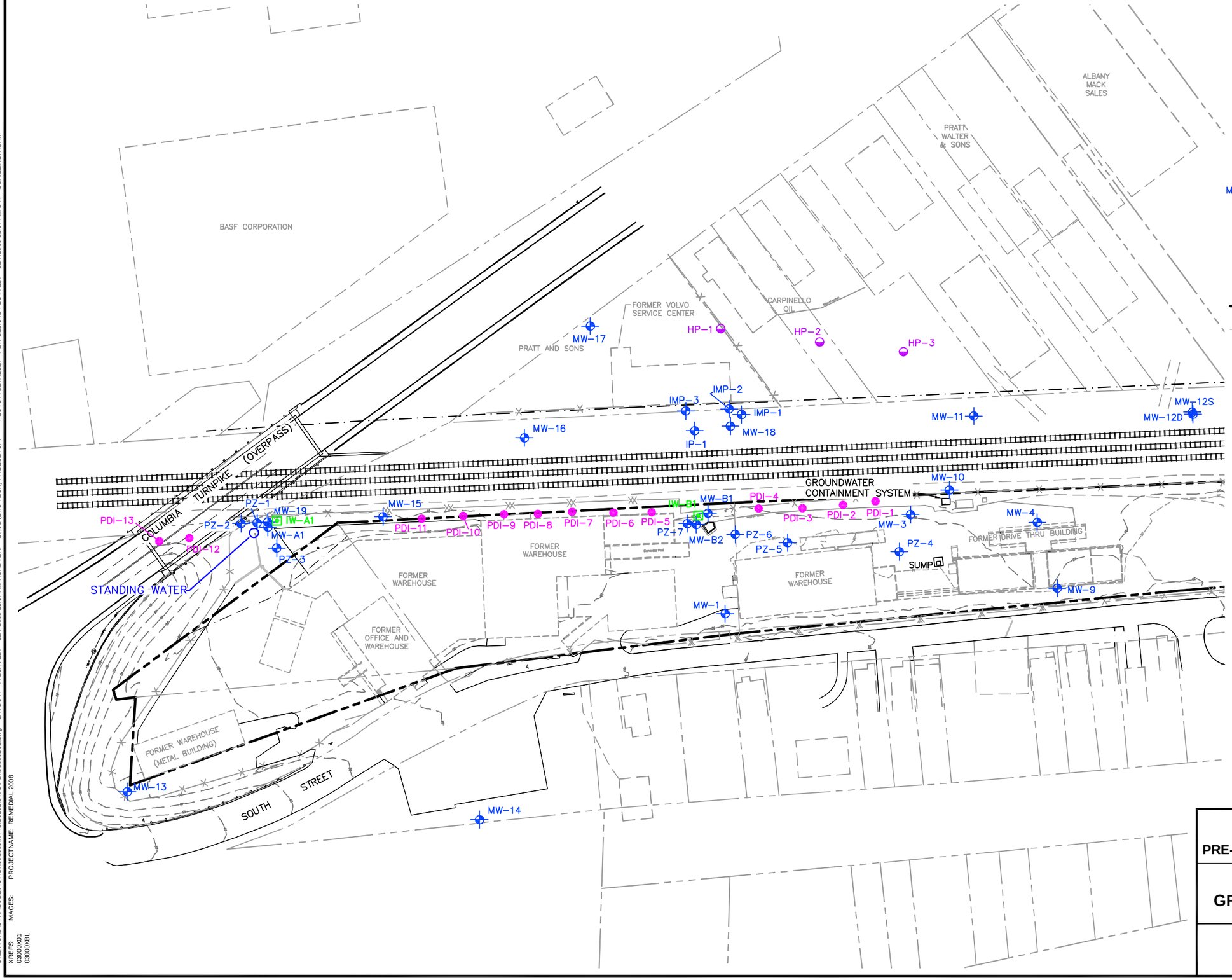
Bolded results represent detections.

mg/kg = milligrams per kilogram.

Lab Qualifiers	Definition
U	Undetected; result is less than the project quantitation limit or if estimated results (J flags) are to be reported, less than the MDL.

ARCADIS

Figures



LEGEND:

- MW-1/PZ-1/GP-18/IMP-1/IP-1 — PERMANENT GROUNDWATER SAMPLING LOCATION
- HP-3 — TEMPORARY GROUNDWATER SAMPLING LOCATION
- IW-B1 — INJECTION WELL LOCATION
- ASHLAND PROPERTY BOUNDARY
- OTHER PROPERTY LINE
- FORMER BUILDINGS AND STRUCTURES
- PDI SOIL BORING AND TEMPORARY WELL LOCATION

NOTES:

1. PDI LOCATIONS 1 THROUGH 13 WERE FIELD LOCATED WITH MULTIPLE TIE-OFFS TO EXISTING POINTS (WELLS, STRUCTURES, ETC.).
2. LOCATIONS AND TOPOGRAPHY EAST OF CSX RAILROAD PROPERTY AND WEST OF AND INCLUDING SOUTH STREET, SURVEYED BY THEW ASSOCIATES PE-LS, PLLC (OCTOBER 2008). REFERENCED HORIZONTALLY TO THE NORTH AMERICAN DATUM OF 1983 (NAD83) AND PROJECTED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (EAST ZONE). VERTICAL REFERENCE TO NGVD 1929. ASHLAND PROPERTY BOUNDARY ESTABLISHED BY THEW ASSOCIATES SURVEY AND DEED RESEARCH (OCTOBER 2008). OTHER PROPERTY LINES AND MAP FEATURES ARE FROM RENSSELAER COUNTY TAX MAPPING AND NEW YORK STATE CLEARING-HOUSE AERIAL PHOTOGRAPHY.

0 100' 200'

GRAPHIC SCALE

ASHLAND INC.
RENSSELAER, NEW YORK

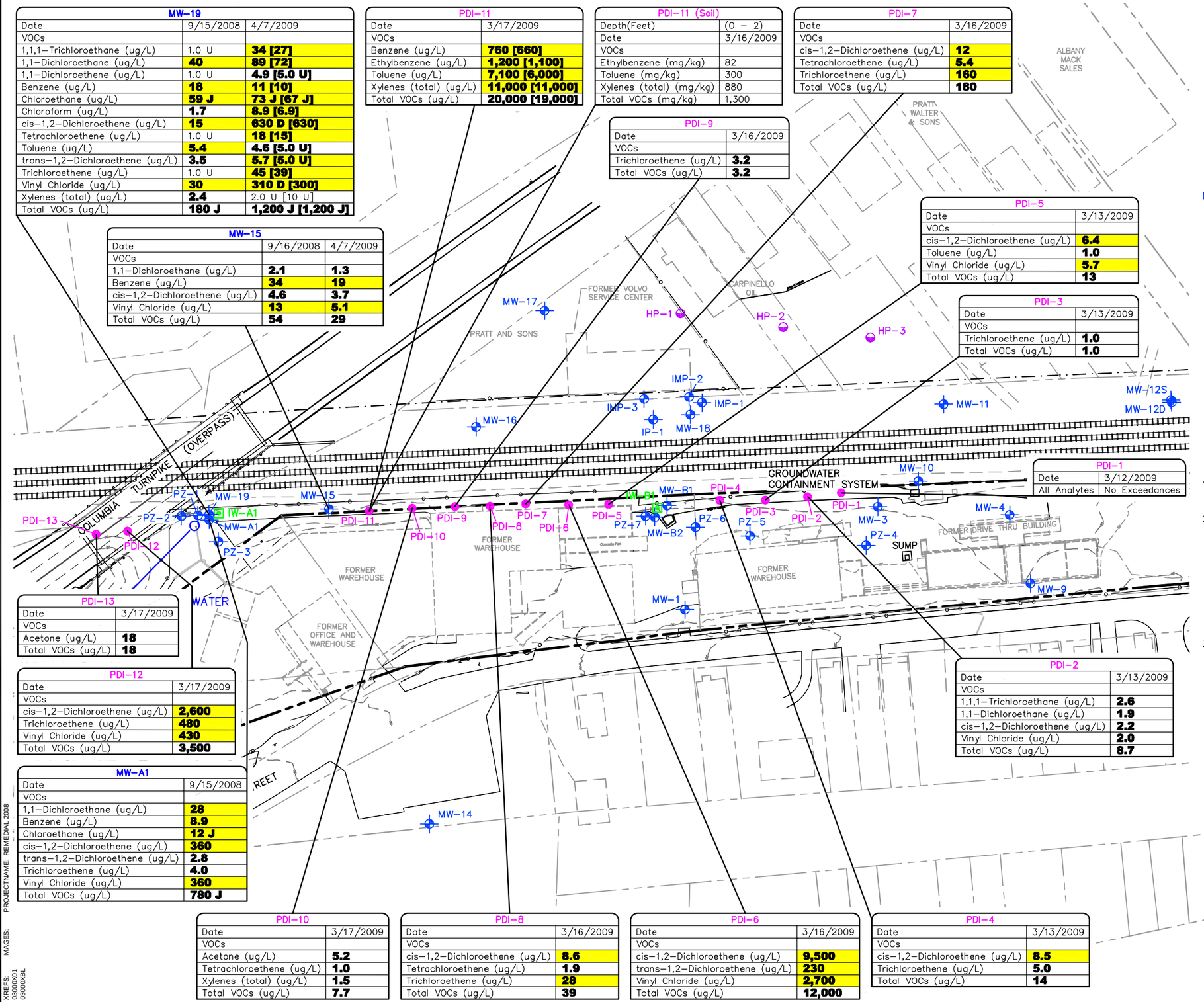
PRE-DESIGN INVESTIGATION SUMMARY REPORT

SITE MAP WITH GROUNDWATER SAMPLE LOCATIONS

ARCADIS

FIGURE **A-1**

CITY: SYRACUSE, NY GROUP: ENVCAD DB: R. BASSETT, R. ALLEN, P. LISTER PM: M. KITTINGER TM/TR: K. POTTER LYR:ON=*;OFF=REF, (FRZ)
G:\ENVCAD\SYRACUSE\ACTIVE\4003000\NY41\S01\01\DWG\PDI\03000B02.dwg LAYOUT: A-1SAVED: 12/7/2009 11:07 AM ACADVER: 17.0S (LMS TECH) PAGESETUP: ---
XREFS: 03000X01 03000XBL IMAGES: PROJECTNAME: REMEDIAL 2008



MW-19

Date	9/15/2008	4/7/2009
VOCs		
1,1,1-Trichloroethane (ug/L)	1.0 U	**34 [27]**
1,1-Dichloroethane (ug/L)	**40**	**89 [72]**
1,1-Dichloroethene (ug/L)	1.0 U	**4.9 [5.0 U]**
Benzene (ug/L)	**18**	**11 [10]**
Chloroethane (ug/L)	**59 J**	**73 J [67 J]**
Chloroform (ug/L)	**1.7**	**8.9 [6.9]**
cis-1,2-Dichloroethene (ug/L)	**15**	**630 D [630]**
Tetrachloroethene (ug/L)	1.0 U	**18 [15]**
Toluene (ug/L)	**5.4**	**4.6 [5.0 U]**
trans-1,2-Dichloroethene (ug/L)	**3.5**	**5.7 [5.0 U]**
Trichloroethene (ug/L)	1.0 U	**45 [39]**
Vinyl Chloride (ug/L)	**30**	**310 D [300]**
Xylenes (total) (ug/L)	**2.4**	2.0 U [10 U]
Total VOCs (ug/L)	**180 J**	**1,200 J [1,200 J]**

MW-15

Date	9/16/2008	4/7/2009
VOCs		
1,1-Dichloroethane (ug/L)	**2.1**	**1.3**
Benzene (ug/L)	**34**	**19**
cis-1,2-Dichloroethene (ug/L)	**4.6**	**3.7**
Vinyl Chloride (ug/L)	**13**	**5.1**
Total VOCs (ug/L)	**54**	**29**

PDI-11

Date	3/17/2009
VOCs	
Benzene (ug/L)	**760 [660]**
Ethylbenzene (ug/L)	**1,200 [1,100]**
Toluene (ug/L)	**7,100 [6,000]**
Xylenes (total) (ug/L)	**11,000 [11,000]**
Total VOCs (ug/L)	**20,000 [19,000]**

PDI-11 (Soil)

Depth(Feet)	(0 - 2)
Date	3/16/2009
VOCs	
Ethylbenzene (mg/kg)	82
Toluene (mg/kg)	300
Xylenes (total) (mg/kg)	880
Total VOCs (mg/kg)	1,300

PDI-9

Date	3/16/2009
VOCs	
Trichloroethene (ug/L)	**3.2**
Total VOCs (ug/L)	**3.2**

PDI-7

Date	3/16/2009
VOCs	
cis-1,2-Dichloroethene (ug/L)	**12**
Tetrachloroethene (ug/L)	**5.4**
Trichloroethene (ug/L)	**160**
Total VOCs (ug/L)	**180**

PDI-5

Date	3/13/2009
VOCs	
cis-1,2-Dichloroethene (ug/L)	**6.4**
Toluene (ug/L)	**1.0**
Vinyl Chloride (ug/L)	**5.7**
Total VOCs (ug/L)	**13**

PDI-3

Date	3/13/2009
VOCs	
Trichloroethene (ug/L)	**1.0**
Total VOCs (ug/L)	**1.0**

PDI-1

Date	3/12/2009
All Analytes	No Exceedances

PDI-13

Date	3/17/2009
VOCs	
Acetone (ug/L)	**18**
Total VOCs (ug/L)	**18**

PDI-12

Date	3/17/2009
VOCs	
cis-1,2-Dichloroethene (ug/L)	**2,600**
Trichloroethene (ug/L)	**480**
Vinyl Chloride (ug/L)	**430**
Total VOCs (ug/L)	**3,500**

MW-A1

Date	9/15/2008
VOCs	
1,1-Dichloroethane (ug/L)	**28**
Benzene (ug/L)	**8.9**
Chloroethane (ug/L)	**12 J**
cis-1,2-Dichloroethene (ug/L)	**360**
trans-1,2-Dichloroethene (ug/L)	**2.8**
Trichloroethene (ug/L)	**4.0**
Vinyl Chloride (ug/L)	**360**
Total VOCs (ug/L)	**780 J**

PDI-2

Date	3/13/2009
VOCs	
1,1,1-Trichloroethane (ug/L)	**2.6**
1,1-Dichloroethane (ug/L)	**1.9**
cis-1,2-Dichloroethene (ug/L)	**2.2**
Vinyl Chloride (ug/L)	**2.0**
Total VOCs (ug/L)	**8.7**

PDI-10

Date	3/17/2009
VOCs	
Acetone (ug/L)	**5.2**
Tetrachloroethene (ug/L)	**1.0**
Xylenes (total) (ug/L)	**1.5**
Total VOCs (ug/L)	**7.7**

PDI-8

Date	3/16/2009
VOCs	
cis-1,2-Dichloroethene (ug/L)	**8.6**
Tetrachloroethene (ug/L)	**1.9**
Trichloroethene (ug/L)	**28**
Total VOCs (ug/L)	**39**

PDI-6

Date	3/16/2009
VOCs	
cis-1,2-Dichloroethene (ug/L)	**9,500**
trans-1,2-Dichloroethene (ug/L)	**230**
Vinyl Chloride (ug/L)	**2,700**
Total VOCs (ug/L)	**12,000**

PDI-4

Date	3/13/2009
VOCs	
cis-1,2-Dichloroethene (ug/L)	**8.5**
Trichloroethene (ug/L)	**5.0**
Total VOCs (ug/L)	**14**

LEGEND:

MW-1/PZ-1/GP-18/IMP-1/IP-1 — PERMANENT GROUNDWATER SAMPLING LOCATION

HP-3 — TEMPORARY GROUNDWATER SAMPLING LOCATION

IW-B1 — INJECTION WELL LOCATION

ASHLAND PROPERTY BOUNDARY

OTHER PROPERTY LINE

FORMER BUILDINGS AND STRUCTURES

PDI SOIL BORING AND TEMPORARY WELL LOCATION

NOTES:

1. PDI LOCATIONS 1 THROUGH 13 WERE FIELD LOCATED WITH MULTIPLE TIE-OFFS TO EXISTING POINTS (WELLS, STRUCTURES, ETC.).
2. LOCATIONS AND TOPOGRAPHY EAST OF CSX RAILROAD PROPERTY AND WEST OF AND INCLUDING SOUTH STREET, SURVEYED BY THEW ASSOCIATES PE-LS, PLLC (OCTOBER 2008). REFERENCED HORIZONTALLY TO THE NORTH AMERICAN DATUM OF 1983 (NAD83) AND PROJECTED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (EAST ZONE). VERTICAL REFERENCE TO NGVD 1929. ASHLAND PROPERTY BOUNDARY ESTABLISHED BY THEW ASSOCIATES SURVEY AND DEED RESEARCH (OCTOBER 2008). OTHER PROPERTY LINES AND MAP FEATURES ARE FROM RENSSELAER COUNTY TAX MAPPING AND NEW YORK STATE CLEARING-HOUSE AERIAL PHOTOGRAPHY.
3. ug/L = MICROGRAMS PER LITER.
   mg/kg = MILLIGRAMS PER KILOGRAM.
   SHADED RESULTS EXCEED NYSDEC TOGS 1.1.1 WATER GUIDANCE VALUES OR STANDARDS = NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION TECHNICAL AND OPERATIONAL GUIDANCE SERIES (TOGS).

0 100' 200'

GRAPHIC SCALE

ASHLAND INC.
RENSSELAER, NEW YORK
CMI WORK PLAN

VOCs IN SOIL AND GROUNDWATER AT PDI AND ADJACENT LOCATIONS

ARCADIS

FIGURE
A-2

CITY:: SYRACUSE, NY GROUP: ENVCAD DB: R. BASSETT, R.ALLEN, P. LISTER PM: M. KITTINGER TM/TR: K. POTTER LYR:ON=*;OFF=REF, (FRZ)
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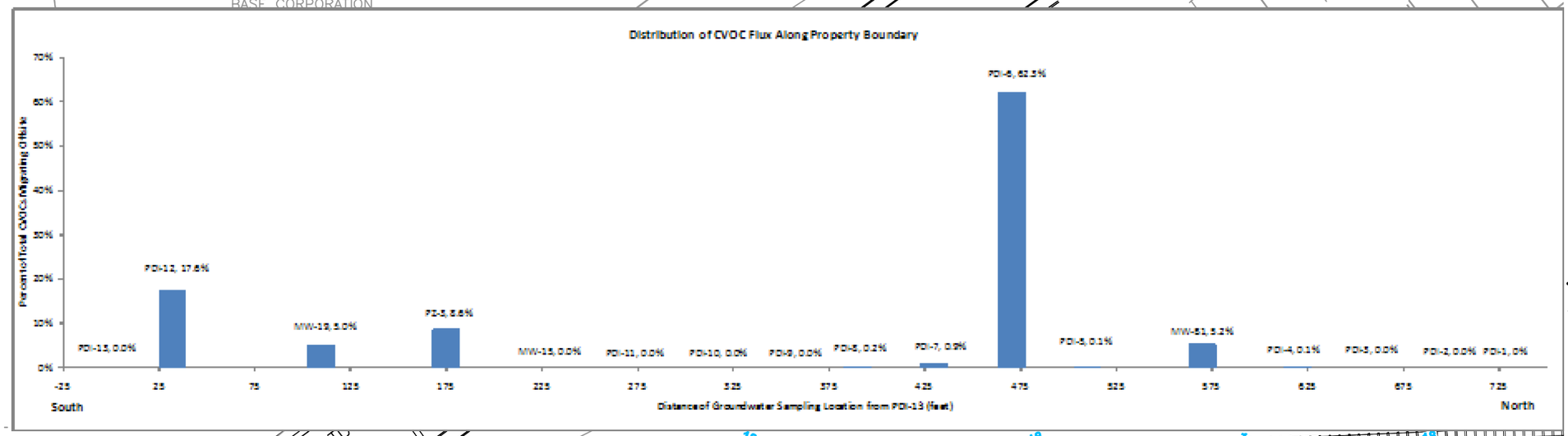


LEGEND:

- MW-1/PZ-1/GP-18/IMP-1/IP-1 — PERMANENT GROUNDWATER SAMPLING LOCATION
- HP-3 — TEMPORARY GROUNDWATER SAMPLING LOCATION
- PDI SOIL BORING AND TEMPORARY WELL LOCATION
- PROPOSED GROUNDWATER SAMPLING LOCATION
- IW-B1 — INJECTION WELL LOCATION
- PROPOSED CMI INJECTION WELL LOCATION
- ASHLAND PROPERTY BOUNDARY
- OTHER PROPERTY LINE
- FORMER BUILDINGS AND STRUCTURES
- PROPOSED EXTENT OF IN-SITU REACTIVE ZONE (IRZ)
- LATERAL EXTENT OF INFLUENCE (30 FEET)
- 20 — GROUNDWATER ELEVATION CONTOURS FROM SEPTEMBER 23, 2009

NOTES:

1. PDI LOCATIONS 1 THROUGH 13 WERE FIELD LOCATED WITH MULTIPLE TIE-OFFS TO EXISTING POINTS (WELLS, STRUCTURES, ETC.).
2. PROPOSED PDI LOCATIONS PDI-14 THROUGH PDI-23 AND PROPOSED MONITORING WELL LOCATIONS MW-20 AND MW-21 WILL BE FIELD LOCATED WITH MULTIPLE TIE-OFFS TO EXISTING POINTS (WELLS, STRUCTURES, ETC.).
3. PROPOSED PDI LOCATIONS IW-A6 AND IW-A7 AND PROPOSED MONITORING WELL LOCATION MW-21 WILL BE INSTALLED UNDER THE COLUMBIA TURNPIKE OVERPASS.
4. LOCATIONS AND TOPOGRAPHY EAST OF CSX RAILROAD PROPERTY AND WEST OF AND INCLUDING SOUTH STREET, SURVEYED BY THEW ASSOCIATES PE-LS, PLLC (OCTOBER 2008). REFERENCED HORIZONTALLY TO THE NORTH AMERICAN DATUM OF 1983 (NAD83) AND PROJECTED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM (EAST ZONE). VERTICAL REFERENCE TO NGVD 1929. ASHLAND PROPERTY BOUNDARY ESTABLISHED BY THEW ASSOCIATES SURVEY AND DEED RESEARCH (OCTOBER 2008). OTHER PROPERTY LINES AND MAP FEATURES ARE FROM RENSSELAER COUNTY TAX MAPPING AND NEW YORK STATE CLEARING-HOUSE AERIAL PHOTOGRAPHY.
5. GROUNDWATER ELEVATION CONTOURS FROM THE FOURTH QUARTER PROGRESS REPORT SUBMITTED 11/10/09.

0 65' 130'

GRAPHIC SCALE

ASHLAND INC.
RENSSELAER, NEW YORK

PRE-DESIGN INVESTIGATION SUMMARY REPORT

PROPOSED IRZ LOCATIONS

ARCADIS

FIGURE
A-3

CITY: SYRACUSE, NY GROUP: ENVCAD DB: R. BASSETT, A.Schilling, W.JONES PM: M. KITTINGER TM/TR: K. POTTER LYR:ON=*;OFF=REF; (FRZ)
G:\ENVCAD\SYRACUSE\ACTIVE\03000\NY41IS\0101\DWG\PDI\03000B04.dwg LAYOUT: A-3 SAVED: 3/23/2010 10:21 AM ACADVER: 17.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 3/23/2010 10:21 AM BY: JONES, WENDY
XREFS: 03000X01 03000X0BL IMAGES: 03000X10.jpg PROJECTNAME: REMEDIAL 2008

ARCADIS

Attachment A

Boring Logs

Date Start/Finish: 3/11/2009
Drilling Company: ARCADIS
Driller's Name: Rob Leroy
Drilling Method: Direct Push
Sampling Method: 2' Acetate Liner
Rig Type: Tractor-mounted AMS

Northing: NA
Easting: NA
Casing Elevation: NA

Borehole Depth: 20' bgs
Surface Elevation: NA

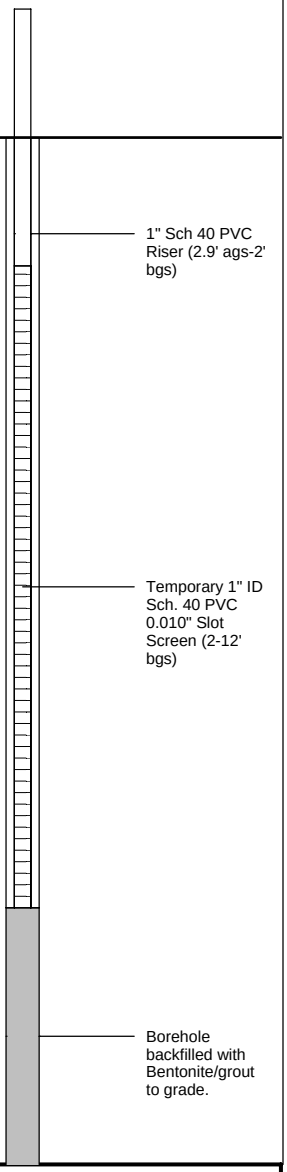
Descriptions By: Ricardo Jaimes

Well/Boring ID: **PDI-1**

Client: Ashland Inc.

Location: 130 South Street
Rensselaer, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0	1	0-2	Hand Auger	5.4			Gray to brown fine to coarse SAND and fine to medium subangular to subrounded GRAVEL, some Silt, little Clay, loose, moist to wet.
		2	2-4	1.3	0.0			Dark gray fine to coarse SAND, some subangular to subrounded fine Gravel, little Silt, loose, moist.
5	-5	3	4-6	NA	NA			NO RECOVERY.
		4	6-8	NA	NA			NO RECOVERY.
		5	8-10	1.6	1.4			Dark gray fine to coarse SAND and fine subrounded to subangular GRAVEL, loose, moist. Brown CLAY and SILT, little fine subrounded Gravel, little Sand, medium plasticity, moist.
10	-10	6	10-12	0.75	1.7			Brown to gray SILT and CLAY, little to trace subangular to subrounded fine Gravel, low plasticity, moist.
		7	12-14	1.88	1.4			Gray SILT, non-plastic, stiff, moist.
15	-15	8	14-16	2.0	1.0			Gray SILT, little very fine Sand, non-plastic to slightly plastic, wet.



ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Client: Ashland Inc.

Well/Boring ID: **PDI-1**

Borehole Depth: 20' bgs

Site Location:
130 South Street
Rensselaer, NY

DEPTH / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	9	16-18	2.0	1.4			Gray SILT, little fine to coarse Sand, trace fine subrounded Gravel, non-plastic, wet.	Borehole backfilled with Bentonite/grout to grade.
	10	18-20	1.55	1.4			Gray CLAY and SILT, little to trace fine Sand and Gravel, low plasticity, moist to wet.	
20 -20								
25 -25								
30 -30								
35 -35								

ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Date Start/Finish: 3/11/2009
Drilling Company: ARCADIS
Driller's Name: Rob Leroy
Drilling Method: Direct Push
Sampling Method: 2' Acetate Liner
Rig Type: Tractor-mounted AMS

Northing: NA
Easting: NA
Casing Elevation: NA

Borehole Depth: 20' bgs
Surface Elevation: NA

Descriptions By: Ricardo Jaimes

Well/Boring ID: **PDI-2**

Client: Ashland Inc.

Location: 130 South Street
Rensselaer, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0	1	0-2	0.7	0.0			Brown fine to coarse SAND and fine to medium angular to subangular GRAVEL, little brick fragments, moist (frozen).
		2	2-4	1.05	0.0			Brown fine to coarse SAND, little fine angular Gravel, trace brick fragments, trace Silt, slightly plastic, moist.
5	-5	3	4-6	1.3	0.0			Dark gray to dark brown fine to coarse SAND, some Silt, little fine to medium subrounded Gravel, loose, wet.
		4	6-8	1.35	0.0			Gray Silty CLAY, plastic, moist.
								Gray fine to coarse SAND, trace Silt, loose, moist.
		5	8-10	1.94	0.0			Gray to brown SILT and CLAY, low plasticity, moist.
10	-10	6	10-12	2.0	0.0			Brown Clayey SILT and very fine SAND, slightly plastic, moist.
		7	12-14	1.85	0.0			Gray Clayey fine SAND and SILT, trace subrounded fine Gravel, low plasticity, moist.
15	-15	8	14-16	1.95	0.0			Gray Clayey SILT, little fine Sand, trace Subangular Gravel, moist.

Well/Boring Construction

1" Sch 40 PVC Riser (2.9' ags-2' bgs)

Temporary 1" ID Sch. 40 PVC 0.010" Slot Screen (2-12' bgs)

Borehole backfilled with Bentonite to grade.

ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Client: Ashland Inc.

Well/Boring ID: **PDI-2**

Borehole Depth: 20' bgs

Site Location:
130 South Street
Rensselaer, NY

DEPTH / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	9	16-18	1.90	0.0			Gray Clayey SILT, slightly plastic, moist.	Borehole backfilled with Bentonite to grade.
	10	18-20	1.95	0.0			Gray SILT, very loose, wet.	
20 -20								
25 -25								
30 -30								
35 -35								

ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Date Start/Finish: 3/11/2009
Drilling Company: ARCADIS
Driller's Name: Rob Leroy
Drilling Method: Direct Push
Sampling Method: 2' Acetate Liner
Rig Type: Tractor-mounted AMS

Northing: NA
Easting: NA
Casing Elevation: NA

Borehole Depth: 20' bgs
Surface Elevation: NA

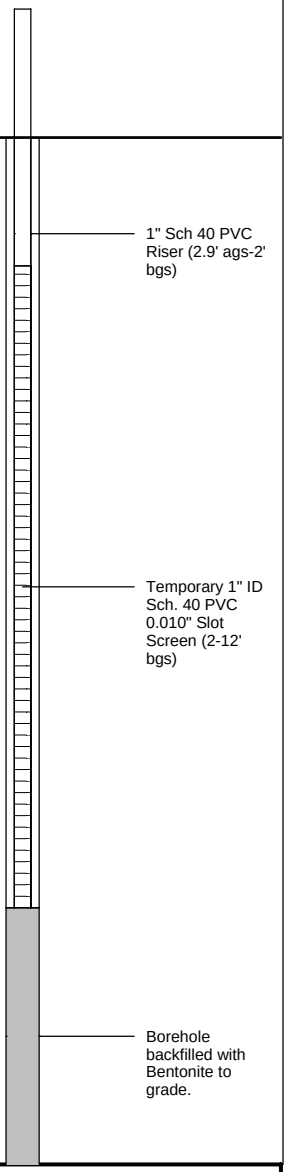
Descriptions By: Ricardo Jaimes

Well/Boring ID: **PDI-3**

Client: Ashland Inc.

Location: 130 South Street
Rensselaer, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0	1	0-2	1.25	0.0			Gray to brown fine to coarse SAND, some angular fine to medium Gravel, little brick fragments, loose to dense, moist.
		2	2-4	1.0	0.0			Brown fine to coarse SAND, some subangular to subrounded Gravel, moist. [FILL]
5	-5	3	4-6	1.11	0.0			Gray fine to coarse SAND, little Gravel, little Silt, moist. Gray Silty CLAY, plastic, moist. Dark gray fine to coarse SAND, some fine subrounded Gravel, little Silt, loose, slight petroleum odor, moist.
		4	6-8	1.35	0.0			Brown fine to coarse SAND, some angular to subrounded fine Gravel. Gray to brown fine to coarse SAND, little subrounded fine Gravel, loose, moist. Brown Silty CLAY, plastic, moist. Light brown SILT and fine to coarse SAND, loose, moist.
		5	8-10	1.90	0.0			Brown to light brown Silty CLAY.
10	-10	6	10-12	1.95	0.0			Brown Silty CLAY and Clayey SILT, soft, wet.
		7	12-14	1.98	0.0			Gray Clayey SILT, low plasticity, moist.
15	-15	8	14-16	NA	NA			NO RECOVERY.



ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Client: Ashland Inc.

Well/Boring ID: **PDI-3**

Borehole Depth: 20' bgs

Site Location:
130 South Street
Rensselaer, NY

DEPTH / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	9	16-18	2.0	0.0			Gray Silty CLAY, plastic, moist.	Borehole backfilled with Bentonite to grade.
	10	18-20	0.8	0.0			Gray to light brown Silty CLAY, moist.	
20 -20								
25 -25								
30 -30								
35 -35								

ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Date Start/Finish: 3/13/09
Drilling Company: ARCADIS
Driller's Name: Rob Leroy
Drilling Method: Direct Push
Sampling Method: 2 and 4' Acetate Liner
Rig Type: Tractor-mounted AMS

Northing: NA
Easting: NA
Casing Elevation: NA

Borehole Depth: 20' bgs
Surface Elevation: NA

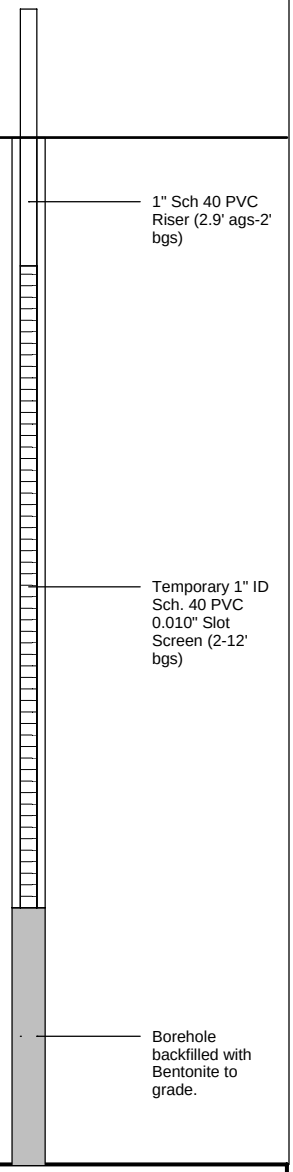
Descriptions By: Ricardo Jaimes

Well/Boring ID: **PDI-4**

Client: Ashland Inc.

Location: 130 South Street
Rensselaer, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0	1	0-2	1.45	3.6			Brown fine to coarse SAND and fine to medium angular GRAVEL, concrete chips, loose, moist. [FILL]
		2	2-4	0.55	3.2			
								Brown to light brown Clayey SILT, moist to wet.
5	-5	3	4-6	1.54	3.2			Dark gray fine to coarse SAND, some Silt, trace fine subrounded Gravel, loose, wet.
		4	6-8	1.52	2.7			Dark gray Clayey SILT, and Silty CLAY, plastic, moist.
								Brown to light brown Clayey SILT, low plasticity, moist.
								Brown to light brown Silty CLAY, plastic, moist.
10	-10	5	8-12	3.95	6.4			Fine to course SAND and SILT, little fine subrounded Gravel, trace Clay 9.4' - 9.9' bgs.
								Gray Clayey SILT and Silty CLAY, medium plasticity to plastic, moist to wet.
15	-15	6	12-16	4.0	1.8			



ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Client: Ashland Inc.

Well/Boring ID: **PDI-4**

Borehole Depth: 20' bgs

Site Location:
130 South Street
Rensselaer, NY

DEPTH / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	7	16-20	4.0	0.9			Gray Clayey SILT, low plasticity, soft, moist.	Borehole backfilled with Bentonite to grade.
20 -20							Gray Clayey SAND, some Silt, slightly plastic, soft, moist to wet.	
25 -25								
30 -30								
35 -35								

ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Date Start/Finish: 3/13/09
Drilling Company: ARCADIS
Driller's Name: Rob Leroy
Drilling Method: Direct Push
Sampling Method: 2 and 4' Acetate Liner
Rig Type: Tractor-mounted AMS

Northing: NA
Easting: NA
Casing Elevation: NA

Borehole Depth: 20' bgs
Surface Elevation: NA

Descriptions By: Ricardo Jaimes

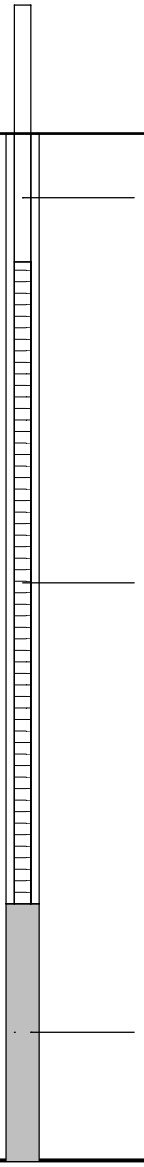
Well/Boring ID: **PDI-5**

Client: Ashland Inc.

Location: 130 South Street
Rensselaer, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0	1	0-2	NA	NA			NO RECOVERY. From hand auger - Brown fine to coarse SAND and fine to medium angular Gravel, some Silt, moist.
		2	2-4	0.9	0.0			Fine to coarse SAND and fine to medium GRAVEL, some Silt, little Organics (Roots), trace Clay, loose, moist.
5	-5	3	4-6	1.92	0.0			Dark gray grading to gray CLAY and SILT, some fine to coarse SAND and little subangular Gravel, soft, slight odor and slight dark gray staining, moist.
		4	6-8	1.52	0.0			Gray Silty CLAY, plastic, moist. Gray fine to coarse SAND, some Silt, loose, wet. Light gray Silty CLAY, plastic, moist. Moist to wet 8.0' - 9.0' bgs.
10	-10	5	8-12	3.91	5.4			Gray fine to coarse SAND, loose, moist to wet. Gray Silty CLAY, moist to wet, plastic.
15	-15	6	12-16	4.0	0.0			Gray Silty CLAY, high plasticity, moist to wet.

Well/Boring Construction



ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Client: Ashland Inc.

Well/Boring ID: **PDI-5**

Borehole Depth: 20' bgs

Site Location:
130 South Street
Rensselaer, NY

DEPTH / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	7	16-20	4.0	0.0			Gray Silty CLAY, high plasticity, moist to wet.	Borehole backfilled with Bentonite/grout to grade.
20 -20								
25 -25								
30 -30								
35 -35								

ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Date Start/Finish: 3/13/2009
Drilling Company: ARCADIS
Driller's Name: Rob Leroy
Drilling Method: Direct Push
Sampling Method: 2 and 4' Acetate Liner
Rig Type: Tractor-mounted AMS

Northing: NA
Easting: NA
Casing Elevation: NA

Borehole Depth: 20' bgs
Surface Elevation: NA

Descriptions By: Ricardo Jaimes

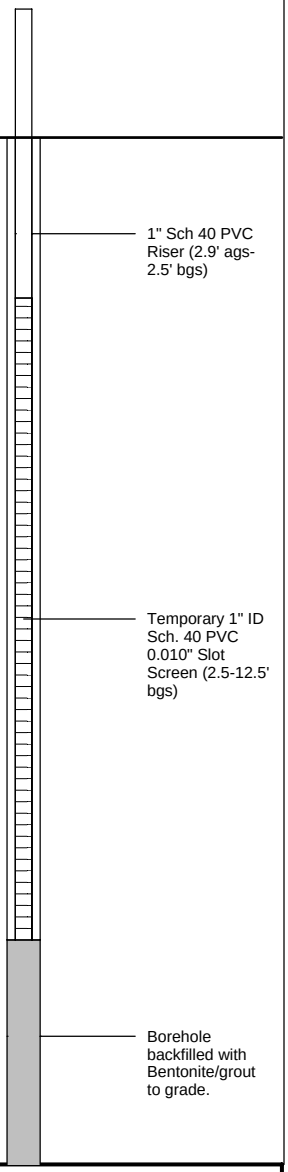
Well/Boring ID: **PDI-6**

Client: Ashland Inc.

Location: 130 South Street
Rensselaer, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0	1	0-2	0.65	0.0			Dark gray to brown fine to coarse SAND and fine to medium subrounded GRAVEL, some Silt, some Organics, loose, moist to wet.
		2	2-4	NA	NA			NO RECOVERY. From hand auger - Fine to coarse SAND and fine to coarse subangular to subrounded GRAVEL, loose, wet.
5	-5	3	4-6	0.35	0.0			Dark gray to brown fine to coarse SAND and fine subrounded GRAVEL, some Silt, loose, wet.
		4	6-8	0.5	0.0			Dark gray CLAY and SILT, medium plasticity, soft, moist.
								Gray to light brown Silty CLAY, plastic, soft, moist.
		5	8-10	NA	NA			NO RECOVERY.
								Dark gray fine to coarse SAND and fine subrounded GRAVEL, trace Silt, slight odor, loose, wet.
10	-10	6	10-12	1.95	26.2			Gray Silty CLAY, plastic, soft, wet.
								Dark gray fine to coarse SAND, loose, wet.
		7	12-16	3.96	0.0			Gray Silty CLAY, high plasticity, soft, moist to wet.
15	-15							

Well/Boring Construction



ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Client: Ashland Inc.

Well/Boring ID: **PDI-6**

Borehole Depth: 20' bgs

Site Location:
130 South Street
Rensselaer, NY

DEPTH / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	8	16-20	4.0	0.0			Gray Silty CLAY, high plasticity, soft, moist to wet.	Borehole backfilled with Bentonite/grout to grade.
20 -20								
25 -25								
30 -30								
35 -35								

ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Date Start/Finish: 3/13/2009
Drilling Company: ARCADIS
Driller's Name: Rob Leroy
Drilling Method: Direct Push
Sampling Method: 2 and 4' Acetate Liner
Rig Type: Tractor-mounted AMS

Northing: NA
Easting: NA
Casing Elevation: NA

Borehole Depth: 20' bgs
Surface Elevation: NA

Descriptions By: Ricardo Jaimes

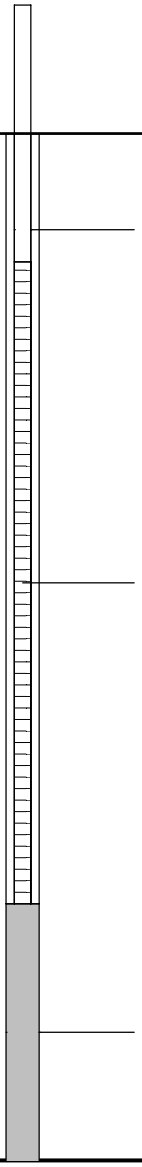
Well/Boring ID: **PDI-7**

Client: Ashland Inc.

Location: 130 South Street
Rensselaer, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0	1	0-2	1.26	2.8			Dark gray to black medium to coarse SAND and fine angular GRAVEL, trace Organics (Roots), loose, moist.
		2	2-4	1.8	2.8			Dark gray to black coarse SAND and fine GRAVEL, little Silt, loose, moist.
								Dark gray fine to coarse SAND, little Silt, loose, moist.
5	-5	3	4-6	1.85	2.8			Dark gray to brown fine to coarse SAND, some Silt and Clay, trace fine subrounded Gravel, slightly plastic, soft to dense, wet.
		4	6-8	1.05	2.0			Gray to brown Silty CLAY, high plasticity, moist.
								Gray to brown fine to coarse SAND, loose, moist.
								Brown Silty CLAY plastic, soft, moist.
10	-10	5	8-12	3.7	4.7			Brown changing to gray fine to coarse SAND, some fine subrounded Gravel, trace Silt, loose, wet.
								Gray Silty CLAY, high plasticity, soft, moist to wet.
15	-15	6	12-16	3.5	1.6			

Well/Boring Construction



ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Client: Ashland Inc.

Well/Boring ID: **PDI-7**

Borehole Depth: 20' bgs

Site Location:
130 South Street
Rensselaer, NY

DEPTH / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	7	16-20	4.0	0.8			Gray Silty CLAY, high plasticity, soft, moist to wet.	Borehole backfilled with Bentonite/grout to grade.
20 -20								
25 -25								
30 -30								
35 -35								

ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Date Start/Finish: 3/13/2009
Drilling Company: ARCADIS
Driller's Name: Rob Leroy
Drilling Method: Direct Push
Sampling Method: 2 and 4' Acetate Liner
Rig Type: Tractor-mounted AMS

Northing: NA
Easting: NA
Casing Elevation: NA

Borehole Depth: 20' bgs
Surface Elevation: NA

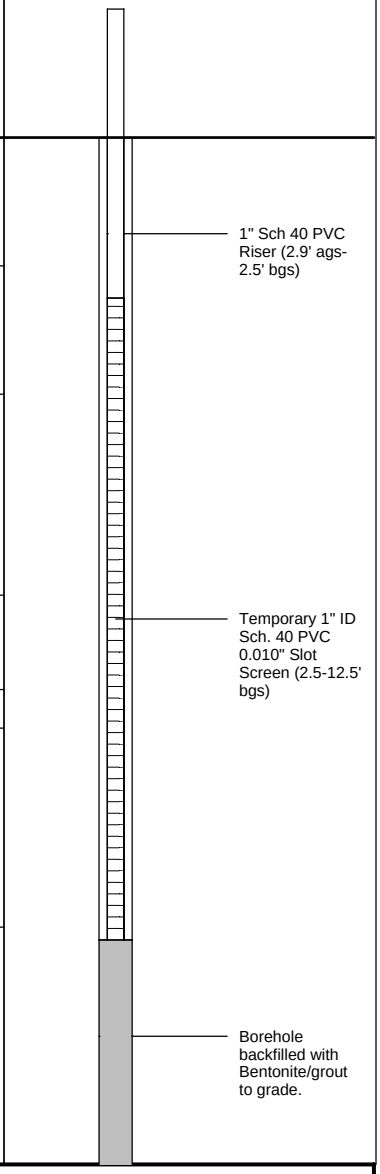
Descriptions By: Ricardo Jaimes

Well/Boring ID: **PDI-8**

Client: Ashland Inc.

Location: 130 South Street
Rensselaer, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0	1	0-2	1.2	2.8			Dark gray to black fine to coarse SAND and fine GRAVEL, some Silt, trace Clay, loose, moist to wet.
		2	2-4	1.15	2.0			Gray to brown fine to coarse SAND and fine to medium subangular GRAVEL, trace Clay, trace Silt, loose, moist to wet.
5	-5	3	4-6	1.4	5.0			Brown CLAY and SILT, little to trace angular fine Gravel, medium plasticity, stiff, moist.
		4	6-8	1.05	1.8			Brown fine to coarse SAND, loose, wet.
								Brown Silty CLAY, plastic, stiff, moist.
10	-10	5	8-12	3.6	1.8			Brown to gray fine to coarse SAND, loose, wet.
		6	12-16	4.0	0.0			Gray Silty CLAY, soft, moist to wet.
15	-15							



ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Client: Ashland Inc.

Well/Boring ID: **PDI-8**

Borehole Depth: 20' bgs

Site Location:
130 South Street
Rensselaer, NY

DEPTH / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	7	16-20	4.0	0.0			Gray Silty CLAY, soft, moist to wet.	Borehole backfilled with Bentonite/grout to grade.
20 -20							Gray fine to medium SAND, loose, moist.	
25 -25								
30 -30								
35 -35								

ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Date Start/Finish: 3/16/2009
Drilling Company: ARCADIS
Driller's Name: Rob Leroy
Drilling Method: Direct Push
Sampling Method: 2' and 4' Acetate Liner
Rig Type: Tractor-mounted AMS

Northing: NA
Easting: NA
Casing Elevation: NA

Borehole Depth: 20' bgs
Surface Elevation: NA

Descriptions By: Katherine Potter

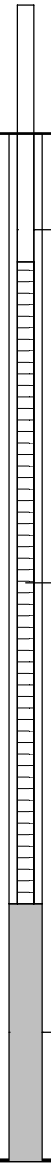
Well/Boring ID: **PDI-9**

Client: Ashland Inc.

Location: 130 South Street
Rensselaer, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0	1	0-2	0.6	0.0			Black fine to medium SAND, little coarse Sand, little fine Gravel, trace Silt, wet. [FILL]
								Dark gray 2.0' - 2.6' bgs.
		2	2-4	1.3	0.0			Gray fine to medium SAND, little to trace coarse Sand, trace fine to medium Gravel, trace Silt, wet. [FILL]
5	-5	3	4-6	1.4	0.0			Gray fine to medium SAND, some Silt, little Clay, trace fine Gravel, trace coarse Sand, wet.
		4	6-8	2.0	0.0			Light brown-gray Silty CLAY, trace fine to medium Sand, wet.
								Gray Silty CLAY, wet.
10	-10	5	8-12	3.4	0.0			Gray fine to medium SAND, trace Silt.
								Gray-light brown Silty CLAY, trace fine to medium Sand, wet.
								Dark gray Silty CLAY, plastic, soft to moderately soft, wet.
15	-15	6	12-16	3.8	0.0			

Well/Boring Construction



1" Sch 40 PVC Riser (2.9' ags-2' bgs)

Temporary 1" ID Sch. 40 PVC 0.010" Slot Screen (2-12' bgs)

Borehole backfilled with Bentonite/grout to grade.

ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Client: Ashland Inc.

Well/Boring ID: **PDI-9**

Borehole Depth: 20' bgs

Site Location:
130 South Street
Rensselaer, NY

DEPTH / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	7	16-20	4.0	0.0			Dark gray Silty CLAY, plastic, soft to moderately soft, wet.	Borehole backfilled with Bentonite/grout to grade.
20 -20								
25 -25								
30 -30								
35 -35								

ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Date Start/Finish: 3/16/09
Drilling Company: ARCADIS
Driller's Name: Rob Leroy
Drilling Method: Direct Push
Sampling Method: 4' Acetate Liner
Rig Type: Tractor-mounted AMS

Northing: NA
Easting: NA
Casing Elevation: NA

Borehole Depth: 20' bgs
Surface Elevation: NA

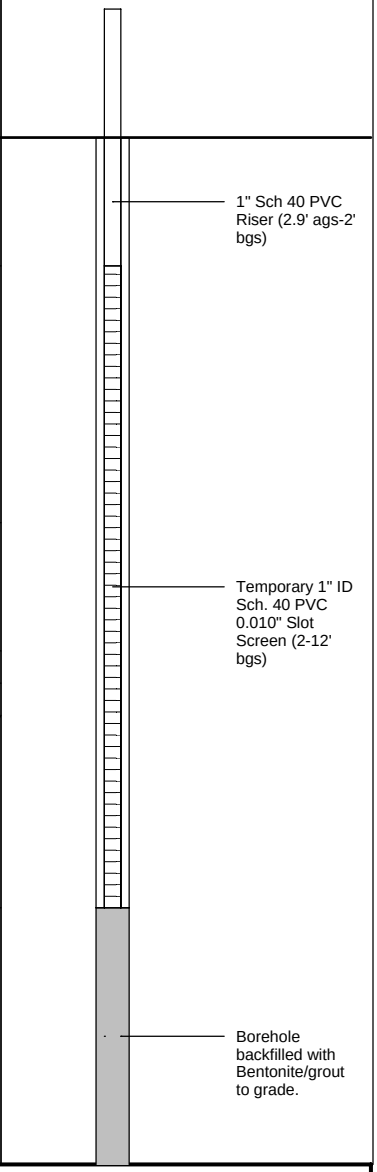
Descriptions By: Katherine Potter

Well/Boring ID: **PDI-10**

Client: Ashland Inc.

Location: 130 South Street
Rensselaer, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0	1	0-2	1.2	0.4			Brown to very dark brown fine to medium SAND, some to little fine to medium Gravel, trace coarse Sand, trace Silt, moist. [FILL]
		2	2-4	1.1	1.2			Dark brown fine to coarse SAND, trace fine Gravel [SLAG], trace Silt, wet.
5	-5	3	4-6	1.0	0.8			No SLAG, little Silt, wet 4.0' - 6.0' bgs.
		4	6-8	1.2	0.0			Dark gray grading to black at 7.5' bgs fine to medium SAND and SILT, trace coarse Sand, trace fine Gravel, trace Clay, wet.
								Gray fine SAND and SILT, some Clay, wet.
								Gray fine to medium SAND, some fine to medium Gravel, little to trace Silt and Clay and Sand, wet.
10	-10	5	8-12	2.6	0.8			Gray fine to coarse GRAVEL, little fine to medium Sand, trace Silt, loose, wet.
		6	12-16	4.0	0.0			Gray Silty CLAY, plastic, soft, wet.
15	-15							



ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Client: Ashland Inc.

Well/Boring ID: **PDI-10**

Borehole Depth: 20' bgs

Site Location:
130 South Street
Rensselaer, NY

DEPTH / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	7	16-20	4.0	0.0			Gray Silty CLAY, plastic, soft, wet.	Borehole backfilled with Bentonite/grout to grade.
20 -20								
25 -25								
30 -30								
35 -35								

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

ARCADIS
Infrastructure, environment, facilities

Date Start/Finish: 3/16/09
Drilling Company: ARCADIS
Driller's Name: Rob Leroy
Drilling Method: Direct Push
Sampling Method: 2 and 4' Acetate Liner
Rig Type: Tractor-mounted AMS

Northing: NA
Easting: NA
Casing Elevation: NA

Borehole Depth: 20' bgs
Surface Elevation: NA

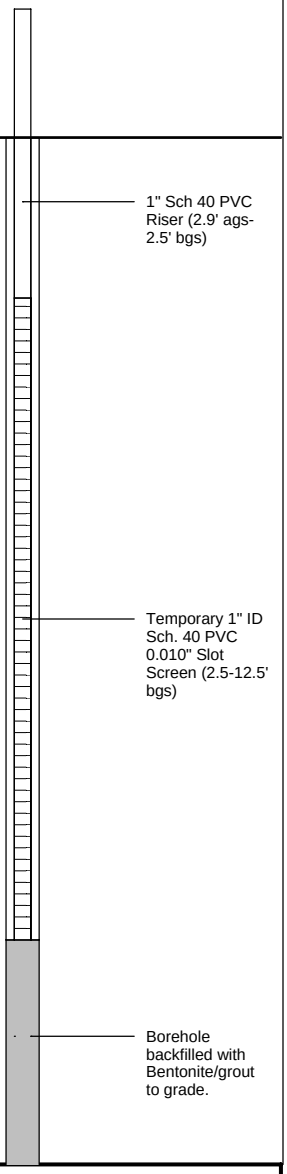
Descriptions By: Katherine Potter

Well/Boring ID: **PDI-11**

Client: Ashland Inc.

Location: 130 South Street
Rensselaer, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0	1	0-2	1.2	10.9 35.8 287	X		Dark brown fine to coarse SAND, trace Silt and fine GRAVEL, sweet odor, wet. Rust-brown fine to coarse SAND, trace fine to medium GRAVEL, trace Silt, odor. Black (possibly stained) fine to coarse SAND, some fine Gravel, trace Silt, strong odor, oil-like sheen, wet.
		2	2-4	1.2	52.5			Gray-black fine to coarse SAND, little fine to medium Gravel, trace Silt, slight sweet odor, moist. Gray fine to coarse SAND, trace fine Gravel, trace Silt, odor, wet.
5	-5	3	4-6	2.0	77.3 38.4 40.6			Dark gray Silty fine to medium SAND, trace coarse Sand and trace fine Gravel, trace Clay, odor, wet. Black (possibly stained) fine to coarse SAND, little fine Gravel, odor, wet.
		4	6-8	1.0	8.4			Very dark gray fine to medium SAND, little Silt, trace fine Gravel and Clay, dense, wet grading to green-black Silty SAND, very dense, moist. 2" lense of fine Gravel at 6.5' - 6.7' bgs.
10	-10	5	8-12	1.3	8.4			Gray-green fine to medium SAND, some Silt, moist. Gray fine to coarse SAND, little Silt, little fine Gravel, little coarse Sand, trace Clay, slight odor, wet.
15	-15	6	12-16	4.0	7.1			Gray Silty SAND grading to Silty CLAY, some fine Sand, wet. Gray Silty CLAY, plastic, soft, wet.



ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Soil sample collected at 0-2' bgs and analyzed for VOCs.

Client: Ashland Inc.

Well/Boring ID: **PDI-11**

Borehole Depth: 20' bgs

Site Location:
130 South Street
Rensselaer, NY

DEPTH / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	7	16-20	4.0	5.8			Gray Silty CLAY, plastic, soft, wet.	Borehole backfilled with Bentonite/grout to grade.
20 -20								
25 -25								
30 -30								
35 -35								

ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Soil sample collected at 0-2' bgs and analyzed for VOCs.

Date Start/Finish: 3/17/2009
Drilling Company: ARCADIS
Driller's Name: Rob Leroy
Drilling Method: Direct Push
Sampling Method: 2 and 4' Acetate Liner
Rig Type: Tractor-mounted AMS

Northing: NA
Easting: NA
Casing Elevation: NA

Borehole Depth: 15' bgs
Surface Elevation: NA

Descriptions By: Katherine Potter

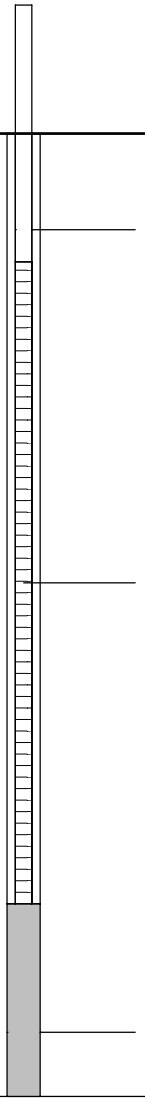
Well/Boring ID: **PDI-12**

Client: Ashland Inc.

Location: 130 South Street
Rensselaer, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0	1	0-2	1.1	0.0			Brown grading to gray fine to medium GRAVEL, some fine to coarse Sand, trace Silt, moist.
		2	2-4	1.1	0.0			Gray-brown fine to coarse SAND, some to little fine to medium Gravel, trace Silt, moist.
5	-5	3	4-6	1.3	0.0			Light brown Silty CLAY, moist.
		4	6-8	1.2	0.0			Light brown Silty CLAY, moist. Gray at 7.0' bgs.
10	-10	5	8-12	3.1	0.0			Grading to light brown at 10.0' bgs.
		6	12-15	0.3	NA			Light brown fine to medium SAND, some Silt, trace Clay.
15	-15							Grading to gray Silty CLAY, moist.

Well/Boring Construction



ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Equipment failure below 15' bgs.

Date Start/Finish: 3/17/2009
Drilling Company: ARCADIS
Driller's Name: Rob Leroy
Drilling Method: Direct Push
Sampling Method: 2 and 4' Acetate Liner
Rig Type: Tractor-mounted AMS

Northing: NA
Easting: NA
Casing Elevation: NA

Borehole Depth: 20' bgs
Surface Elevation: NA

Descriptions By: Katherine Potter

Well/Boring ID: **PDI-13**

Client: Ashland Inc.

Location: 130 South Street
Rensselaer, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	0	1	0-2	1.1	0.0			Gray fine to medium SAND, some to little Silt and fine to medium Gravel, wet. [FILL]
								Brown fine to medium SAND, trace Silt, trace fine to medium Gravel, moist. [FILL]
								Gray-brown fine to medium SAND, some to little fine to medium Gravel and coarse Sand, trace Silt, moist to wet. [FILL]
		2	2-4	0.9	0.0			Brown fine to medium SAND, trace Silt, moist. [FILL]
								Gray fine to medium SAND, little fine to medium Gravel, trace Silt, moist. [FILL]
5	-5	3	4-6	1.2	0.0			Brown fine to medium SAND, trace Silt, trace fine Gravel, moist to wet.
		4	6-8	0.8	0.0			
		5	8-12	3.7	0.0			Brown-light brown Silty CLAY, moist.
10	-10							Brown-light brown fine SAND, some Silt, wet.
								Light brown SILT and CLAY, moist.
								Dark gray fine to medium SAND, trace coarse Sand, trace fine Sand, wet.
		6	12-16	4.0	0.0			Light brown Silty CLAY, changing to gray at 15.0' bgs, wet.
15	-15							

Well/Boring Construction

1" Sch 40 PVC Riser (2.9' ags-2.5' bgs)

Temporary 1" ID Sch. 40 PVC 0.010" Slot Screen (2.5-12.5' bgs)

Borehole backfilled with Bentonite/grout to grade.

ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

Client: Ashland Inc.

Well/Boring ID: **PDI-13**

Borehole Depth: 20' bgs

Site Location:
130 South Street
Rensselaer, NY

DEPTH / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	7	16-20	4.0	0.0			Gray Silty CLAY, plastic, soft, wet.	Borehole backfilled with Bentonite/grout to grade.
20 -20								
25 -25								
30 -30								
35 -35								

ARCADIS
Infrastructure, environment, facilities

Remarks: bgs = below ground surface; NA = Not Applicable/Available.

The temporary well was developed, sampled for VOCs in groundwater, and abandonded by removal of the PVC and backfilling with bentonite/grout.

ARCADIS

Attachment B

Groundwater Sampling Logs

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Burlington
30 Community Drive, Suite 11
South Burlington, VT 05403 Tel: 802 660 1990

CHAIN OF CUSTODY RECORD

Report to:	Invoice to:
Company: ARCADIS	Company: ARCADIS
Address: 6723 Towpath Rd P.O.Box 66 Syracuse NY 13214	Address: 6723 Towpath Rd Syracuse NY 13214
Contact: Katherine Potter	Contact: Katherine Potter
Phone: 315-671-9199	Phone: 315-671-9199
Fax: 315-446-8053	Fax: 315-446-8053
Contract/ Quote:	

Sampler's Name: Elliot Baird

Sampler's Signature:

Proj. No.: OH001000.0001

Project Name: Ashland - PDI Rensselaer

Lab Use Only
Due Date:

Temp. of coolers when received (C°):

1	2	3	4	5

Custody Seal N / Y
Intact N / Y

Screened For Radioactivity ☐

Matrix[1]	Date	Time	Comp	Grab	Identifying Marks of Sample(s)	No/Type of Containers[2] VOA	A/G 1 Lt.	250 ml	P/O	ANALYSIS REQUESTED VOC 8260B	Lab/Sample ID (Lab Use Only)
W	3/12/09	16:40		X	PDI - 1	3				X	
W	3/13/09	08:40		X	PDI - 2	3				X	
W	3/13/09	10:45		X	PDI - 3	3				X	
W	3/13/09	13:15		X	PDI - 4	3				X	
W	3/13/09	17:45		X	PDI - 5	3				X	
W	3/11/09	-			Trip Blank	1				X	

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
	3-13-09	18:30			
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

Remarks

Client's delivery of samples constitutes acceptance of TestAmerica terms and conditions contained in the Price Schedule.

[1]Matrix WW - Wastewater W - Water S - Soil L - Liquid A - Air bag C - Charcoal Tube SL - Sludge O - Oil
[2]Container VOA - 40 ml vial A/G - Amber / Or Glass 1 Liter 250 ml - Glass wide mouth P/O - Plastic or other _____

TestAmerica Cannot accept verbal changes. Please Fax written changes to (802) 660-1919

TAL-8234(1007)

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Burlington
30 Community Drive, Suite 11
South Burlington, VT 05403 Tel: 802 660 1990

CHAIN OF CUSTODY RECORD

Report to:	Invoice to:
Company: ARCADIS	Company: ARCADIS
Address: 6723 Towpath Rd P.O.Box 66 Syracuse NY 13214	Address: 6723 Towpath Rd P.O.Box 66 Syracuse NY 13214
Contact: Katherine Potter	Contact: Katherine Potter
Phone: 315-671-9199	Phone: 315-671-9199
Fax: 315-446-8053	Fax: 315-446-8053
Contract/ Quote:	

Sampler's Name: Elliot Baird

Sampler's Signature:

Proj. No.

Project Name

No/Type of Containers[2]

ANALYSIS REQUESTED: VOC 8260B; MS/MSD

Lab Use Only
Due Date:

Temp. of coolers when received (C°): 1 | 2 | 3 | 4 | 5

Custody Seal N / Y

Intact N / Y

Screened For Radioactivity ☐

Matrix[1]	Date	Time	Comp	Grab	Identifying Marks of Sample(s)	VOA	A/G 1 Lt.	250 ml	P/O	VOC 8260B	MS/MSD	Lab/Sample ID (Lab Use Only)
W	3/16/09	12:15		X	PDI-6	3				X		
W	3/16/09	1420		X	PDI-7	3				X		
W	3/16/09	1615		X	PDI-8	3				X		
W	3/16/09	1755		X	PDI-9	3				X		
W	3/17/09	910		X	PDI-10	3				X		
W	3/17/09	1100		X	PDI-11	3				X		
W	3/17/09			X	DUP031709	3				X		
W	3/16/09				Trip Blank	1				X		
W	3/17/09	1840		X	PDI-12	3				X		
W	3/17/09	1435		X	PDI-13	9				X	X	

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
	3/18/09	900			
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

Remarks

Client's delivery of samples constitutes acceptance of TestAmerica terms and conditions contained in the Price Schedule.

[1]Matrix WW - Wastewater W - Water S - Soil L - Liquid A - Air bag C - Charcoal Tube SL - Sludge O - Oil
[2]Container VOA - 40 ml vial A/G - Amber / Or Glass 1 Liter 250 ml - Glass wide mouth P/O - Plastic or other _____

TestAmerica Cannot accept verbal changes. Please Fax written changes to (802) 660-1919

TAL-8234(1007)

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Burlington
30 Community Drive, Suite 11
South Burlington, VT 05403 Tel: 802 660 1990

CHAIN OF CUSTODY RECORD

Report to:	Invoice to:
Company: ARCADIS	Company: ARCADIS
Address: 6723 Towpath Rd PO Box 66 Syracuse NY 13214	Address: 6723 Towpath Rd P.O. Box 66 Syracuse NY 13214
Contact: Katherine Potter	Contact: Katherine Potter
Phone: 315 671 - 9199	Phone: 315 - 671 - 9199
Fax: 315 - 446 - 8053	Fax: 315 - 446 - 8053
Contract/ Quote:	

Sampler's Name: Elliot Baird

Sampler's Signature: EB

Proj. No.

Project Name

No/Type of Containers[2]

ANALYSIS REQUESTED: VOC 8260B

Lab Use Only
Due Date:

Temp. of coolers when received (C°):

1	2	3	4	5

Custody Seal N / Y

Intact N / Y

Screened For Radioactivity ☐

Matrix[1]	Date	Time	Comp	Grab	Identifying Marks of Sample(s)	VOA	A/G 1 Lt.	250 ml	P/O	VOC 8260B	Lab/Sample ID (Lab Use Only)
S	3/16/09	1500		X	PDJ-11 (0-2')				1	X	

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
EB	3-18-09	9:00			
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

Remarks

Client's delivery of samples constitutes acceptance of TestAmerica terms and conditions contained in the Price Schedule.

[1]Matrix WW - Wastewater W - Water S - Soil L - Liquid A - Air bag C - Charcoal Tube SL - Sludge O - Oil

[2]Container VOA - 40 ml vial A/G - Amber / Or Glass 1 Liter 250 ml - Glass wide mouth P/O - Plastic or other 4 oz

TestAmerica Cannot accept verbal changes. Please Fax written changes to (802) 660-1919

TAL-8234(1007)

ARCADIS
Infrastructure, environment, buildings

Site

Event

WELL DEVELOPMENT FIELD LOG

BBL Personnel: ESB
Oversight Personnel:
Client / Job Number: OH002000NY41.00302
Weather:

Well ID: PDT-1
Date: 3/12/09
PID (ppm) 0.0
Time In: 13:50 Time Out: 15:33

Well Information

Depth to Water: (initial) (TIC)	(feet) 2.01	Time: 13:55
Depth to Water: (with equipment) (TIC)	(feet) 1.89	Time: 13:52
Depth to Water: (Final) (TIC)	(feet)	Time:
Total Depth: (TIC)	(feet) 12	Time:
Total Depth: (TIC)	(feet)	Time:
Depth to NAPL: (TIC) (DNAPL or LNAPL)	(feet)	Time:
Length of Water Column:	(feet)	
Volume of Water in Well:	(gal)	

Equipment

Probe Type:	(Water Level)	Interface
Purging Method:	Waterra Pump Other Peristaltic	
Tubing Type:	(Polyethylene)	Teflon lined
Well Diameter:	(1") 2"	Other:

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Purging Information

Pump Start time: 14:06 Pump End time: 14:31
Duration of Pumping: (min) 25
Average Pumping Rate: (ml/min) 500 Water-Quality Meter Type: Horiba
Total Volume Removed: (gal) Did well go dry: Yes (No)

Time Elapsed	1 —	2	3	4	5	6	7	8	9
Volume Purged (liters)	—								
Rate (mL/min)	500	500	500	500	500	500			
Depth to Water (ft.)	3.50	4.29	4.51	4.50	4.43	4.34			
Color	Grey	Grey	Grey	L. Brown	L. Brown	L. Brown			
Temp oC	4.07	4.62	4.73	4.70	4.67	4.85			
pH	7.37	7.26	7.24	7.24	7.25	7.23			
Conductivity (mS/cm)	0.572	0.535	0.482	0.473	0.472	0.471			
ORP (mV)	-89	-121	-127	-117	-116	-115			
DO (%)	0.00	0.00	0.00	0.00	0.00	0.00			
Turbidity (NTU)	>999	>999	7999	849	745	661			
Notes:									

RECOVERY

30	4.07								
1:00	3.77	7	2.36	15	2.09	23	2.04		
1:30	3.48	8	2.30	16	2.08	24	2.04		
2:00	3.29	9	2.25	17	2.08	25	2.04		
2:30	3.10	10	2.20	18	2.06	26	2.04		
3:00	2.94	11	2.16	19	2.06	27	2.03		
4	2.65	12	2.14	20	2.05	28	2.03		
5	2.55	13	2.12	21	2.05	29	2.03		
6	2.44	14	2.09	22	2.05	30	2.03		

Problems / Observations

Ashland—PDI Rensselaer Site
Rensselar, New York
Site

ARCADIS
Infrastructure, environment, buildings
Event

GROUND-WATER SAMPLING LOG

Sampling Personnel:	Ricardo Jaimes/Rob LeRoy/Elliot Baird	Well ID:	PDI - 1
Client / Job Number:	Ashland / OH002000NY41.00302	Date:	3-12-09
Weather:		Time In: 16:09	Time Out:

Well Information

Depth to Water:	(feet)	2.00	(from MP)
Total Depth:	(feet)	12.00	(from MP)
Length of Water Column:	(feet)	10.00	
Volume of Water in Well:	(gal)	0.41	
Three Well Volumes:	(gal)	1.23	

Well Type:	Flushmount		Stick-Up
Well Material:	Stainless Steel		(PVC)
Well Locked:	Yes		(No)
Measuring Point Marked:	Yes		(No)
Well Diameter:	(1")	2"	Other:

Purging Information

Purging Method:	Bailer	(Peristaltic)	Waterra	Other:
Tubing/Bailer Material:	Steel	(Polyethylene)	Teflon	Other:
Sampling Method:	(Bailer)	Peristaltic	Bailer	Other:

Duration of Pumping:	(min)	26		
Average Pumping Rate:	(ml/min)	300	Water-Quality Meter Type:	Horiba
Total Volume Removed:	(gal)		Did well go dry: Yes	(No)

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Unit Stability			
pH	DO	Cond.	ORP
0.1	10%	3.0%	10 mV

Parameter:	1	2	3	4	5	6	7	8	9
Volume Purged (gal)	-								
Rate (mL/min)	300	300	300	300	300	300			
Depth to Water (ft.)	2.60	3.29	3.41	3.36	3.21	3.12			
pH	7.27	7.21	7.16	7.15	7.15	7.19			
Temp. (C)	4.29	4.35	4.49	4.51	4.44	4.29			
Conductivity (mS/cm)	0.509	0.484	0.477	0.474	0.466	0.464			
Dissolved Oxygen (mg/L)	0.00	0.00	0.00	0.00	0.00	0.00			
ORP (mV)	-85	-72	-87	-97	-98	-96			
Turbidity (NTU)	>999	>999	733	545	619	514			
Notes:	Pump on 16:10					Pump off 16:36			

Sampling Information

Analyses	#	Laboratory
TCL VOCs		TestAmerica
Sample ID: PDI - 1	Sample Time: 16:40	
MS/MSD: Yes	(No)	
Duplicate: Yes	(No)	
Duplicate ID	Dup. Time:	
Chain of Custody Signed By:		

Problems / Observations

ARCADIS
infrastructure, environment, buildings

Site

Event

WELL DEVELOPMENT FIELD LOG

BBL Personnel: EJB
Well ID: PDZ - 2
Oversight Personnel:
Date: 3-12-09
Client / Job Number: OH002000NY41.00302
PID (ppm)
Weather: Sunny High 20's Windy
Time In: 17:15 Time Out: 18:16

Well Information

Depth to Water: (initial) (TIC)	(feet) 2.09	Time:	17:15
Depth to Water: (with equipment) (TIC)	(feet) 1.87	Time:	17:14
Depth to Water: (Final) (TIC)	(feet)	Time:	
Total Depth: (TIC)	(feet) 12	Time:	
Total Depth: (TIC)	(feet)	Time:	
Depth to NAPL: (TIC) (DNAPL or LNAPL)	(feet)	Time:	
Length of Water Column:	(feet) 10.13		
Volume of Water in Well:	(gal) 1.6415		

Equipment

Probe Type:	(Water Level)	Interface
Purging Method:	(Waterra Pump) Other Peristaltic	
Tubing Type:	(Polyethylene)	Teflon lined
Well Diameter:	(1") 2"	Other:

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Purging Information

Pump Start time:	17:31	Pump End time:	1756
Duration of Pumping:	(min) 25		
Average Pumping Rate:	(ml/min)	Water-Quality Meter Type:	Horiba
Total Volume Removed:	(gal) 3.5	Did well go dry: Yes	(No)

Time Elapsed	1	2	3	4	5	6	7	8	9
Volume Purged (liters)	—								
Rate (mL/min)	300	300	400	400	500	400	400		
Depth to Water (ft.)	2.65	3.76	4.50	4.59	4.64	4.68	4.66		
Color	D Brown	Grey	Grey	Grey	Grey	Grey	Grey		
Temp oC	3.64	4.09	4.17	4.50	4.61	4.57	4.55		
pH	7.30	7.21	7.16	7.06	7.05	7.04	7.03		
Conductivity (mS/cm)	0.729	0.672	0.607	0.533	0.507	0.493	0.483		
ORP (mV)	-83	-97	-94	-87	-86	-87	-85		
DO (%)	4.76	0.00	0.00	0.00	0.00	0.00	0.00		
Turbidity (NTU)	> 999	> 999	> 999	> 999	> 999	> 999	> 999		
Notes:									

RECOVERY

:30	4.22	7	3.45	11	2.18	25
Rec	3.96	8	2.38	12	2.11	26
1:30	3.65	9	2.30	13	2.16	27
2:00	3.44	10	2.24	14	2.09	28
2:30	3.26	11	2.22	20	2.07	29
3	3.12	13	2.19	21		30
4	2.87	13	2.17	22		
5	2.70	14	2.15	23		
6	2.54	15	2.13	24		

7:.. DIC 7:.. DIC 7:.. DIC 7:.. DIW

Problems / Observations

Ashland—PDI Rensselaer Site
Rensselar, New York
Site

ARCADIS
infrastructure, environment, buildings
Event

GROUND-WATER SAMPLING LOG

Sampling Personnel:	Ricardo Jaimes/Rob LeRoy/Elliot Baird	Well ID:	PDI 2
Client / Job Number:	Ashland / OH002000NY41.00302	Date:	3-13-09
Weather:		Time In: 800	Time Out: 0900

Well Information

Depth to Water:	(feet)	2.16	(from MP)
Total Depth:	(feet)	12'	(from MP)
Length of Water Column:	(feet)	9.84	
Volume of Water in Well:	(gal)	0.40	
Three Well Volumes:	(gal)	1.21	

Well Type:	Flushmount		Stick-Up
Well Material:	Stainless Steel		PVC
Well Locked:	Yes		No
Measuring Point Marked:	Yes		No
Well Diameter:	1"	2"	Other:

Purging Information

Purging Method:	Bailer	Peristaltic	Waterra	Other:
Tubing/Bailer Material:	Steel	Polyethylene	Teflon	Other:
Sampling Method:	Bailer	Peristaltic	Bailer	Other:
Duration of Pumping:	(min) 33			
Average Pumping Rate:	(ml/min) 378	Water-Quality Meter Type:	Horiba	
Total Volume Removed:	(gal) 3.2	Did well go dry:	Yes	No

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Unit Stability			
pH	DO	Cond.	ORP
0.1	10%	3.0%	10 mV

Parameter:	1	2	3	4	5	6	7	8	9
Volume Purged (gal)	—	.51	1.02	1.66	2.18	2.69	3.2		
Rate (mL/min)	400	400	500	400	400	460	402		
Depth to Water (ft.)	3.46	4.63	4.91	~~4.15~~ 4.90	4.94	4.99	5.05		
pH	7.53	7.10	6.96	6.90	6.91	7.00	7.03		
Temp. (C)	5.34	3.96	4.06	4.14	4.24	4.29	4.29		
Conductivity (mS/cm)	0.629	0.548	0.529	0.505	0.487	0.479	0.478		
Dissolved Oxygen (mg/L)	5.74	0.00	0.00	0.00	0.68	0.00	0.00		
ORP (mV)	-46	-63	-61	-61	-66	-72	-73		
Turbidity (NTU)	> 999	> 999	> 999	643.0	358.0	240	511		
Notes:	Pump On 8:05						Pump Off @ 38		

Sampling Information

Analyses	#	Laboratory
TCL VOCs		TestAmerica

Sample ID: PDI - 2	Sample Time: 0840	
MS/MSD:	Yes	No
Duplicate:	Yes	No
Duplicate ID	Dup. Time:	
Chain of Custody Signed By:		

Problems / Observations

ARCADIS

Site

Event

WELL DEVELOPMENT FIELD LOG

BBL Personnel: ESB
Oversight Personnel:
Client / Job Number: OH002000NY41.00302
Weather:

Well ID: PDI - 3
Date: 3-13-09
PID (ppm)
Time In: 0910 Time Out: 1015

Well Information

Depth to Water: (initial) (TIC)	(feet)	5.10	Time: 0919
Depth to Water: (with equipment) (TIC)	(feet)	5.10	Time: 0917
Depth to Water: (Final) (TIC)	(feet)	5.11	Time:
Total Depth: (TIC)	(feet)	15.00	Time:
Total Depth: (TIC)	(feet)	~~9.41~~	Time:
Depth to NAPL: (TIC) (DNAPL or LNAPL)	(feet)		Time:
Length of Water Column:	(feet)	9.90	
Volume of Water in Well:	(gal)	0.41	

Equipment

Probe Type:	(Water Level)	Interface
Purging Method:	(Waterra Pump) Other Peristaltic	
Tubing Type:	(Polyethylene)	Teflon lined
Well Diameter:	(1") 2"	Other:

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Purging Information

Pump Start time: 930 Pump End time: 10:08
Duration of Pumping: (min) 38
Average Pumping Rate: (ml/min) 550 Water-Quality Meter Type: Horiba
Total Volume Removed: (gal) 5 Did well go dry: Yes (No)

Time Elapsed	1	2	3	4	5	6	7	8	9
Volume Purged (liters)	-								
Rate (mL/min)	700	600	500	500	500	500	500		
Depth to Water (ft.)	5.21	5.22	5.19	5.22	5.23	5.23	5.23		
Color	Gray	Clear	Clear	Clear	Clear	Clear	Clear		
Temp oC	3.83	3.29	3.25	3.11	3.05	3.00	3.06		
pH	7.39	7.16	7.07	7.00	6.97	6.95	6.95		
Conductivity (mS/cm)	0.773	0.795	0.800	0.814	0819	0.828	0.827		
ORP (mV)	58	50	53	63	68	73	74		
DO (%)	2.14	0.98	0.49	1.07	1.09	0.49	1.00		
Turbidity (NTU)	> 999	554	531	251	317	NM	148		
Notes:									

RECOVERY

Time	DTW	Time	DTW	Time	DTW
30	5.18	6		14	
45	5.14	7		15	
1:30	5.13	8		16	
2:00	5.13	9		17	
2:30	5.13	10		18	
3	5.12	11		19	
4	5.11	12		20	
5	5.11	13			

Problems / Observations

Horiba Frozen at start, pumping actually began 9:40

Ashland—PDI Rensselaer Site
Rensselar, New York
Site

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Event

GROUND-WATER SAMPLING LOG

Sampling Personnel:	Ricardo Jaimes/Rob LeRoy/Elliot Baird	Well ID:	PDI-3
Client / Job Number:	Ashland / OH002000NY41.00302	Date:	3-13-09
Weather:	Sunny 20s	Time In:	10:15 Time Out: 11:05

Well Information

Depth to Water:	(feet)	5.11	(from MP)
Total Depth:	(feet)	15.00	(from MP)
Length of Water Column:	(feet)	9.89	
Volume of Water in Well:	(gal)	0.405	
Three Well Volumes:	(gal)	1.22	

Well Type:	Flushmount		Stick-Up
Well Material:	Stainless Steel		(PVC)
Well Locked:	Yes		(No)
Measuring Point Marked:	Yes		(No)
Well Diameter:	(1")	2"	Other:

Purging Information

Purging Method:	Bailer	(Peristaltic)	Waterra	Other:
Tubing/Bailer Material:	Steel	(Polyethylene)	Teflon	Other:
Sampling Method:	(Bailer)	Peristaltic	Bailer	Other:

Duration of Pumping:	(min)	22		
Average Pumping Rate:	(ml/min)	600	Water-Quality Meter Type:	Horiba
Total Volume Removed:	(gal)	5	Did well go dry: Yes	(No)

Conversion Factors

gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469

1 gal = 3.785 L =3875 ml = 0.1337 cubic feet

Unit Stability

pH	DO	Cond.	ORP
0.1	10%	3.0%	10 mV

Parameter:	1	2	3	4	5	6	7	8	9
Volume Purged (gal)	-	0.77	1.54	2.31	3.08				
Rate (mL/min)	600	600	600	600	600				
Depth to Water (ft.)	5.21	5.22	5.22	5.22	5.24				
pH	6.93	6.95	6.94	6.93	6.93				
Temp. (C)	3.12	3.20	3.17	3.11	3.08				
Conductivity (mS/cm)	0.845	0.818	0.820	0.821	0.826				
Dissolved Oxygen (mg/L)	0.91	1.07	1.07	1.04	1.01				
ORP (mV)	77	74	74	75	77				
Turbidity (NTU)	233	97.7	88.2	72.1	74.8				
Notes:	Pump Start 10:20				Pump OFF 10:42				

Sampling Information

Analyses	#	Laboratory
TCL VOCs		TestAmerica
Sample ID: PDI-3	Sample Time: 10:45	
MS/MSD: Yes (No)		
Duplicate: Yes (No)		
Duplicate ID	Dup. Time:	
Chain of Custody Signed By:		

Problems / Observations

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Event

WELL DEVELOPMENT FIELD LOG

BBL Personnel: EJB
Oversight Personnel:
Client / Job Number: OH002000NY41.00302
Weather: Sunny 30s

Well ID: PDI - 4
Date: 3-13-09
PID (ppm)
Time In: 13:30 Time Out: 1430

Well Information

Depth to Water: (initial) (TIC)	(feet) 6.02	Time:	13:39
Depth to Water: (with equipment) (TIC)	(feet) 6.01	Time:	13.46
Depth to Water: (Final) (TIC)	(feet)	Time:	
Total Depth: (TIC)	(feet) 15.00	Time:	
Total Depth: (TIC)	(feet) 14.00	Time:	1437
Depth to NAPL: (TIC) (DNAPL or LNAPL)	(feet)	Time:	
Length of Water Column:	(feet) 8.99		
Volume of Water in Well:	(gal) 0.37		

Equipment

Probe Type:	(Water Level)	Interface
Purging Method:	Waterra Pump Other Bailer	
Tubing Type:	(Polyethylene)	Teflon lined
Well Diameter:	(1") 2"	Other:

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Purging Information

Pump Start time: 1348 Pump End time: 14:02
Duration of Pumping: (min) 14
Average Pumping Rate: (ml/min) 179.7 Water-Quality Meter Type: Horiba
Total Volume Removed: (gal) 1.5 Did well go dry: (Yes) No

Time Elapsed	1	2	3	4	5	6	7	8	9
Volume Purged (liters)	—	2.5	5	6.5					
Rate (mL/min)	500	500	300						
Depth to Water (ft.)	7.24	8.65	9.73						
Color	Gray	Brown	D Brown						
Temp oC	3.75	3.50	3.58						
pH	7.39	7.12	6.98						
Conductivity (mS/cm)	1.11	0.95	0.885						
ORP (mV)	-33	13	42						
DO (%)	1.00	1.78	5.50						
Turbidity (NTU)	> 999	> 999	> 999						
Notes:									

RECOVERY

Time	DTW	Time	DTW	Time	DTW
1430	9.69	6	7.76	14	6.65
1445	9.60	7	7.38	15	6.03
1500	9.22	8	6.90	16	6.03
2:00	9.09	9	6.52	17	6.02
2:30	8.94	10	6.31	18	
3	8.78	11	6.24	19	
4	8.47	12	6.11	20	
5	8.18	13	6.07	21	

Problems / Observations

Ashland—PDI Rensselaer Site
Rensselar, New York
Site

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infrastructure, environment, buildings

Event

GROUND-WATER SAMPLING LOG

Sampling Personnel:	Ricardo Jaimes/Rob LeRoy/Elliot Baird	Well ID:	PDI-4
Client / Job Number:	Ashland / OH002000NY41.00302	Date:	3-13-09
Weather:		Time In: 1435	Time Out: 1511

Well Information

Depth to Water:	(feet)	5.98	(from MP)
Total Depth:	(feet)	14.00	(from MP)
Length of Water Column:	(feet)	8.02	
Volume of Water in Well:	(gal)	1.28	
Three Well Volumes:	(gal)	4.86	

Well Type:	Flushmount		Stick-Up
Well Material:	Stainless Steel		PVC
Well Locked:	Yes		No
Measuring Point Marked:	Yes		No
Well Diameter:	1"	2"	Other:

Purging Information

Purging Method:	Bailer	Peristaltic	Waterra	Other:
Tubing/Bailer Material:	Steel	Polyethylene	Teflon	Other:
Sampling Method:	Bailer	Peristaltic	Bailer	Other:
Duration of Pumping:	(min)			
Average Pumping Rate:	(ml/min) 200	Water-Quality Meter Type:	Horiba	
Total Volume Removed:	(gal) 1.5	Did well go dry:	Yes	No

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Unit Stability			
pH	DO	Cond.	ORP
0.1	10%	3.0%	10 mV

Parameter:	1	2	3	4	5	6	7	8	9
Volume Purged (gal)	-	0.25	.5	.75	1.00	1.25	1.5		
Rate (mL/min)	200	200	200	200	200	200	200		
Depth to Water (ft.)	6.39	6.56	6.88	6.95	6.95	6.96	6.97		
pH	7.28	7.19	7.15	7.10	7.08	7.07	7.06		
Temp. (C)	3.89	3.18	2.89	2.69	2.68	2.54	2.46		
Conductivity (mS/cm)	0.578	0.559	0.561	0.556	0.550	0.543	0.544		
Dissolved Oxygen (mg/L)	9.28	6.13	5.52	5.15	4.77	4.88	4.77		
ORP (mV)	82	82	86	89	93	97	98		
Turbidity (NTU)	> 999	> 999	> 999	858.0	> 999	533.0	335.0		
Notes:	Pump on 14:40								

Sampling Information

Analyses	#	Laboratory
TCL VOCs		TestAmerica
Sample ID: PDI-4	Sample Time: 15:15	
MS/MSD: Yes	(No)	
Duplicate: Yes	(No)	
Duplicate ID	Dup. Time:	
Chain of Custody Signed By:		

Problems / Observations

ARCADIS

Site | Event

WELL DEVELOPMENT FIELD LOG

BBL Personnel: EJB | Well ID: PDI-5
Oversight Personnel: | Date: 3-13-09
Client / Job Number: OH002000NY41.00302 | PID (ppm)
Weather: | Time In: 15:50 Time Out: 17:00

Well Information

Depth to Water: (initial) (TIC)	(feet) 1.06	Time:	
Depth to Water: (with equipment) (TIC)	(feet) .91	Time:	
Depth to Water: (Final) (TIC)	(feet) 1.13	Time:	
Total Depth: (TIC)	(feet) 12	Time:	
Total Depth: (TIC)	(feet)	Time:	
Depth to NAPL: (TIC) (DNAPL or LNAPL)	(feet)	Time:	
Length of Water Column:	(feet) 10.94		
Volume of Water in Well:	(gal) .448		

Equipment

Probe Type:	(Water Level)	Interface
Purging Method:	Waterra Pump Other Peristaltic	
Tubing Type:	Polyethylene	Teflon lined
Well Diameter:	(1") 2"	Other:

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Purging Information

Pump Start time: 16:04 | Pump End time: 16:45
Duration of Pumping: (min) 41
Average Pumping Rate: (ml/min) 437 | Water-Quality Meter Type: Horiba
Total Volume Removed: (gal) 5 | Did well go dry: Yes (No)

Time Elapsed	1	2	3	4	5	6	7	8	9
Volume Purged (liters)	—	2	4	6	8	10.5	13	15.5	18
Rate (mL/min)	400	400	400	400	400	500	500	500	500
Depth to Water (ft.)	3.20	3.31	3.48	3.53	3.65	3.79	3.80	3.90	3.97
Color	Dark Gray	Dark Gray	Gray	Gray	Gray	Clear Gray	Clear Gray	Clear	Clear
Temp oC	6.70	6.34	6.32	6.29	6.24	6.17	6.27	6.24	6.35
pH	6.88	6.98	7.08	7.07	7.06	7.06	7.09	7.04	7.03
Conductivity (mS/cm)	1.59	1.54	1.73	1.67	1.75	1.71	1.80	1.81	1.82
ORP (mV)	-48	-76	-117	-119	-119	-117	-119	-118	-117
DO (%)	1.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Turbidity (NTU)	> 999	> 999	> 999	> 999	> 999	> 999	873	554	466
Notes:									

RECOVERY

Min.	DTW				
30	3.27	6	1.19	14	1.14
1	2.39	7	1.18	15	1.14
1:30	1.80	8	1.17	16	1.14
2	1.47	9	1.17	17	1.14
2.30	1.30	10	1.16	18	1.13
3	1.24	11	1.16	19	1.13
4	1.20	12	1.15	20	1.13
5	1.20	13	1.15		

Problems / Observations

Ashland—PDI Rensselaer Site
Rensselar, New York
Site

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infrastructure, environment, buildings
Event

GROUND-WATER SAMPLING LOG

Sampling Personnel:	Ricardo Jaimes/Rob LeRoy/Elliot Baird	Well ID:	PDI-5
Client / Job Number:	Ashland / OH002000NY41.00302	Date:	3-13-09
Weather:		Time In: 12:06	Time Out: 1805

Well Information

Depth to Water:	(feet) 1.13	(from MP)	
Total Depth:	(feet) 12	(from MP)	
Length of Water Column:	(feet) 10.87		
Volume of Water in Well:	(gal) .445		
Three Well Volumes:	(gal) 1.337		

Well Type:		(Flushmount)	Stick-Up
Well Material:	Stainless Steel		(PVC)
Well Locked:	Yes		(No)
Measuring Point Marked:	Yes		(No)
Well Diameter:	1"	(2")	Other:

Purging Information

Purging Method:	Bailer	(Peristaltic)	Waterra	Other:
Tubing/Bailer Material:	Steel	(Polyethylene)	Teflon	Other:
Sampling Method:	(Bailer)	Peristaltic	Bailer	Other:

Duration of Pumping:	(min) 31				
Average Pumping Rate:	(ml/min) 500	Water-Quality Meter Type:	Horiba		
Total Volume Removed:	(gal) 3.8	Did well go dry:	Yes	(No)	

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Unit Stability			
pH	DO	Cond.	ORP
0.1	10%	3.0%	10 mV

Parameter:	1	2	3	4	5	6	7	8	9
Volume Purged (gal)		~~0.5~~ 0.6	1.29	~~1.5~~ 1.93	~~2.0~~ 2.5	~~2.5~~ 3.9	~~3.5~~ 3.8		
Rate (mL/min)	500	500	500	500	500	500	500		
Depth to Water (ft.)	2.91	3.26	3.37	3.42	3.45	3.48	3.50		
pH	7.10	7.06	7.05	7.04	7.03	7.03	7.02		
Temp. (C)	6.81	5.97	5.98	5.96	5.97	5.97	5.98		
Conductivity (mS/cm)	1.45	1.56	1.62	1.64	1.66	1.68	1.68		
Dissolved Oxygen (mg/L)	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
ORP (mV)	-103	-103	-110	-111	-111	-111	-111		
Turbidity (NTU)	> 999	> 999	500	202	259	131	133		
Notes:	Pump On 1710						Pump off 17:41		

Sampling Information

Analyses	#	Laboratory
TCL VOCs		TestAmerica
Sample ID: PDI-5	Sample Time: 17:45	
MS/MSD: Yes	(No)	
Duplicate: Yes	(No)	
Duplicate ID	Dup. Time:	
Chain of Custody Signed By:		

Problems / Observations

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Site | Event

WELL DEVELOPMENT FIELD LOG

BBL Personnel: ESB | Well ID: PDI-6
Oversight Personnel: | Date: 3-16-09
Client / Job Number: OH002000NY41.00302 | PID (ppm)
Weather: Sunny 40s | Time In: 10:00 Time Out: 11:37

Well Information

Depth to Water: (initial) (TIC)	(feet)	4.06	Time: 10:17
Depth to Water: (with equipment) (TIC)	(feet)	4.07	Time: 10:20
Depth to Water: (Final) (TIC)	(feet)	4.11	Time:
Total Depth: (TIC)	(feet)	~~14.5~~ 14.5	Time:
Total Depth: (TIC)	(feet)		Time:
Depth to NAPL: (TIC) (DNAPL or LNAPL)	(feet)		Time:
Length of Water Column:	(feet)	~~10.43~~ 10.43	
Volume of Water in Well:	(gal)	0.42	

Equipment

Probe Type:	(Water Level)	Interface
Purging Method:	Waterra Pump Other Peristaltic	
Tubing Type:	(Polyethylene)	Teflon lined
Well Diameter:	(1") 2"	Other:

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Purging Information

Pump Start time: 10:25 | Pump End time: 11:00
Duration of Pumping: (min) 35
Average Pumping Rate: (ml/min) 500 | Water-Quality Meter Type: Horiba
Total Volume Removed: (gal) 4.52 | Did well go dry: Yes (No)

Time Elapsed	1	2	3	4	5	6	7	8	9
Volume Purged (liters)	-	2.5	5	7.5	10	12.5	15	17.5	
Rate (mL/min)	500	500	500	500	500	566	500	500	
Depth to Water (ft.)	5.63	6.71	7.78	8.08	8.32	8.30	8.35	8.40	
Color	Brown	Brown	Brown	Grey	Grey	Grey	Grey	Grey	
Temp oC	7.54	6.75	6.75	7.08	7.21	7.39	7.50	7.50	
pH	6.83	6.76	6.71	6.70	6.68	6.67	6.66	6.65	
Conductivity (mS/cm)	0.784	0.839	1.51	1.94	2.26	2.59	2.89	3.65	
ORP (mV)	-103	-106	-124	-131	-131	-129	-126	-125	
DO (%)	0.49	0.00	0.00	0.00	0.05	0.00	0.00	0.11	
Turbidity (NTU)	> 999	> 999	> 999	> 999	> 999	> 999	935	957	
Notes:									

RECOVERY

Min	NTU							
30	8.12	6	5.21	14	4.30	22	4.13	
1	7.80	7	5.06	15	4.28	23	4.13	
1:30	7.43	8	4.90	16	4.24	24	4.12	
2	7.00	9	4.78	17	4.22	25	4.11	
2:30	6.65	10	4.67	18	4.18			
3	6.33	11	4.51	19	4.17			
4	5.99	12	4.42	20	4.16			
5	5.58	13	4.32	21	4.14			

Problems / Observations

Ashland—PDI Rensselaer Site
Rensselar, New York
Site

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Event

GROUND-WATER SAMPLING LOG

Sampling Personnel:	Ricardo Jaimes/Rob LeRoy/Elliot Baird	Well ID:	PDI-6
Client / Job Number:	Ashland / OH002000NY41.00302	Date:	3-18-09
Weather:		Time In: 11:27	Time Out: 12:35

Well Information

Depth to Water:	(feet) 4.11	(from MP)
Total Depth:	(feet) 14.5	(from MP)
Length of Water Column:	(feet) 10.39	
Volume of Water in Well:	(gal) 1.685	
Three Well Volumes:	(gal) 1.177	

Well Type:	Flushmount		(Stick-Up)
Well Material:	Stainless Steel		(PVC)
Well Locked:	Yes		(No)
Measuring Point Marked:	Yes		(No)
Well Diameter:	(1")	2"	Other:

Purging Information

Purging Method:	Bailer	(Peristaltic)	Waterra	Other:
Tubing/Bailer Material:	Steel	(Polyethylene)	Teflon	Other:
Sampling Method:	(Bailer)	Peristaltic	Bailer	Other:

Duration of Pumping:	(min) 36		
Average Pumping Rate:	(ml/min) 500	Water-Quality Meter Type:	Horiba
Total Volume Removed:	(gal) 4.64	Did well go dry: Yes	(No)

Conversion Factors

gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469

1 gal = 3.785 L =3875 ml = 0.1337 cubic feet

Unit Stability

pH	DO	Cond.	ORP
0.1	10%	3.0%	10 mV

Parameter:	1	2	3	4	5	6	7	8	9
Volume Purged (gal)	..	~~2.5~~	~~5~~	~~7.5~~	~~10~~	~~12.5~~	~~15~~	12.5	
Rate (mL/min)	500	500	500	500	500	500	500	500	
Depth to Water (ft.)	4.11	6.76	7.69	7.98	8.25	8.37	8.43	8.50	
pH	6.66	6.68	6.69	6.68	6.65	6.64	6.64	6.62	
Temp. (C)	7.52	7.14	7.17	7.36	7.60	7.65	7.68	7.71	
Conductivity (mS/cm)	3.21	3.25	3.34	3.39	3.68	3.82	3.86	3.83	
Dissolved Oxygen (mg/L)	0.00	0.00	0.00	0.60	0.61	0.30	0.65	0.91	
ORP (mV)	-125	-132	-140	-139	-132	-130	-127	-126	
Turbidity (NTU)	> 999	> 999	> 999	950	618	514	532	857	
Notes:	Pump On 11:30							Pump Off 12:06	

Sampling Information

Analyses	#	Laboratory
TCL VOCs		TestAmerica
Sample ID: PDI-6	Sample Time: 13:15	
MS/MSD: Yes	(No)	
Duplicate: Yes	(No)	
Duplicate ID	Dup. Time:	
Chain of Custody Signed By:		

Problems / Observations

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Ashland - Rensselaer
Site

Event

WELL DEVELOPMENT FIELD LOG

BBL Personnel: ESB
Oversight Personnel:
Client / Job Number: OH002000NY41.00302
Weather: Sunny 40's

Well ID: PDI-7
Date: 3-16-09
PID (ppm)
Time In: 12:35 Time Out: 13:25

Well Information

Depth to Water: (initial) (TIC)	(feet) 4.56	Time: 10:40
Depth to Water: (with equipment) (TIC)	(feet) 4.41	Time: 10:44
Depth to Water: (Final) (TIC)	(feet)	Time:
Total Depth: (TIC)	(feet) 14.5	Time:
Total Depth: (TIC)	(feet)	Time:
Depth to NAPL: (TIC) (DNAPL or LNAPL)	(feet)	Time:
Length of Water Column:	(feet) 10.09	
Volume of Water in Well:	(gal) 0.413	

Equipment

Probe Type:	(Water Level)	Interface
Purging Method:	Waterra Pump Other Peristaltic	
Tubing Type:	(Polyethylene)	Teflon lined
Well Diameter:	(1") 2"	Other:

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Purging Information

Pump Start time:	10:45	Pump End time:	13:15
Duration of Pumping:	(min) 30		
Average Pumping Rate:	(ml/min) 500	Water-Quality Meter Type:	Horiba
Total Volume Removed:	(gal) 3.87	Did well go dry: Yes	(No)

Time Elapsed	1	2	3	4	5	6	7	8	9
Volume Purged (liters)	-	2.5	5	7.5	10	12.5	15		
Rate (mL/min)	500	500	500	500	500	500	500		
Depth to Water (ft.)	4.41	4.42	4.43	4.43	4.44	4.43	4.43		
Color	Dark Grey	Dark Grey	Clear/Grey	Clear/Grey	Clear	Clear	Clear		
Temp oC	8.20	7.03	5.85	5.60	5.48	5.46	5.54		
pH	6.98	6.83	6.72	6.65	6.66	6.68	6.70		
Conductivity (mS/cm)	0.528	0.464	0.431	0.434	0.433	6.435	0.435		
ORP (mV)	-21	-16	10	24	34	36	41		
DO (%)	3.78	3.68	4.80	4.65	4.58	4.51	4.61		
Turbidity (NTU)	> 999	> 999	447	375	167	125	96.5		
Notes:									

RECOVERY

Min	DTW				
30	4.40	6	4.40	14	
1	4.46	7	4.40	15	
1:30	4.40	8	4.46	16	
2	4.40	9	4.40	17	
2:30	4.40	10	4.46	18	
3	4.40	11		19	
4	4.40	12		20	
5	4.40	13			

Problems / Observations

Ashland—PDI Rensselaer Site
Rensselar, New York
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Infrastructure, environment, buildings
Event

GROUND-WATER SAMPLING LOG

Sampling Personnel:	Ricardo Jaimes/Rob LeRoy/Elliot Baird	Well ID:	PDI-7
Client / Job Number:	Ashland / OH002000NY41.00302	Date:	3-16-09
Weather:		Time In: 13.49	Time Out: 1440

Well Information

Depth to Water:	(feet)	4.40	(from MP)
Total Depth:	(feet)	14.5	(from MP)
Length of Water Column:	(feet)	10.1	
Volume of Water in Well:	(gal)	0.414	
Three Well Volumes:	(gal)	1.24	

Well Type:	Flushmount		Stick-Up
Well Material:	Stainless Steel		PVC
Well Locked:	Yes		No
Measuring Point Marked:	Yes		No
Well Diameter:	1"	2"	Other:

Purging Information

Purging Method:	Bailer	Peristaltic	Waterra	Other:
Tubing/Bailer Material:	Steel	Polyethylene	Teflon	Other:
Sampling Method:	Bailer	Peristaltic	Bailer	Other:
Duration of Pumping:	(min)	26		
Average Pumping Rate:	(ml/min)	500	Water-Quality Meter Type:	Horiba
Total Volume Removed:	(gal)	3.35	Did well go dry: Yes	No

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Unit Stability			
pH	DO	Cond.	ORP
0.1	10%	3.0%	10 mV

Parameter:	1	2	3	4	5	6	7	8	9
Volume Purged (gal)	-	~~0.5~~ 0.64	1.28	1.92	2.56	3.2			
Rate (mL/min)	500	500	500	500	500	500			
Depth to Water (ft.)	4.40	4.43	4.44	4.43	4.43	4.43			
pH	6.94	6.84	6.78	6.77	6.77	6.77			
Temp. (C)	8.29	6.41	5.82	5.69	5.65	5.51			
Conductivity (mS/cm)	0.426	0.430	0.431	0.432	0.431	0.433			
Dissolved Oxygen (mg/L)	6.01	4.67	4.49	4.44	4.46	4.33			
ORP (mV)	27	24	34	39	41	44			
Turbidity (NTU)	71.9	81.9	83.6	63.9	57.0	50.4			
Notes:	Pump On 13.50								

Sampling Information

Analyses	#	Laboratory
TCL VOCs		TestAmerica

Sample ID:	PDI-7	Sample Time:	1430
MS/MSD:	Yes	No	
Duplicate:	Yes	No	
Duplicate ID		Dup. Time:	
Chain of Custody Signed By:			

Problems / Observations

ARCADIS
Ashland Rensselaer
Site

Event

WELL DEVELOPMENT FIELD LOG

BBL Personnel: ESB
Oversight Personnel:
Client / Job Number: OH002000NY41.00302
Weather: Sunny 56s

Well ID: PDZ-8
Date: 3-16-09
PID (ppm)
Time In: 1443 Time Out: 1530

Well Information

Depth to Water: (initial) (TIC)	(feet) 1.78	Time: 1444	
Depth to Water: (with equipment) (TIC)	(feet) 1.76	Time: 1453	
Depth to Water: (Final) (TIC)	(feet)	Time:	
Total Depth: (TIC)	(feet) 11.95	Time: 1445	
Total Depth: (TIC)	(feet)	Time:	
Depth to NAPL: (TIC) (DNAPL or LNAPL)	(feet)	Time:	
Length of Water Column:	(feet) 10.17		
Volume of Water in Well:	(gal) 0.48		

Equipment

Probe Type:	(Water Level)	Interface
Purging Method:	Waterra Pump Other Peristaltic	
Tubing Type:	(Polyethylene)	Teflon lined
Well Diameter:	(1") 2" Other:	

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Purging Information

Pump Start time: 1455 Pump End time: 1525
Duration of Pumping: (min) 30
Average Pumping Rate: (ml/min) 558 Water-Quality Meter Type: Horiba
Total Volume Removed: (gal) 4.38 Did well go dry: Yes (No)

Time Elapsed	1	2	3	4	5	6	7	8	9
Volume Purged (liters)	-	2.5	5.25	8.0	11	14	17		
Rate (mL/min)	500	550	550	550	600	600	600		
Depth to Water (ft.)	1.78	1.79	1.79	1.79	1.78	1.78	1.77		
Color	L. Brown	Clear	Clear	Clear	Clear	Clear	Clear		
Temp oC	6.67	5.20	5.06	~~5.36~~ 5.01	4.97	4.98	4.98		
pH	6.97	6.95	6.88	6.88	6.89	6.90	6.91		
Conductivity (mS/cm)	0.361	0.398	0.409	0.409	0.449	0.444	0.451		
ORP (mV)	-4	37	43	50	46	46	50		
DO (%)	8.01	6.38	5.75	5.35	4.95	4.72	4.51		
Turbidity (NTU)	> 999	181.0	73.3	41.7	43.1	36.0	30.4		
Notes:									

RECOVERY

Min	DTW		
30	1.78	6	14
1	1.78	7	15
1:30	1.78	8	16
2	1.78	9	17
2:30	1.78	10	18
3	1.78	11	19
4	1.78	12	30
5	1.78	13	

Problems / Observations

Ashland—PDI Rensselaer Site
Rensselar, New York
Site

ARCADIS
infrastructure, environment, buildings
Event

GROUND-WATER SAMPLING LOG

Sampling Personnel:	Ricardo Jaimes/Rob LeRoy/Elliot Baird	Well ID:	PDI-8
Client / Job Number:	Ashland / OH002000NY41.00302	Date:	3-16-09
Weather:	Sunny 50	Time In: 15:33	Time Out: 16:25

Well Information

Depth to Water:	(feet)	1.78	(from MP)
Total Depth:	(feet)	11.95	(from MP)
Length of Water Column:	(feet)	10.17	
Volume of Water in Well:	(gal)	0.916	
Three Well Volumes:	(gal)	1.25	

Well Type:	(Flushmount)	Stick-Up	
Well Material:	Stainless Steel	(PVC)	
Well Locked:	Yes	(No)	
Measuring Point Marked:	Yes	(No)	
Well Diameter:	(1")	2"	Other:

Purging Information

Purging Method:	Bailer	(Peristaltic)	Waterra	Other:
Tubing/Bailer Material:	Steel	(Polyethylene)	Teflon	Other:
Sampling Method:	(Bailer)	Peristaltic	Bailer	Other:

Duration of Pumping:	(min)	25		
Average Pumping Rate:	(ml/min)	500	Water-Quality Meter Type:	Horiba
Total Volume Removed:	(gal)	3.2	Did well go dry: Yes	(No)

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Unit Stability			
pH	DO	Cond.	ORP
0.1	10%	3.0%	10 mV

Parameter:	1	2	3	4	5	6	7	8	9
Volume Purged (gal)	-	~~2.5~~ 1.64	5 1.28	~~7.5~~ 1.92	~~10~~ 2.56	~~12.5~~ 3.20			
Rate (mL/min)	500	500	500	500	500	500			
Depth to Water (ft.)	1.78	1.80	1.79	1.80	1.80	1.81			
pH	6.94	6.97	6.99	6.95	6.94	6.93			
Temp. (C)	5.86	5.00	4.95	4.95	4.96	4.92			
Conductivity (mS/cm)	0.455	0.435	0.444	0.458	0.461	0.465			
Dissolved Oxygen (mg/L)	4.51	4.67	4.51	4.17	3.99	3.44			
ORP (mV)	39	34	39	43	44	47			
Turbidity (NTU)	66.5	49.1	36.3	35.3	33.8	29.6			
Notes:	Pump Start 15:40					Pump Off 16:05			

Sampling Information

Analyses	#	Laboratory
TCL VOCs		TestAmerica
Sample ID: PDI-8	Sample Time: 16:15	
MS/MSD: Yes	(No)	
Duplicate: Yes	(No)	
Duplicate ID	Dup. Time:	
Chain of Custody Signed By:		

Problems / Observations

ARCADIS
Improving Quality of Environment Worldwide

Site | Event

WELL DEVELOPMENT FIELD LOG

BBL Personnel: EJB
Oversight Personnel:
Client / Job Number: OH002000NY41.00302
Weather: Cloudy 50

Well ID: MW-9
Date: 3-16-09
PID (ppm)
Time In: 1630 Time Out: 1721

Well Information

Depth to Water: (initial) (TIC)	(feet) 1.74	Time: 1633	
Depth to Water: (with equipment) (TIC)	(feet) 1.74	Time: 1639	
Depth to Water: (Final) (TIC)	(feet)	Time:	
Total Depth: (TIC)	(feet) ~~19~~ 11.96	Time: 1639	
Total Depth: (TIC)	(feet)	Time:	
Depth to NAPL: (TIC) (DNAPL or LNAPL)	(feet)	Time:	
Length of Water Column:	(feet) 10.16		
Volume of Water in Well:	(gal) 0.416		

Equipment

Probe Type:	(Water Level)	Interface
Purging Method:	Waterra Pump Other Peristaltic	
Tubing Type:	(Polyethylene)	Teflon lined
Well Diameter:	(1") 2"	Other:

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Purging Information

Pump Start time:	16:41	Pump End time:	17:16	
Duration of Pumping:	(min) 35			
Average Pumping Rate:	(ml/min) 500	Water-Quality Meter Type:	Horiba	
Total Volume Removed:	(gal) ~5	Did well go dry:	Yes	(No)

Time Elapsed	1	2	3	4	5	6	7	8	9
Volume Purged (liters)	-	2.5	5	7.5	9.16	12.5	15	17.5	
Rate (mL/min)	500	500	500	500	500	500	500	500	
Depth to Water (ft.)	1.74	1.77	1.78	1.77	1.77	1.77	1.77	1.77	
Color	Dark Brown	Dark Brown	Clear	Clear	Clear	Clear	Clear	Clear	
Temp oC	6.20	5.61	5.34	5.27	5.24	5.86	5.17	5.18	
pH	7.00	6.81	6.62	6.57	6.56	6.57	6.60	6.58	
Conductivity (mS/cm)	0.745	0.762	0.774	0.779	0.783	0.787	0.795	0.798	
ORP (mV)	-90	17	61	73	81	88	93	79	
DO (%)	2.31	2.03	1.94	1.93	1.92	1.85	1.85	1.79	
Turbidity (NTU)	> 999	987	136	64.5	51.3	50.8	72.4	56.2	
Notes:									

RECOVERY

1:30	1.75
1:00	1.75
1:30	1.74
2:00	1.74
2:30	1.73
3:00	1.73

Problems / Observations

Ashland—PDI Rensselaer Site
Rensselar, New York
Site

ARCADIS
Event

GROUND-WATER SAMPLING LOG

Sampling Personnel:	Ricardo Jaimes/Rob LeRoy/Elliot Baird	Well ID:	PDI-9
Client / Job Number:	Ashland / OH002000NY41.00302	Date:	3-16-09
Weather:		Time In: 1721	Time Out: 1804

Well Information

Depth to Water:	(feet)	1.73	(from MP)
Total Depth:	(feet)	11.90	(from MP)
Length of Water Column:	(feet)	10.17	
Volume of Water in Well:	(gal)	0.416	
Three Well Volumes:	(gal)	1.25	

Well Type:	(Flushmount)		Stick-Up
Well Material:	Stainless Steel		(PVC)
Well Locked:		Yes	(No)
Measuring Point Marked:		Yes	(No)
Well Diameter:	(1")	2"	Other:

Purging Information

Purging Method:	Bailer	(Peristaltic)	Waterra	Other:
Tubing/Bailer Material:	Steel	(Polyethylene)	Teflon	Other:
Sampling Method:	(Bailer)	Peristaltic	Bailer	Other:

Duration of Pumping:	(min)	20		
Average Pumping Rate:	(ml/min)	500	Water-Quality Meter Type:	Horiba
Total Volume Removed:	(gal)	~3	Did well go dry: Yes	(No)

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Unit Stability			
pH	DO	Cond.	ORP
0.1	10%	3.0%	10 mV

Parameter:	1	2	3	4	5	6	7	8	9
Volume Purged (gal)	-	.64	1.28	1.92	2.56				
Rate (mL/min)	500	500	500	500	500				
Depth to Water (ft.)	1.73	1.86	1.80	1.79	1.79				
pH	6.56	6.56	6.56	6.56	6.56				
Temp. (C)	5.58	5.16	5.12	5.07	5.13				
Conductivity (mS/cm)	0.823	0.809	0.806	0.809	0.811				
Dissolved Oxygen (mg/L)	1.88	1.73	1.73	1.67	1.67				
ORP (mV)	83	83	87	88	91				
Turbidity (NTU)	132.0	76.5	66.0	61.2	64.3				
Notes:	Pump Start 17:25				Pump Off 1745				

Sampling Information

Analyses	#	Laboratory
TCL VOCs		TestAmerica
Sample ID: PDI-9	Sample Time: 1755	
MS/MSD: Yes (No)		
Duplicate: Yes (No)		
Duplicate ID	Dup. Time:	
Chain of Custody Signed By:		

Problems / Observations

ARCADIS

Site | Event

WELL DEVELOPMENT FIELD LOG

BBL Personnel: EAB | Well ID: PDI-10
Oversight Personnel: | Date: 3-17-09
Client / Job Number: OH002000NY41.00302 | PID (ppm)
Weather: Sunny 30's | Time In: 7:45 Time Out: 8:30

Well Information

Depth to Water: (initial) (TIC)	(feet) 3.07	Time: 7:46
Depth to Water: (with equipment) (TIC)	(feet) 7.08	Time: 7:53
Depth to Water: (Final) (TIC)	(feet)	Time:
Total Depth: (TIC)	(feet) 11.11	Time: 7:46
Total Depth: (TIC)	(feet)	Time:
Depth to NAPL: (TIC) (DNAPL or LNAPL)	(feet)	Time:
Length of Water Column:	(feet) 8.03	
Volume of Water in Well:	(gal) 0.329	

Equipment

Probe Type:	Water Level	Interface
Purging Method:	Waterra Pump Other Peristaltic	
Tubing Type:	Polyethylene	Teflon lined
Well Diameter:	(1") 2"	Other:

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Purging Information

Pump Start time: 7:54 | Pump End time: 8:16
Duration of Pumping: (min) 22
Average Pumping Rate: (ml/min) 704 | Water-Quality Meter Type: Horiba
Total Volume Removed: (gal) 4.09 | Did well go dry: Yes (No)

Time Elapsed	1	2	3	4	5	6	7	8	9
Volume Purged (liters)	-	3.5	7.5	11.5	15.5	~~19.5~~			
Rate (mL/min)	700	800	800	800	800	~~800~~			
Depth to Water (ft.)	4.02	6.29	6.52	6.53	5.46				
Color	D Gray	D. Gray	D Gray	D. Gray	Gray	~~Gray~~			
Temp oC	6.20	6.60	6.94	6.82	6.78				
pH	7.36	7.41	7.50	7.45	7.42				
Conductivity (mS/cm)	0.705	0.588	0.555	0.543	0.539				
ORP (mV)	-126	-115	-115	-125	-121				
DO (%)	1.11	0.06	0.88	0.08	1.32				
Turbidity (NTU)	> 999	744	> 999	> 999	> 999				
Notes:									

RECOVERY

No.	DTW			
30	4.64	6	3.30	14
1	4.43	7	3.26	15
1:30	4.13	8	3.20	
2	3.96	9	3.18	
2:30	3.61	10	3.15	
3	3.55	11	3.14	
4	3.44	12		
5	3.36	13		

Problems / Observations

Ashland—PDI Rensselaer Site
Rensselar, New York
Site

ARCADIS
infrastructure, environment, buildings
Event

GROUND-WATER SAMPLING LOG

Sampling Personnel:	Ricardo Jaimes/Rob LeRoy/Elliot Baird	Well ID:	PDI-10
Client / Job Number:	Ashland / OH002000NY41.00302	Date:	3-12-09
Weather:	Sunny 30s	Time In: 833	Time Out: 925

Well Information

Depth to Water:	(feet)	3.11	(from MP)
Total Depth:	(feet)	11.11	(from MP)
Length of Water Column:	(feet)	8.00	
Volume of Water in Well:	(gal)	0.328	
Three Well Volumes:	(gal)	0.984	

Well Type:	(Flushmount)		Stick-Up
Well Material:	Stainless Steel		(PVC)
Well Locked:		Yes	(No)
Measuring Point Marked:		Yes	(No)
Well Diameter:	(1")	2"	Other:

Purging Information

Purging Method:	Bailer	(Peristaltic)	Waterra	Other:
Tubing/Bailer Material:	Steel	(Polyethylene)	Teflon	Other:
Sampling Method:	(Bailer)	Peristaltic	Bailer	Other:

Duration of Pumping:	(min)	30		
Average Pumping Rate:	(ml/min)	500	Water-Quality Meter Type:	Horiba
Total Volume Removed:	(gal)	3.85	Did well go dry: Yes	(No)

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Unit Stability			
pH	DO	Cond.	ORP
0.1	10%	3.0%	10 mV

Parameter:	1	2	3	4	5	6	7	8	9
Volume Purged (gal)	–	0.64	1.38	1.93	2.57	3.21	3.85		
Rate (mL/min)	500	500	500	500	500	500	500		
Depth to Water (ft.)	3.58	4.02	4.18	4.32	4.39	4.44	4.49		
pH	7.35	7.29	7.28	7.31	7.33	7.32	7.32		
Temp. (C)	6.47	6.25	6.21	6.41	6.46	6.43	6.41		
Conductivity (mS/cm)	0.515	0.494	0.497	0.515	0.519	0.519	0.518		
Dissolved Oxygen (mg/L)	1.00	0.97	1.55	1.45	1.40	1.46	1.79		
ORP (mV)	-89	-78	-78	-93	-100	-100	-99		
Turbidity (NTU)	> 999	> 999	> 999	> 999	> 999	865	638		
Notes:	Pump On 8:35						Pump Off 9:05		

Sampling Information

Analyses	#	Laboratory
TCL VOCs		TestAmerica
Sample ID: PDI-10	Sample Time: 910	
MS/MSD: Yes	No	
Duplicate: Yes	No	
Duplicate ID	Dup. Time:	
Chain of Custody Signed By:		

Problems / Observations

ARCADIS

Ashland - Rensselaer
Site

Event

WELL DEVELOPMENT FIELD LOG

BBL Personnel: ESB
Oversight Personnel:
Client / Job Number: OH002000NY41.00302
Weather:

Well ID: PD2-11
Date: 3-17-09
PID (ppm)
Time In: 9:35 Time Out: 10:35

Well Information

Depth to Water: (initial) (TIC)	(feet) 3.28	Time: 949
Depth to Water: (with equipment) (TIC)	(feet) 3.12	Time: 947
Depth to Water: (Final) (TIC)	(feet)	Time:
Total Depth: (TIC)	(feet) 12	Time:
Total Depth: (TIC)	(feet)	Time:
Depth to NAPL: (TIC) (DNAPL or LNAPL)	(feet)	Time:
Length of Water Column:	(feet) 8.88	
Volume of Water in Well:	(gal) 0.364	

Equipment

Probe Type:	Water Level	Interface
Purging Method:	Waterra Pump Other Peristaltic	
Tubing Type:	Polyethylene	Teflon lined
Well Diameter:	1" 2"	Other:

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Purging Information

Pump Start time:	949	Pump End time:	10:09
Duration of Pumping:	(min) 20		
Average Pumping Rate:	(ml/min) 775	Water-Quality Meter Type:	Horiba
Total Volume Removed:	(gal) 4.09	Did well go dry:	Yes (No)

Time Elapsed	1	2	3	4	5	6	7	8	9
Volume Purged (liters)	-	3.5	7.5	11.5	15.5				
Rate (mL/min)	700	800	800	800	800				
Depth to Water (ft.)	3.12	3.81	3.91	3.97	4.00				
Color	Dark Brown	Gray	Gray	Clear	Clear				
Temp oC	6.44	5.94	5.59	5.49	5.43				
pH	6.26	6.19	6.16	6.18	6.19				
Conductivity (mS/cm)	0.550	0.529	0.503	0.498	0.500				
ORP (mV)	-54	-57	-60	-65	-68				
DO (%)	0.78	0.00	0.00	0.00	0.00				
Turbidity (NTU)	> 999	> 999	657	310	235				
Notes:									

RECOVERY

Min.	DTW				
30	3.77	6	3.40	14	3.36
1	3.71	7	3.36	15	3.36
1:30	3.66	8	3.34		
2	3.61	9	3.33		
2:30	3.59	10	3.31		
3	3.55	11	3.29		
4	3.48	12	3.29		
5	3.44	13	3.27		

Problems / Observations

Sheen in Bucket
Strong Odor

Ashland—PDI Rensselaer Site
Rensselar, New York
Site

ARCADIS
Event

GROUND-WATER SAMPLING LOG

Sampling Personnel:	Ricardo Jaimes/Rob LeRoy/Elliot Baird	Well ID:	PDI-11
Client / Job Number:	Ashland / OH002000NY41.00302	Date:	3-17-09
Weather:		Time In: 10:25	Time Out:

Well Information

Depth to Water:	(feet)	3.26	(from MP)
Total Depth:	(feet)	12	(from MP)
Length of Water Column:	(feet)	8.74	
Volume of Water in Well:	(gal)	0.358	
Three Well Volumes:	(gal)	1.07	

Well Type:	(Flushmount)		Stick-Up
Well Material:	Stainless Steel		(PVC)
Well Locked:	Yes		(No)
Measuring Point Marked:	Yes		(No)
Well Diameter:	(1")	2"	Other:

Purging Information

Purging Method:	Bailer	(Peristaltic)	Waterra	Other:
Tubing/Bailer Material:	Steel	(Polyethylene)	Teflon	Other:
Sampling Method:	(Bailer)	Peristaltic	Bailer	Other:

Duration of Pumping:	(min)	25		
Average Pumping Rate:	(ml/min)	500	Water-Quality Meter Type:	Horiba
Total Volume Removed:	(gal)	3.2	Did well go dry: Yes	(No)

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Unit Stability			
pH	DO	Cond.	ORP
0.1	10%	3.0%	10 mV

Parameter:	1	2	3	4	5	6	7	8	9
Volume Purged (gal)	–	.64	1.28	1.92	2.56	3.2			
Rate (mL/min)	500	500	500	500	500	500			
Depth to Water (ft.)	3.26	3.62	3.70	3.73	3.74	3.76			
pH	6.17	6.21	6.20	6.20	6.21	6.21			
Temp. (C)	5.64	5.77	5.62	5.53	5.57	5.56			
Conductivity (mS/cm)	0.493	0.498	0.492	0.485	0.490	0.490			
Dissolved Oxygen (mg/L)	1.50	0.00	0.00	0.00	0.00	0.00			
ORP (mV)	-70	-74	-74	-74	-76	-77			
Turbidity (NTU)	264.0	172	136.0	120.0	182.0	129.6			
Notes:	Pump Start 10:30					Pump Off 10:55			

Sampling Information

Analyses	#	Laboratory
TCL VOCs		TestAmerica
Sample ID: PDI-11	Sample Time: 11:00	
MS/MSD: Yes (No)		
Duplicate: (Yes) No		
Duplicate ID: DUP031709	Dup. Time: –	
Chain of Custody Signed By:		

Problems / Observations

Strong Odor
Sheen in Bucket

ARCADIS
environment, ecology, management

Ashland - Rensselaer
Site

Event

WELL DEVELOPMENT FIELD LOG

BBL Personnel:
Oversight Personnel:
Client / Job Number: OH002000NY41.00302
Weather:

Well ID: PDS-12
Date: 3-12-09
PID (ppm)
Time In: 1630 Time Out: 1746

Well Information

Depth to Water: (initial) (TIC)	(feet)	4.73	Time: 16:38
Depth to Water: (with equipment) (TIC)	(feet)	4.66	Time: 16:41
Depth to Water: (Final) (TIC)	(feet)		Time:
Total Depth: (TIC)	(feet)	12.75	Time: 16:38
Total Depth: (TIC)	(feet)		Time:
Depth to NAPL: (TIC) (DNAPL or LNAPL)	(feet)		Time:
Length of Water Column:	(feet)	8.02	
Volume of Water in Well:	(gal)	0.32	

Equipment

Probe Type:	(Water Level)	Interface
Purging Method:	Waterra Pump Other Bailer	
Tubing Type:	(Polyethylene)	Teflon lined
Well Diameter:	(1") 2"	Other:

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Purging Information

Pump Start time: 16:41 Pump End time: 16:47
Duration of Pumping: (min) 6
Average Pumping Rate: (ml/min) 700 Water-Quality Meter Type: Horiba
Total Volume Removed: (gal) .92 Did well go dry: (Yes) No

Time Elapsed	1	2	3	4	5	6	7	8	9
Volume Purged (liters)	-	3.5							
Rate (mL/min)	700								
Depth to Water (ft.)	4.60								
Color	D. Brown								
Temp oC	10.78								
pH	7.48								
Conductivity (mS/cm)	1.91								
ORP (mV)	57								
DO (%)	2.07								
Turbidity (NTU)	> 999								
Notes:									

RECOVERY

Time	DTW		
30	9.35	6	8.85
1	9.25	7	8.79
1:30	9.21	8	8.74
2	9.20	9	8.66
2:30	9.11	10	8.63
3	9.06		
4	9.00		
5	8.90		

Problems / Observations

Ashland—PDI Rensselaer Site
Rensselar, New York
Site

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Event

GROUND-WATER SAMPLING LOG

Sampling Personnel:	Ricardo Jaimes/Rob LeRoy/Elliot Baird	Well ID:	PDI-12
Client / Job Number:	Ashland / OH002000NY41.00302	Date:	3-17
Weather:		Time In: 17:46	Time Out: 1856

Well Information

Depth to Water:	(feet)	7.19	(from MP)
Total Depth:	(feet)	12.06	(from MP)
Length of Water Column:	(feet)	4.81	
Volume of Water in Well:	(gal)	.197	
Three Well Volumes:	(gal)	0.59	

Well Type:	Flushmount		Stick-Up
Well Material:	Stainless Steel		PVC
Well Locked:	Yes		No
Measuring Point Marked:	Yes		No
Well Diameter:	1"	2"	Other:

Purging Information

Purging Method:	Bailer	Peristaltic	Waterra	Other:
Tubing/Bailer Material:	Steel	Polyethylene	Teflon	Other:
Sampling Method:	Bailer	Peristaltic	Bailer	Other:

Duration of Pumping:	(min)	7			
Average Pumping Rate:	(ml/min)	200	Water-Quality Meter Type:	Horiba	
Total Volume Removed:	(gal)	.25	Did well go dry:	Yes	No

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Unit Stability			
pH	DO	Cond.	ORP
0.1	10%	3.0%	10 mV

Parameter:	1	2	3	4	5	6	7	8	9
Volume Purged (gal)	-	.25							
Rate (mL/min)	200	200							
Depth to Water (ft.)	7.19	9.54							
pH	7.41	7.38							
Temp. (C)	12.92	11.10							
Conductivity (mS/cm)	1.76	1.83							
Dissolved Oxygen (mg/L)	0.33	6.84							
ORP (mV)	46	43							
Turbidity (NTU)	> 999	> 999							
Notes:	Pump On 17:42		Pump Off 17:49						

Sampling Information

Analyses	#	Laboratory
TCL VOCs		TestAmerica
Sample ID: PDI-12	Sample Time: ~~18:45~~ 1846	
MS/MSD: Yes	No	
Duplicate: Yes	No	
Duplicate ID	Dup. Time:	
Chain of Custody Signed By:		

Problems / Observations

ARCADIS
environment, ecology

Ashland - Rensselaer
Site

Event

WELL DEVELOPMENT FIELD LOG

BBL Personnel: ESB
Oversight Personnel:
Client / Job Number: OH002000NY41.00302
Weather: Sunny 50

Well ID: PDJ-13
Date: 3-17-09
PID (ppm)
Time In: 1315 Time Out: ~~1353~~ 1357

Well Information

Depth to Water: (initial) (TIC)	(feet) 5.58	Time:	1319
Depth to Water: (with equipment) (TIC)	(feet) 5.58	Time:	1323
Depth to Water: (Final) (TIC)	(feet)	Time:	
Total Depth: (TIC)	(feet) 13.90	Time:	1326
Total Depth: (TIC)	(feet)	Time:	
Depth to NAPL: (TIC) (DNAPL or LNAPL)	(feet)	Time:	
Length of Water Column:	(feet) 7.32		
Volume of Water in Well:	(gal) 0.30		

Equipment

Probe Type:	(Water Level)	Interface
Purging Method:	Waterra Pump Other Peristaltic	
Tubing Type:	(Polyethylene)	Teflon lined
Well Diameter:	(1") 2"	Other:

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Purging Information

Pump Start time:	1325		Pump End time:	1350	
Duration of Pumping:	(min) 25				
Average Pumping Rate:	(ml/min) 700		Water-Quality Meter Type:	Horiba	
Total Volume Removed:	(gal) 4.62		Did well go dry:	Yes	(No)

Time Elapsed	1	2	3	4	5	6	7	8	9
Volume Purged (liters)	-	3.5	7	10.5	14	17.5			
Rate (mL/min)	700	700	700	700	700	700			
Depth to Water (ft.)	5.58	5.81	5.82	5.82	5.82	5.82			
Color	Brown	Brown	Brown	L. Brown	L Brown	L. Brown			
Temp oC	10.43	10.22	10.17	10.15	10.15	10.15			
pH	6.93	7.09	7.08	7.07	7.07	7.07			
Conductivity (mS/cm)	3.63	3.51	3.47	3.44	3.41	3.41			
ORP (mV)	55	58	63	66	68	69			
DO (%)	7.76	0.33	0.00	0.00	0.00	0.00			
Turbidity (NTU)	> 999	> 999	> 999	> 999	> 999	> 999			
Notes:									

RECOVERY

Min	DTW		
30	5.68	6	5.60
1	5.64	7	
1:30	5.63	8	
2	5.60	9	
2.30	5.60	10	
3	5.60		
4	5.60		
5	5.60		

Problems / Observations

Ashland—PDI Rensselaer Site
Rensselar, New York
Site

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Event

GROUND-WATER SAMPLING LOG

Sampling Personnel:	Ricardo Jaimes/Rob LeRoy/Elliot Baird	Well ID:	PDI-13
Client / Job Number:	Ashland / OH002000NY41.00302	Date:	
Weather:	Sunny 50	Time In: 13 58	Time Out: 1455

Well Information

Depth to Water:	(feet) 5.60	(from MP)	
Total Depth:	(feet) 19.96	(from MP)	
Length of Water Column:	(feet) 7.3		
Volume of Water in Well:	(gal) 0.999		
Three Well Volumes:	(gal) ~~0.999~~ 0.897		

Well Type:	(Flushmount)	Stick-Up	
Well Material:	Stainless Steel	(PVC)	
Well Locked:	Yes	(No)	
Measuring Point Marked:	Yes	(No)	
Well Diameter:	(1")	2"	Other:

Purging Information

Purging Method:	Bailer	(Peristaltic)	Waterra	Other:
Tubing/Bailer Material:	Steel	(Polyethylene)	Teflon	Other:
Sampling Method:	(Bailer)	Peristaltic	Bailer	Other:

Duration of Pumping:	(min) 20			
Average Pumping Rate:	(ml/min) 500	Water-Quality Meter Type:	Horiba	
Total Volume Removed:	(gal) 1.56	Did well go dry:	Yes	No

Conversion Factors				
gal / ft. of water	1" ID	2" ID	4" ID	6" ID
	0.041	0.163	0.653	1.469
1 gal = 3.785 L =3875 ml = 0.1337 cubic feet				

Unit Stability			
pH	DO	Cond.	ORP
0.1	10%	3.0%	10 mV

Parameter:	1	2	3	4	5	6	7	8	9
Volume Purged (gal)	-	0.64	1.28	1.92	2.56				
Rate (mL/min)	500	500	500	500	500				
Depth to Water (ft.)	5.60	5.74	5.74	5.74	5.74				
pH	7.09	7.08	7.07	7.07	7.07				
Temp. (C)	9.95	10.10	10.07	10.08	10.05				
Conductivity (mS/cm)	3.48	3.41	3.41	3.41	3.41				
Dissolved Oxygen (mg/L)	0.00	0.00	0.00	0.00	0.00				
ORP (mV)	68	67	67	67	67				
Turbidity (NTU)	> 999	922.0	575.0	522.0	434.0				
Notes:	Pump On 14:00				Pump Off 14:20				

Sampling Information

Analyses	#	Laboratory
TCL VOCs		TestAmerica
Sample ID: PDI-13	Sample Time: 1425	
MS/MSD: (Yes)	No	
Duplicate: Yes	No	
Duplicate ID	Dup. Time:	
Chain of Custody Signed By:		

Problems / Observations

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Attachment C

Grain Size Curves

TestAmerica

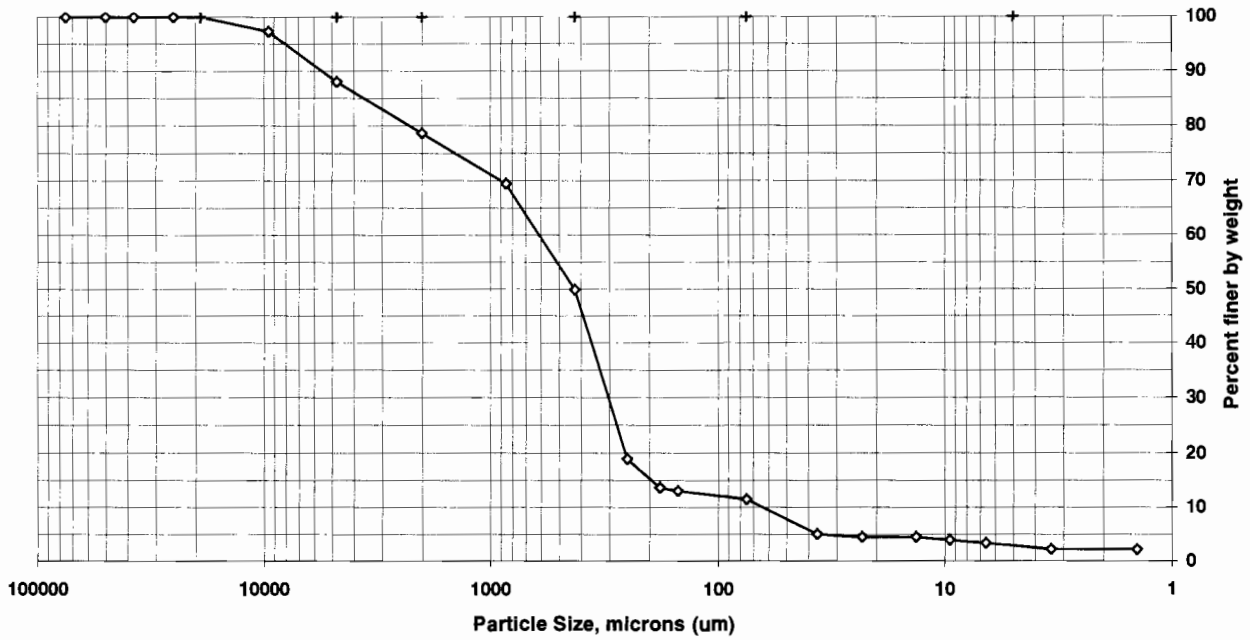
THE LEADER IN ENVIRONMENTAL TESTING

Sample Data Summary – Geotechnical

Particle Size of Soils by ASTM D422

Client Code:	ASHINI	**SDG:**	NY130783	**Date Received:**	3/21/2009
Sample ID:	PDI-7 (8-9)	**ETR(s):**	130783	**Start Date:**	3/23/2009
Lab ID:	789565			**End Date:**	4/1/2009

Percent Solids:	85.3%	**Non-soil material:**	na
Specific Gravity:	2.650	**Shape (> #10):**	subrounded
Maximum Particle Size:	19 mm	**Hardness (> #10):**	hard



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	97.3	2.7
#4	4750	88.0	9.3
#10	2000	78.6	9.4
#20	850	69.5	9.1
#40	425	49.9	19.6
#60	250	18.9	31.0
#80	180	13.7	5.2
#100	150	13.1	0.6
#200	75	11.5	1.6
Hydrometer	36.5	5.1	6.5
|	23.2	4.5	0.6
|	13.4	4.5	0.0
|	9.5	3.9	0.6
|	6.6	3.4	0.6
|	3.4	2.2	1.1
V	1.4	2.2	0.1

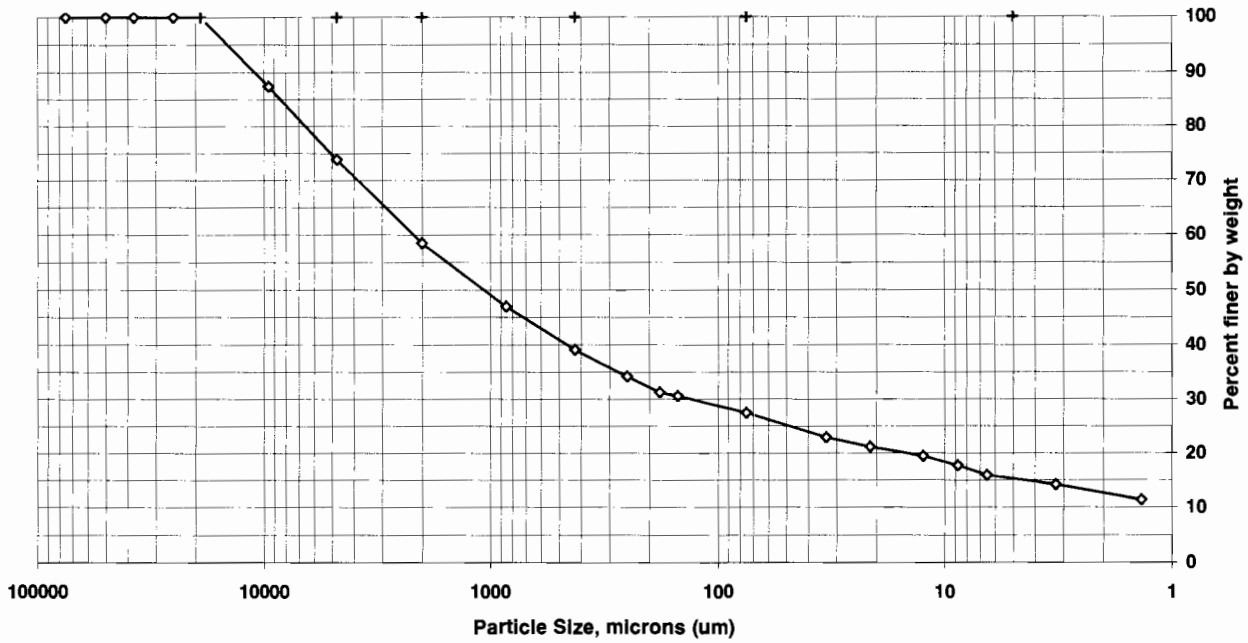
Soil Classification	Percent of Total Sample
Gravel	12.0
Sand	76.5
Coarse Sand	9.4
Medium Sand	28.8
Fine Sand	38.3
Silt	8.1
Clay	3.4

Preparation Method: **D2217**
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

Particle Size of Soils by ASTM D422

Client Code:	ASHINI	**SDG:**	NY130783	**Date Received:**	3/21/2009
Sample ID:	PDI-11 (8-12)	**ETR(s):**	130783	**Start Date:**	3/23/2009
Lab ID:	789567			**End Date:**	4/1/2009

Percent Solids:	87.1%	**Non-soil material:**	na
Specific Gravity:	2.650	**Shape (> #10):**	subangular
Maximum Particle Size:	19 mm	**Hardness (> #10):**	hard



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	87.4	12.6
#4	4750	73.8	13.6
#10	2000	58.5	15.3
#20	850	47.0	11.5
#40	425	39.1	8.0
#60	250	34.2	4.9
#80	180	31.3	2.9
#100	150	30.6	0.7
#200	75	27.5	3.1
Hydrometer	33.3	23.0	4.5
|	21.3	21.2	1.8
|	12.4	19.4	1.8
|	8.7	17.7	1.8
|	6.5	15.9	1.8
|	3.2	14.2	1.8
V	1.4	11.4	2.8

Soil Classification	Percent of Total Sample
Gravel	26.2
Sand	46.3
Coarse Sand	15.3
Medium Sand	19.5
Fine Sand	11.6
Silt	11.6
Clay	15.9

Preparation Method: **D2217**
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

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Appendix B

Health and Safety Plan–
Addendum 1

ARCADIS
Infrastructure, environment, buildings

Imagine the result

Ashland Inc.

Health and Safety Plan

Ashland Distribution Company Site
Rensselaer, New York

September 2007
Revised March 2008 and March 2009

ARCADIS

George Thomas
Project Manager

Katherine Murray
Field Task Manager

Charles Webster
Health and Safety Manager

Health and Safety Plan

Ashland Distribution Company Site
Rensselaer, New York

Prepared for:
Ashland Inc.

Prepared by:
ARCADIS
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New York 13214-0066
Tel 315.446.9120
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Our Ref.:
OH00200NY41

Date:
September 2007
Revised March 2008 and March 2009

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D Defensive Driving Procedure

E PPE Procedure

F Hearing Conservation Procedure

G Material Safety Data Sheets

H Incident/Near Miss Investigation Form

I Loss Prevention Observation Form

J Air Monitoring Log

K Health and Safety Inspection Form

L Site Activities Tailgate Health & Safety Briefing Form

M Health and Safety Plan Acknowledgment Forms

N Hazardous Materials Shipment Form

O Hazardous Materials Transportation Form

P Real Time Exposure Monitoring Data Collection Form

Q Field Health & Safety Stewardship Checklist

Approvals and Acknowledgments

Approvals

I have read and approved this Health and Safety Plan (HASP) with respect to project hazards, regulatory requirements, and ARCADIS procedures.

Project Name: Ashland Distribution Company Site
Rensselaer, New York
Project Number: OH002000.NY41

_____

Project Manager/Date

_____

Health and Safety Supervisor/Date

Acknowledgments

The final approved version of this HASP has been provided to the Site Supervisor. I acknowledge my responsibility to provide the Site Supervisor with the equipment, materials and qualified personnel to implement fully all safety requirements in this HASP. I will formally review this plan with the Health and Safety Staff every six months until project completion.

_____

Project Manager/Date

I acknowledge receipt of this HASP from the Project Manager, and that it is my responsibility to explain its contents to all site personnel and cause these requirements to be fully implemented. Any change in conditions, scope of work, or other change that might affect worker safety requires me to notify the Project Manager and/or the Health and Safety Officer.

_____

Site Supervisor/Date

1. Introduction

1.1 Objective

The objective of site activities is to conduct additional RFI data collection at the Ashland Distribution Company in Rensselaer, New York. Field activities are expected to include the following general tasks:

- Mobilization
- Monitoring well installations
- Collection of soil samples for characterization only during the advancement of the monitoring wells and soil borings
- Decontamination
- Demobilization
- Subslab soil vapor probe installation
- Subslab and indoor air soil vapor sampling

The objective of this Health and Safety Plan (HASP) is to provide a mechanism for establishing safe working conditions at the site. The safety organization, procedures, and protective equipment have been established based on an analysis of potential physical, chemical, and biological hazards. Specific hazard control methodologies have been evaluated and selected to minimize the potential of injury, illness, or other hazardous incident.

The HASP should be used in conjunction with the August 30, 2007 letter to the United States Environmental Protection Agency (USEPA) proposing the plan going forward at Rensselaer. The letter defines the field sampling program. The PMP contains field procedures and sample collection methods to be used during implementation of the work. The PMP addresses the management strategies to accomplish all the RFI activities. The QAPP presents the quality assurance/quality control (QA/QC) procedures to be used during implementation of the work, as well as a description of the general field and laboratory procedures. The DMP outlines procedures that are established to process data effectively.

1.2 Site Description

The site is located in the City of Rensselaer, Rensselaer County, New York at 130 South St. The site is approximately 11.5 acres in size and is located on the corner of South St. and 9J. The facility is in an area which is zoned as general industrial and as such is compatible with land use in the area. The properties immediately adjacent to the facility are: CSX tracks to the northwest, South Street to the southeast with residential and commercial properties across from the site. The site is not located in a flood plain. This facility once served as a solvent and chemical distribution site. These operations are no longer performed. The facility is scheduled for demolition in the fall of 2007.

1.3 Policy Statement

The policy of ARCADIS is to provide a safe and healthful work environment. No aspect of operations is of greater importance than injury and illness prevention. A fundamental principle of safety management is that all injuries, illnesses, and incidents are preventable. ARCADIS will take every reasonable step to eliminate or control hazards in order to minimize the possibility of injury, illness, or incident.

This HASP prescribes the procedures that must be followed during activities at the site. Operational changes that could affect the health and safety of personnel, the community, or the environment will not be made without the prior approval of the Project Manager (PM) and the Health and Safety Officer (HSO) or his designee. This document will be reviewed periodically to ensure that it is current and technically correct. Any changes in site conditions and/or the scope of work will require a review and modification to this HASP. Such changes will be completed in the form of an addendum or a revision to the plan.

The provisions of this plan are mandatory for all ARCADIS personnel and ARCADIS subcontractors assigned to the project. Subcontractors may prepare their own site-specific HASPs that must meet the basic requirements of this HASP. All visitors to ARCADIS work areas at the site must abide by the requirements of this plan.

1.4 References

This HASP complies with applicable Occupational Safety and Health Administration (OSHA) regulations, United States Environmental Protection Agency (USEPA) regulations, and ARCADIS health and safety policies and procedures. This plan follows the guidelines established in the following:

- *Standard Operating Safety Guides*, USEPA (Publication 9285.1-03, June 1992)
- *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, National Institute for Occupational Safety and Health (NIOSH), OSHA, United States Coast Guard (USCG), USEPA (86116, October 1985)
- *Title 29 of the Code of Federal Regulations* (CFR), Part 1910
- *Title 29 of the* CFR, Part 1926
- *Pocket Guide to Chemical Hazards*, Department of Health and Human Services (DHHS), Public Health Service (PHS), Center for Disease Control and Prevention (CDC), NIOSH (2005)
- *Threshold Limit Values*, American Conference of Governmental Industrial Hygienists (ACGIH) (2007)
- *Guide to Occupational Exposure Values*, ACGIH (2007)
- *Quick Selection Guide to Chemical Protective Clothing*, Forsberg, K. and S.Z. Mansdorf, 2nd Ed. (1993)
- *Health and Safety Manual*, ARCADIS

1.5 Definitions

The following definitions (listed alphabetically) are applicable to this HASP:

- *Contamination Reduction Zone (CRZ)* - Area between the exclusion zone and support zone that provides a transition between contaminated and clean areas. Decontamination stations are located in this zone.
- *Exclusion Zone (EZ)* - Any portions of the site where hazardous substances are, or are reasonably suspected to be present, and pose an exposure hazard to on-site personnel.
- *Incident* - All losses, including first aid cases, injuries, illnesses, near misses, spills/leaks, equipment and property damage, motor vehicle accidents, regulatory violations, fires, and business interruptions.

- *Near Miss* - An incident in which no injury, illness, motor vehicle accident, equipment or property damage, etc., occurred, but under slightly different circumstances, could have occurred.

- *On-Site Personnel* - All ARCADIS and subcontractor personnel involved with the project.

- *Project* - All on-site work performed under the scope of work.

- *Site* - The area described in Section 1.2, Site and Facility Description, where the work is to be performed by ARCADIS personnel and subcontractors.

- *Subcontractor* - Includes contractor personnel hired by ARCADIS.

- *Support Zone (SZ)* - All areas of the site, except the EZ and CRZ; the SZ surrounds the CRZ and EZ. Support equipment and break areas are located in this zone.

- *Visitor* - All other personnel, except the on-site personnel.

- *Work Area* - The portion of the site where work activities are actively being performed. This area may change daily as work progresses and includes the SZ, CRZ, and EZ. If the work area is located in an area on the site that is not contaminated, or suspected of being contaminated, the entire work area may be a SZ.

1.6 Acronyms

The following acronyms (listed alphabetically) are applicable to this HASP:

- *ACGIH* – American Conference of Governmental Industrial Hygienists

- *ANSI* – American National Standards Institute

- *ARCADIS* – ARCADIS of New York, Inc.

- *BTEX* – Benzene, Toluene, Ethylbenzene, Xylene

- *CPR* – Cardiopulmonary Resuscitation

- *COC* – Constituent(s) of Concern

- *CRZ* – Contamination Reduction Zone
- *EMS* – Emergency Management System
- *EZ* – Exclusion Zone
- *GFCI* – Ground Fault Circuit Interrupter
- *HASP* – Health and Safety Plan
- *HSM* – Health and Safety Manager
- *HSO* – Health and Safety Officer
- *HSS* – Health and Safety Supervisor
- *II* – Incident Investigation
- *JSA* – Job Safety Analysis
- *LEL* – Lower Explosive Limit
- *LPS* – Loss Prevention System
- *LPO* – Loss Prevention Observation
- *MSDS* – Material Safety Data Sheet
- *NIOSH* – National Institute for Occupational Safety and Health
- *NRR* – Noise Reduction Rating
- *NYSDEC* – New York State Department of Environmental Conservation
- *NYSDOH* – New York State Department of Health
- *OSHA* – Occupational Safety and Health Administration
- *PAH* – Polycyclic Aromatic Hydrocarbons
- *PEL* – Permissible Exposure Limit

- *PFD* – Personal Floatation Device
- *PIC* – Principal in Charge
- *PID* – Photoionization Detector
- *PM* – Project Manager
- *PO* – Project Officer
- *PPE* – Personal Protective Equipment
- *SPSA* – Safe Performance Self-Assessment
- *SC* – Site Characterization
- *SS* – Site Supervisor
- *SZ* – Support Zone
- *TLV* – Threshold Limit Value
- *USCG* – United States Coast Guard
- *USEPA* – United States Environmental Protection Agency
- *VOC* – Volatile Organic Compound

2. Roles and Responsibilities

2.1 All Personnel

All ARCADIS and subcontractor personnel must adhere to the procedures outlined in this HASP during the performance of their work. Each person is responsible for completing tasks safely, and reporting any unsafe acts or conditions to their supervisor. No person may work in a manner that conflicts with these procedures. After due warnings, the PM will dismiss from the site any person or subcontractor who violates safety procedures.

All ARCADIS and subcontractor personnel will receive training in accordance with applicable regulations, and be familiar with the requirements and procedures contained in this HASP prior to initiating site activities. In addition, all personnel will attend an initial hazard briefing prior to beginning work at the site.

The roles of ARCADIS personnel and subcontractors are outlined in the following sections. Key project personnel and contacts are summarized in Table 2-1.

2.2 ARCADIS Personnel

2.2.1 Project Officer (PO)/Principal in Charge (PIC)

The PO or PIC is responsible for providing resources to assure project activities are completed in accordance with this HASP, and for meeting all regulatory and contractual requirements.

2.2.2 Health and Safety Officer

The HSO or his designee (the Health and Safety Manager [HSM]) has overall responsibility for the technical health and safety aspects of the project, including review and approval of this HASP. Inquiries regarding ARCADIS health and safety procedures, project procedures, and other technical or regulatory issues should be addressed to this individual. The HSO or his designee must approve changes or addenda to this HASP.

2.2.3 Project Manager

The PM is responsible for verifying that project activities are completed in accordance with the requirements of this HASP. The PM is responsible for confirming that the Site Supervisor (SS) has the equipment, materials, and qualified personnel to fully

implement the safety requirements of this HASP, and/or that subcontractors assigned to this project meet the requirements established by ARCADIS. It is also the responsibility of the PM to:

- Consult with the HSO/ HSM on site health and safety issues.
- Verify that subcontractors meet health and safety requirements prior to commencing work.
- Review Loss Prevention Observation (LPO) forms.
- Verify that all incidents are thoroughly investigated.
- Approve, in writing, addenda or modifications of this HASP.
- Suspend work or modify work practices, as necessary, for personal safety, protection of property, and regulatory compliance.

2.2.4 Health and Safety Supervisor (HSS)

The HSS is responsible for field health and safety issues, including the execution of this HASP. Questions in the field regarding health and safety procedures, project procedures, and other technical or regulatory issues should be addressed to this individual. The HSS will advise the PM on health and safety issues, and will establish and coordinate the project air monitoring program if one is deemed necessary (see Section 6.1, Air Monitoring). The HSS is the primary site contact on health and safety matters. It is the responsibility of the HSS to:

- Provide on-site technical assistance, if necessary.
- Participate in all incident investigations (IIs) and ensure that they are reported to the HSM/HSO, PIC, Ashland, and PM within 24 hours.
- Coordinate site and personal air monitoring as required, including equipment maintenance and calibration.
- Conduct site safety orientation training and safety meetings.
- Verify that ARCADIS personnel and subcontractors have received the required physical examinations and medical certifications.

- Review site activities with respect to compliance with this HASP.
- Maintain required health and safety documents and records.
- Assist the SS in instructing field personnel on project hazards and protective procedures.
- Review LPO forms.

2.2.5 Site Supervisor

The SS is responsible for implementing this HASP, including communicating requirements to on-site personnel and subcontractors. The SS will be responsible for informing the PM of changes in the work plan, procedures, or site conditions so that those changes may be addressed in this HASP. Other responsibilities are to:

- Consult with the HSS on site health and safety issues.
- Conduct LPOs at the site, and complete the LPO forms.
- Stop work, as necessary, for personal safety, protection of property, and regulatory compliance.
- Obtain a site map and determine and post routes to medical facilities and emergency telephone numbers.
- Notify local public emergency representatives (as appropriate) of the nature of the site operations, and post their telephone numbers (i.e., local fire department personnel who would respond for a confined space rescue).
- Observe on-site project personnel for signs of ill health effects.
- Investigate and report any incidents to the HSS.
- Verify that all on-site personnel have had applicable training.
- Verify that on-site personnel are informed of the physical, chemical, and biological hazards associated with the site activities, and the procedures and protective equipment necessary to control the hazards.
- Issue/obtain any required work permits (hot work, confined space, etc.).

For this SC project, the HSS and SS duties may be performed by the same person for some of the work activities and tasks (e.g., soil boring and monitoring well installations where subcontractors are working on site).

2.3 Subcontractors

Subcontractors and their personnel must understand and comply with applicable regulations and site requirements established in this HASP. Subcontractors may prepare their own site-specific HASP that must be consistent with the requirements of this HASP.

All subcontractor personnel will receive training in accordance with applicable regulations, and be familiar with the requirements and procedures contained in this HASP prior to initiating site activities. All subcontractor personnel will attend an initial hazard briefing prior to beginning work at the site. Additionally, on-site subcontractor personnel must attend and participate in the daily site safety meetings.

Subcontractors must designate individuals to function as the PM, HSO, HSS, and SS. In some firms, it is not uncommon for the duties of the HSO to be carried out by the PM. This is acceptable provided the PM has the required knowledge, training, and experience to properly address all hazards associated with the work, and to prepare, approve, and oversee the execution of the site-specific HASP. A subcontractor may designate the same person to perform the duties of both the HSS and the SS. However, depending on the level of complexity of a contractor's scope of work, it may be infeasible for one person to perform both functions satisfactorily.

2.4 All On-Site Personnel

All on-site personnel (including subcontractors) must read and acknowledge their understanding of this HASP before commencing work, and abide by the requirements of the plan. All on-site personnel shall sign the HASP Acknowledgement Form following their review of this HASP.

All ARCADIS and subcontractor personnel will receive training in accordance with applicable regulations, and be familiar with the requirements and procedures contained in this HASP prior to initiating site activities. In addition, all on-site personnel will attend an initial hazard briefing prior to beginning work at the site and the daily safety meetings.

All on-site personnel must perform a Safe Performance Self-Assessment (SPSA) prior to beginning each work activity. The SPSA process is presented in Section 4.2.1. This

process must be performed prior to beginning each activity, and must be performed after any near miss or other incident in order to determine if it is safe to proceed. On-site personnel will immediately report the following to the SS or HSS:

- Personal injuries and illnesses no matter how minor
- Unexpected or uncontrolled release of chemical substances
- Symptoms of chemical exposure
- Unsafe or hazardous situations
- Unsafe or malfunctioning equipment
- Changes in site conditions that may affect the health and safety of project personnel
- Damage to equipment or property
- Situations or activities for which they are not properly trained
- Near misses

2.5 Visitors

All visitors to ARCADIS work areas must check in with the SS. Visitors will be cautioned to avoid skin contact with surfaces, soils, groundwater, or other materials that may impacted or be suspected to be impacted by constituents of concern (COC).

Visitors requesting to observe work at the site must don appropriate personal protective equipment (PPE) prior to entry to the work area and must have the appropriate training and medical clearances to do so. If respiratory protective devices are necessary, visitors who wish to enter the work area must have been respirator-trained and fit tested for a respirator within the past 12 months.

Table 2-1. Key Personnel

ARCADIS Personnel		
Role	**Name**	**Address/Telephone No.**
Project Manager	George Thomas	6723 Towpath Rd., P.O. Box 66 Syracuse, NY 13214-0066 315.446.9120
Field Supervisor	Katherine Murray	6723 Towpath Rd., P.O. Box 66 Syracuse, NY 13214-0066 315.446.9120
Health and Safety Manager	Charles Webster	6723 Towpath Rd., P.O. Box 66 Syracuse, NY 13214-0066 315.446.9120
Site Supervisor	Ricardo Jaimes	6723 Towpath Rd., P.O. Box 66 Syracuse, NY 13214-0066 315.446.9323
Health and Safety Supervisor		
Subcontractors		
Company/Role	**Name**	**Address/Telephone No.**
Drilling/Monitoring Well Installation	ARCADIS	6723 Towpath Rd., P.O. Box 66 Syracuse, NY 13214-0066 315.446.9323
Ashland Inc		
Role	**Name**	**Address/Telephone No.**
Ashland Project Manager	Jim Vondracek	Ashland Inc 5200 Blazer Parkway Dublin, OH 43017 614.790.6146
Agency Personnel		
Agency/Role	**Name**	**Address/Telephone No.**
US Environmental Protection Agency (USEPA)	Mr. Michael Infurna	New York Section USEPA Region 2 290 Broadway New York, NY 10007-1866 212.637.4177

2.6 Stop Work Authority

Every ARCADIS employee and ARCADIS subcontractor has the authority and the responsibility to stop the work of another co-worker if the working conditions or behaviors are considered unsafe, and is expected to do so.

2.7 Short-Service Employee (SSE) Program

Recognizing that inexperienced employees are at a greater risk for incidents, the following guidelines are established to identify those employees and ease their transition.

- ARCADIS employees new to the industry and new to ARCADIS will be identified in the field by wearing an orange hardhat/baseball cap for 6 months.

- ARCADIS employees experienced in the industry, but new to ARCADIS will wear the orange hardhat/baseball cap for 3 months.

The following guidelines apply:

- A crew of two to three may have one SSE on site.
- A crew of five may have two SSEs on site.
- A crew of ten may have no more than four SSEs on site.

2.8 Near-Miss/Incident Reporting Hotline

Ashland has established a Near Miss/Incident reporting hotline number. This number is to be called for **all** near-miss or incidents. In addition the ARCADIS Near-Miss hot line reporting number should be called to report Near-Misses. The ARCADIS hotline will be checked daily and data will be entered into the ARCADIS LPS Database, with the caller listed as the primary contact for the event. All entries will be saved as initial and can be accessed by the caller when they return to their computers. Entry into the database does not relieve the caller from the responsibility of following through with the near-miss investigation, or of notifying other employees in the office or project team of the occurrence.

THE ASHLAND NEAR MISS/INCIDENT NUMBER IS 1.800.ASHLAND (274.5263)

THE ARCADIS NEAR-MISS REPORTING NUMBER IS 1.866.242.4304.

Callers to the ARCADIS number will be prompted to provide the following information:

- Name and phone number

- Date of near miss

- Location
- Project number (if applicable)
- Brief description of what happened
- Name of division or office Vice President
- What you think could have happened if this situation had resulted in an injury or damage
- Any other information you think may be important

The intent of the ARCARDIS Near-Miss call number is to enable employees to phone in near misses immediately and have the events entered into the ARCADIS LPS Database. As we all know, the expectation is that immediately after having a near miss, an SPSA will be conducted to provide that it is safe to continue whatever the employee was doing.

Remember, reporting and acting on a near-miss today can save your fellow employees from an injury in the future. Please do your part to help us reach our goal of zero injuries at ARCADIS!

3. Project Hazards and Control Measures

3.1 Scope of Work

Field activities are expected to include the following general tasks:

- Mobilization
- Soil boring installations
- Monitoring well installations
- Collection of soil samples during the advancement of the monitoring wells and soil borings
- Decontamination
- Demobilization
- Subslab soil vapor probe installation and sampling
- Indoor air sampling

3.2 Field Activities, Hazards, and Control Procedures

The following job safety analyses (JSAs) identify potential health, safety, and environmental hazards associated with each type of field activity. Because of the complex and changing nature of field projects, supervisors must continually inspect the site to identify hazards that may affect on-site personnel, the community, or the environment. The SS must be aware of these changing conditions and discuss them with the PM whenever these changes impact employee health, safety, the environment, or performance of the project. The SS will keep on-site personnel informed of the changing conditions, and the PM will write and/or approve addenda or revisions to this HASP as necessary.

3.2.1 Mobilization

Site mobilization will include establishing drilling and excavation locations, determining the location of utilities and other installations, and establishing work areas. A break area will be set up outside of regulated work areas. Mobilization may involve clearing areas for the SZ and CRZ. During this initial phase, project personnel will walk the site

to confirm the existence of anticipated hazards, and identify safety and health issues that may have arisen since the writing of this plan.

The hazards of this phase of activity are associated with, manual materials handling and manual site preparation.

Manual materials handling and manual site preparation may cause blisters, sore muscles, and joint and skeletal injuries; and may present eye, contusion, and laceration hazards. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Freezing weather hazards include frozen, slick, and irregular walking surfaces.

Environmental hazards include plants, such as poison ivy and poison oak; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather, such as sunburn, lightning, rain, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and blood-borne pathogens.

Control procedures for these hazards are discussed in Section 4, General Safety Practices.

3.2.2 Installation of Soil Borings, Soil Vapor Points, and Groundwater Monitoring Wells

This task includes the installation of groundwater monitoring wells, soil vapor points, and soil borings at specified locations. The hazards associated with the potential contact with impacted soils and groundwater during these installations are discussed in Sampling Sections 3.2.3, 3.2.4, and 3.2.5.

In general, the installation of soil borings and monitoring wells will involve the use of conventional drilling rigs and equipment. The collection of soil samples and installation of soil vapor points may also involve the use of direct push type boring equipment. The equipment poses a hazard if it is not properly operated. The equipment is hydraulically powered, and uses static force and dynamic percussion force to advance small-diameter sampling tools. The presence of overhead utilities and underground obstacles poses a hazard if boring equipment contacts them. As the hazards are similar to those encountered when using a conventional drill rig, the required control procedures are also the same as a conventional rig and are included in the following sections.

3.2.2.1 Drilling Hazards

The primary physical hazards for this activity are associated with the use of drilling equipment. Rig accidents can occur as a result of improperly placing the rig on uneven or unstable terrain, or failing to adequately secure the rig prior to the start of operations. Underground and overhead utility lines can create hazardous conditions if contacted by drilling equipment. Tools and equipment, such as elevators, cat lines, and wire rope, have the potential for striking, pinning, or cutting personnel.

Wire Rope - Worn or frayed wire rope presents a laceration hazard if loose wires protrude from the main bundle.

Cat Lines - Cat lines are used on drilling rigs to hoist material. Accidents that occur during cat line operations may injure the employee doing the rigging, as well as injure the operator. Minimal hoisting control causes sudden and erratic load movements, which may result in hand and foot injuries.

Working Surfaces - Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, and slips and falls.

Materials Handling - The most common type of accident that occurs in material handling operations is the “caught between” situation when a load is being handled and a finger or toe gets caught between two objects. Rolling stock can shift and/or fall from a pipe rack or truck bed.

3.2.2.2 Drilling Safety Procedures

Drill Crews - All drillers must possess required state or local licenses to perform such work. All members of the drill crew shall receive site-specific training prior to beginning work.

The driller is responsible for the safe operation of the drill rig, as well as the crew’s adherence to the requirements of this HASP. The driller must ensure that all safety equipment is in proper condition and is properly used. The members of the crew must follow all instructions of the driller, wear all PPE, and be aware of all hazards and control procedures. The drill crews must participate in the Daily Safety Meetings and be aware of all emergency procedures.

Rig Inspection - Each day, prior to the start of work, the drill rig and associated equipment must be inspected by the driller and/or drill crew. Inspections will be documented. The following items must be inspected:

- Vehicle condition
- Proper storage of equipment
- Condition of all wire rope and hydraulic lines
- Condition of all drill rods and threads
- Fire extinguisher
- First aid kit

Drill Rig Set Up - The drill rig must be properly blocked and leveled prior to raising the derrick. The wheels that remain on the ground must be chocked. The leveling jacks shall not be raised until the derrick is lowered. The rig shall be moved only after the derrick has been lowered.

Site Drilling Rules - Before drilling activities commence, the existence and location of underground pipe, electrical equipment, and gas lines shall be determined. Dig Safely New York must be contacted at least one week, but no more than two weeks, prior to subsurface activities. The Underground/Overhead Utility Checklist (see Attachment G) shall be used to document that nearby utilities have been marked on the ground, and that the drilling areas have been cleared. The completed Underground/Overhead Utility Checklist will be in the possession of the SS prior to commencement of any intrusive investigation.

Overhead Electrical Clearances - If drilling is conducted in the vicinity of overhead power lines, the power to the lines must be shut off or the equipment must be positioned and blocked such that no part, including cables, can come within the minimum clearances as follows:

Nominal System Voltage	Minimum Required Clearance
0-50Kv	10 feet
51-100kV	12 feet
101-200kV	15 feet
201-300kV	20 feet
301-500kV	25 feet
501-750kV	35 feet
751-1,000kV	45 feet

When the drill rig is in transit, with the boom lowered and no load, the equipment clearance must be at least 4 feet for voltages less than 50kV, 10 feet for voltages of 50kV to 345kV, and 16 feet for voltages above 345kV.

Rig Set Up - All well sites will be inspected by the driller prior to the location of the rig to verify a stable surface exists. This is especially important in areas where soft, unstable terrain is common.

All rigs will be properly blocked and leveled prior to raising the derrick. Blocking provides a more stable drilling structure by evenly distributing the weight of the rig. Proper blocking ensures that differential settling of the rig does not occur.

When the ground surface is soft or otherwise unstable, wooden blocks, at least 24 inches by 24 inches and 4 inches to 8 inches thick, shall be placed between the jack swivels and the ground. The emergency brake shall be engaged, and the wheels that are on the ground shall be chocked.

Hoisting Operations - Drillers should never engage the rotary clutch without watching the rotary table, and ensuring it is clear of personnel and equipment.

Unless the drawworks is equipped with an automatic feed control, the brake should not be left unattended without first being tied down.

Auger strings or casing should be picked up slowly.

During instances of unusual loading of the derrick or mast, such as when making an unusually hard pull, only the driller should be on the rig floor; no one else should be on the rig or derrick.

The brakes on the drawworks of the drill rig should be tested by the driller each day. The brakes should be thoroughly inspected by a competent individual each week.

A hoisting line with a load imposed should not be permitted to be in direct contact with any derrick member or stationary equipment, unless it has been specifically designed for line contact.

Workers should never stand near the borehole whenever any wire line device is being run.

Hoisting control stations should be kept clean and controls labeled as to their functions.

Cat Line Operations - Only experienced workers will be allowed to operate the cathead controls. The kill switch must be clearly labeled and operational prior to operation of the cat line. The cathead area must be kept free of obstructions and entanglements.

The operator should not use more wraps than necessary to pick up the load. More than one layer of wrapping is not permitted.

Personnel should not stand near, step over, or go under a cable or cat line that is under tension.

Under no circumstances will personnel be permitted to ride the traveling block or elevators, nor will the cat line be used as a personnel carrier.

Employees rigging loads on cat lines shall:

- Keep out from under the load.
- Keep fingers and feet where they will not be crushed.
- Be sure to signal clearly when the load is being picked up.
- Use standard visual signals only and not depend on shouting to co-workers.
- Make sure the load is properly rigged, since a sudden jerk in the cat line will shift or drop the load.

Wire Rope - When two wires are broken or rust or corrosion is found adjacent to a socket or end fitting, the wire rope shall be removed from service or resocketed. Special attention shall be given to the inspection of end fittings on boom support, pendants, and guy ropes.

Wire rope removed from service due to defects shall be cut up or plainly marked as being unfit for further use as rigging.

Wire rope clips attached with U-bolts shall have the U-bolts on the dead or short end of the rope; the clip nuts shall be re-tightened immediately after initial load carrying use and at frequent intervals thereafter.

When a wedge socket fastening is used, the dead or short end of the wire rope shall have a clip attached to it or looped back and secured to itself by a clip; the clip shall not be attached directly to the live end.

Protruding ends of strands in splices on slings and bridles shall be covered or blunted.

Except for eye splices in the ends of wires and for endless wire rope slings, wire rope used in hoisting, lowering, or pulling loads, shall consist of one continuous piece without knot or splice.

An eye splice made in any wire rope shall have not less than five full tucks.

Wire rope shall not be secured by knots. Wire rope clips shall not be used to splice rope.

Eyes in wire rope bridles, slings, or bull wires shall not be formed by wire clips or knots.

Auger Handling - Auger sections shall be transported by cart or carried by two persons. Individuals should not carry auger sections without assistance.

Workers should not be permitted on top of the load during loading, unloading, or transferring of rolling stock.

When equipment is being hoisted, personnel should not stand where the bottom end of the equipment could whip and strike them.

Augers stored in racks, catwalks, or on flatbed trucks should be secured to prevent rolling.

3.2.3 Direct-Push drill rigs hazards and Controls

Direct-push equipment (Such as Geoprobe® or AMS Power-Probe™) is hydraulically powered and uses static force and dynamic percussion force to advance small-diameter sampling tools. As the hazards are similar to those encountered when using a conventional drill rig, the required control procedures are also the same as a conventional rig presented in the previous section.

3.2.4 Sub-slab Soil Vapor Point Installation

Temporary sub-slab soil vapor points will be installed in the basements of nearby private homes and in the Ashland on-site office building. ARCADIS staff will work in pairs at all times while on private property and in residences. Tools needed for installation through the basement concrete floors include a hand drill with concrete bit. Safety equipment would include puncture-resistant gloves, eye and ear protection. Prior to installation of sampling points and sampling, a building review and product inventory will be conducted. The product inventory involves identifying and documenting products in the building that may act as a source of VOCs. Potential VOC

sources are removed from the building for a minimum of 24 hours in advance of indoor air sampling, where practicable.

Hazards – Potential injury associated with drilling through concrete includes punctures, laceration, hand injury, eye injury, hearing damage and electric shock. Slips/trips/falls associated with poor lighting and/or dilapidated stairways in older residences are also a potential hazard. Sampling personnel should ask residents if aggressive dogs are present. Inhalation of COCs is possible during installation of sub-slab sampling points.

Control – Appropriate ear and eye protection will be worn while drilling. The drill, GFCI and electrical power cord will be inspected prior to connecting to a power supply. Leather gloves will be worn to protect hands. Flashlights will be used to supplement lighting if necessary. Homes will not be entered until dogs are secured. To control dermal exposure to COCs, a minimum of Modified Level D will be worn. A photoionization detector (PID) will be used to monitor airborne exposure potential to the worker. If necessary, based on field observations and site conditions, air monitoring may be conducted during soil vapor sampling activities to assess the potential for exposure to airborne COCs. If the results of air monitoring indicate the presence of organic vapors in a concentration causing concern, personnel will upgrade to Level C protection. Refer to Section 6.1, Air Monitoring, for a description of air monitoring requirements and action levels. A description of each level of personal protection is included in Section 5, Personal Protective Equipment. Control procedures for environmental and general hazards are discussed in Section 4, General Site Safety Procedures.

3.2.5 Soil Vapor Sampling (Exterior Soil Vapor Points)

Soil vapor sampling will involve purging, and sampling soil vapor from newly installed vapor points. Vapor samples collected from the points are contained in stainless steel canisters and are then shipped to analytical laboratory for analysis. The physical hazards of these operations are primarily associated with the sample collection methods and procedures utilized.

Hazards - Inhalation of COCs are the primary route of entry associated with soil vapor sampling due to the manipulation of sample media and equipment, and proximity of operations to the breathing zone. The hazards associated with soil vapor sampling procedures are generally limited to strains/sprains from lifting. Stainless steel canisters associated with the sampling are received under a vacuum, therefore, care should be taken not to drop or damage the canister risking injury. Exposure to soil containing COCs is also possible.

The flora and fauna of the site may present hazards of poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders, and snakes. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Freezing weather hazards include frozen, slick, and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces and unstable soil.

Control - To control dermal exposure during the soil vapor sampling activities, a minimum of Modified Level D will be worn. The vapor points should be approached, opened and sampled from the upwind side. The photoionization detector (PID) will be used to determine exposure potential to the worker. If necessary, based on field observations and site conditions, air monitoring may be conducted during soil vapor sampling activities to assess the potential for exposure to airborne COCs. If the results of air monitoring indicate the presence of organic vapors in a concentration causing concern, personnel will upgrade to Level C protection. Refer to Section 6.1, Air Monitoring, for a description of air monitoring requirements and action levels. A description of each level of personal protection is included in Section 5, Personal Protective Equipment. Control procedures for environmental and general hazards are discussed in Section 4, General Site Safety Procedures.

3.2.6 Indoor Air and Sub-slab Soil Vapor Sampling

Sampling for indoor and ambient air as well as sub-slab soil vapor will take place in several nearby private residences and the Ashland on-site office building. ARCADIS staff will work in pairs at all times while on private property and in residences. Prior to installation of sampling points and sampling, a building review and product inventory will be conducted. The product inventory involves identifying and documenting products in the building that may act as a source of VOCs. Potential VOC sources are removed from the building for a minimum of 24 hours in advance of indoor air sampling, where practicable. The sampling procedure involves installing sub-slab sampling points (see 3.2.3 above), setting up the equipment to collect the sample and returning 8 to 24 hours later to retrieve equipment.

Hazards - Inhalation of COCs are the primary route of entry associated with soil vapor sampling due to the manipulation of sample media and equipment, and proximity of operations to the breathing zone. The hazards associated with indoor air/sub-slab sampling procedures are generally limited to strains/sprains from lifting and slips/trips/falls due to damaged stairways, cluttered basements and/or poor lighting. Stainless steel canisters associated with the sampling are received under a vacuum, therefore, care should be taken not to drop or damage the canister risking injury.

Control – Flashlights will be utilized to supplement lighting if necessary. Homes will not be entered until dogs are secured. To control dermal exposure during the soil vapor sampling activities, a minimum of Modified Level D will be worn. The photoionization detector (PID) will be used to monitor airborne exposure to COCs. If the results of air monitoring indicate the presence of organic vapors in a concentration causing concern, personnel will upgrade to Level C protection. Refer to Section 6.1, Air Monitoring, for a description of air monitoring requirements and action levels. A description of each level of personal protection is included in Section 5, Personal Protective Equipment. Control procedures for environmental and general hazards are discussed in Section 4, General Site Safety Procedures.

3.2.7 Groundwater Sampling and Monitoring

Groundwater sampling and water level monitoring will involve uncapping, purging (pumping water out of the well), and sampling and monitoring new and existing monitoring wells. A mechanical pump may be utilized to purge the wells and can be hand-, gas-, or electric-operated. Water samples taken from the wells are then placed in containers and shipped to analytical laboratory for analysis. The physical hazards of these operations are primarily associated with the sample collection methods and procedures utilized.

Hazards - Inhalation and absorption (contact) of COCs are the primary routes of entry associated with groundwater sampling due to the manipulation of sample media and equipment, manual transfer of media into sample containers, and proximity of operations to the breathing zone. During the course of this project, several different groundwater sampling methodologies may be utilized based on equipment accessibility and the types of materials to be sampled. These sampling methods may include hand or mechanical bailing. The primary hazards associated with these specific sampling procedures are not potentially serious; however, other operations in the area or the conditions under which samples must be collected may present chemical and physical hazards. The hazards directly associated with groundwater sampling procedures are generally limited to strains/sprains from hand bailing and potential eye hazards. Exposure to soil and water containing COCs is also possible.

The flora and fauna of the site may present hazards of poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders, and snakes. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Freezing weather hazards include frozen, slick, and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces and unstable soil.

Control - To control dermal exposure during groundwater sampling and monitoring activities, a minimum of Modified Level D will be worn. The well should be approached, opened and sampled from the upwind side. The photoionization detector (PID) will be used to determine exposure potential to the worker. If necessary, based on field observations and site conditions, air monitoring may be conducted during groundwater sampling and monitoring activities to assess the potential for exposure to airborne COCs. If the results of air monitoring indicate the presence of organic vapors in a concentration causing concern, personnel will upgrade to Level C protection. Refer to Section 6.1, Air Monitoring, for a description of air monitoring requirements and action levels. A description of each level of personal protection is included in Section 5, Personal Protective Equipment. Control procedures for environmental and general hazards are discussed in Section 4, General Site Safety Procedures.

3.2.8 Surface and Subsurface Soil Sampling *(not anticipated for Rensselaer)*

This task consists of collecting surface and subsurface soil samples for subsequent analysis and evaluation of potential impact by COC. The physical hazards of these operations are primarily associated with the sample collection methods and procedures utilized. In addition, personnel may be exposed to hazards associated with working in or near excavations.

Hazards - Inhalation and absorption (contact) of COC are the primary routes of entry associated with soil sampling due to the manipulation of sample media and equipment, manual transfer of media into sample containers, and proximity of operations to the breathing zone. During the course of this project, several different soil sampling methodologies may be utilized based on equipment accessibility and the types of materials to be sampled. These sampling methods may include the use of hand-auger/sampling probes, sampling spoons, or trowels. The primary hazards associated with these specific sampling procedures are not potentially serious; however, other operations in the area or the conditions under which samples must be collected may present chemical and physical hazards. The hazards directly associated with soil sampling procedures are generally limited to strains/sprains and potential eye hazards. Exposure to soil and water containing COC is also possible. In addition to the safety hazards specific to sampling operations, hazards associated with the operation of vehicles, especially large vehicles with limited operator visibility, is a concern. Of particular concern will be the backing up of trucks, excavation equipment, and other support vehicles.

The flora and fauna of the site may present hazards of poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders, and snakes. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Freezing weather

hazards include frozen, slick, and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces and unstable soil.

Control - To control dermal exposure during soil sampling activities, a minimum of Modified Level D protection will be worn. In addition, air monitoring will be conducted during soil sampling activities to assess the potential for exposure to airborne COC. Subsurface soil samples will be collected and screened for volatile organic compounds (VOCs) using a PID. If the results of air monitoring indicate the presence of organic vapors in a concentration causing concern, personnel will upgrade to Level C protection. Refer to Section 6.1, Air Monitoring for a description of air monitoring requirements and action levels. A description of each level of personal protection is included in Section 5, Personal Protective Equipment. Control procedures for environmental and general hazards are discussed in Section 4, General Safety Practices.

3.3 Decontamination

All equipment will be decontaminated before leaving the site using visual inspection to verify that COCs have been removed. In addition, all operations that have the potential to generate or release hazardous material will be conducted in a controlled area using the appropriate engineering controls. Specific decontamination techniques will be established based on site conditions. Decontamination procedures will be reviewed with all personnel on-site. It is anticipated that a decontamination pad will be constructed on a suitable surface with polyethylene sheeting or other appropriate containment system. Pressure washing or manual scrub brushing will be used as needed to decontaminate equipment. COC-impacted equipment will be determined “clean” by using visual inspection of all equipment.

Personnel involved in decontamination activities may be exposed to skin contact with contaminated materials and chemicals brought to the site as part of the project work. All personnel will review the operating procedures and PPE prior to decontamination. The equipment used for decontamination and the decontamination containment facility will be inspected daily prior to use. Personnel involved in decontamination activities must wear PPE that is one level below the level worn by personnel working in the EZ.

3.3.1 Pressure Washing

Equipment will be decontaminated before leaving the site. Personnel involved in decontamination activities may be exposed to skin contact with residuals containing site constituents, volatile emissions from heavily soiled equipment, high pressure water spray, and noise.

Hydro blasting is the process of using a stream of water at high pressure to clean or prepare surfaces by removing foreign matter and contaminants. The hazards of high pressure water cleaning are related to the high pressure of the water, which may exceed 10,000 pounds per square inch (psi) at the nozzle. Contact with the water spray may cause severe lacerations, which may then be contaminated with hazardous material. Because of the high pressure involved, the opportunity for slicing or injecting the water stream through soft tissues of the body exists. Hydro blasters will also cut through bone at high enough pressures. A second hazard is repetitive motion, or cumulative trauma disorder. These serious disorders are related to repeatedly squeezing the trigger or constantly fighting the pressure of the spray gun with the forearm or wrist. When pressure washing, steaming, or hydro blasting, the health and safety precautions for hydro blasting outlined below must be observed.

Pressure washing presents a splash hazard. Protection against splash to face and skin is mandatory. The pressure washer is not to be pointed at a person at any time. Steam cleaning presents a thermal burn hazard in addition to the hazards presented by pressure washing. Adequate protection from the hot surfaces must be provided. Only persons trained in use and maintenance of a hydro blaster may use such equipment. Hydro blasting operations will conducted only by qualified subcontractor personnel.

The following general requirements are provided for high-pressure water cleaning activities:

- The gun, pressure piping, pressure hose ends, and couplings will have a burst pressure of at least four times the operating pressure.
- No equipment or component of such equipment will be operated beyond the manufacturer's specifications or beyond the rated working pressure.
- The maximum operating pressure will be permanently displayed on the pumping unit.
- Wear safety glasses, face-shield, hearing protection, and safety shoes.
- Alternate hands frequently during long periods of use.
- Rotate personnel periodically.
- Use a washer with a gun which supplies water to the wand in a straight line as opposed to supplying water through the grip. This eliminates the gun's twisting motion.

- Keep the equipment in good condition.
- Check to see that releasing the trigger stops the flow of water. Do not wire back the trigger.
- A hose safety shroud will be placed on hoses whenever operating pressure exceeds 2,000 psi.
- The pressure control will be a "deadman" type to safely reduce the nozzle discharge pressure when control is released.
- The pressure discharge gauge indicating pump pressure will be clearly visible for monitoring pump pressure.
- A pressure relief device set to relieve at 110% of the maximum working pressure of the unit or its components, whichever is lower, will be installed on the pump. The relief will be clearly marked and displayed on the device.
- A strainer or filter should be installed on the water supply system to prevent debris from entering the water blasting units and clogging the gun, control, or other device.

Pay close attention to the water line. It is under pressure, and may whip about if broken. If a water line breaks, relieve the pressure before trying to grab the line.

3.4 Demobilization

Demobilization involves the removal of all tools, equipment, supplies, and vehicles brought to the site. The hazards of this phase of activity are associated with heavy equipment operation and manual materials handling.

Manual materials handling may cause blisters, sore muscles, and joint and skeletal injuries; and may present eye, contusion, and laceration hazards. Heavy equipment operation presents noise and vibration hazards, and hot surfaces, to operators. Personnel in the vicinity of heavy equipment operation may be exposed to physical hazards resulting in fractures, contusions, and lacerations and may be exposed to high noise levels. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Freezing weather hazards include frozen, slick, and irregular walking surfaces.

Environmental hazards include plants, such as poison ivy and poison oak; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather, such as sunburn, lightning, rain, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and blood-borne pathogens.

Control procedures for these hazards are discussed in Section 4, General Safety Practices.

3.5 Chemical Hazards

The chemical hazards associated with site operations are related to inhalation, ingestion, and skin exposure to site COCs. Concentrations of airborne COCs during site tasks may be measurable, and may require air monitoring during certain operations. Air monitoring requirements for site tasks are outlined in Section 6.1.

Site COCs may include: tetrachloroethylene, cis-1,2-dichloroethene, trichloroethylene, 1,2-dichloroethene, 1,1-dichlorethane, 1,1,1-trichloroethane, vinyl chloride, toluene, ethylbenzene, and xylenes.

The potential for inhalation of site COCs is low. The potential for dermal contact with soils and groundwater containing site COCs during excavation, drilling, and sampling operations is moderate. Table 3-2 lists the chemical, physical, and toxicological properties of site COCs. Material Safety Data Sheets (MSDS) for the COCs is included in Attachment A.

Chemical Hazard Information

Substance (CAS Number)	IP(eV)	Odor Threshold (ppm)	Route	Symptoms of Exposure	Treatment	TWA	STEL	Source	IDLH (NIOSH)
Cis-1,2-Dichloroethene	9.65	NA	Inh	Irritated eyes, nausea, vomiting, and epigastric distress. Symptoms of exposure-related narcosis including drowsiness, tremor, incoordination, dizziness, and weakness; defatting of skin/dermatitis	Eye: Irrigate immediately	200 ppm		PEL	1000 ppm
156-59-2			Ing		Skin: Soap wash promptly	200 ppm		TLV	
			Con		Breath: Respiratory support	200 ppm		REL	
					Swallow: Immediate medical attention				
1,2 Dichloroethylene	9.65	0.08-17 ppm	Inh	Irritated eyes, respiratory system; CNS depression	Eye: Irrigate immediately	200 ppm		PEL	1000 ppm
(DCE) Acetylene dichloride			Ing		Skin: Soap wash immediately	200 ppm		TLV	
540-59-0			Con		Breath: Respiratory support	200 ppm		REL	
					Swallow: Immediate medical attention				
1,1-Dichlorethane (Ethylidene chloride)	11.06	49-1359 ppm	Inh	Irritated skin, CNS depression, liver, kidney, lung damage	Eye: Irrigate immediately	100 ppm		PEL	3000 ppm
75-34-3			Ing		Skin: Soap wash immediately	100 ppm		TLV	
			Con		Breath: Move to fresh air, respiratory support	100 ppm		REL	
					Swallow: Medical support, do not induce vomiting				
Ethyl benzene	8.76	0.09-0.6	Inh	Irritated eyes, mucous membranes; headache; dermatitis; narcosis, coma	Eye: Irrigate immediately	100 ppm		PEL	800 ppm
[100-41-4]			Ing		Skin: Water flush immediately	100 ppm	125 ppm	TLV	
			Con		Breath: Respiratory support	100 ppm	125 ppm	REL	
					Swallow: Immediate medical attention				
Tetrachloroethylene (perchloroethylene)	9.32	2-71 ppm	Inh	Irritation to eyes, skin, nose, throat, and respiratory system; nausea; flush face, neck; vertigo, dizziness, incoordination; headache, somnolence; skin erythema; liver damage; carcinogen	Eye: Irrigate immediately	100 ppm	C 200 ppm; 300 ppm*	PEL	150 ppm
[127-18-4]			Abs		Skin: Soap wash immediately	25 ppm	100 ppm	TLV	
			Ing		Breath: Respiratory support	Lowest feasible concentration		REL	
			Con		Swallow: Immediate medical attention		* 5 min peak in any 3 hrs		
Toluene	8.82	0.16-37	Inh	Irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage	Eye: Irrigate immediately	200 ppm	C 300 ppm; 500ppm*	PEL	500 ppm
[108-88-3]			Abs		Skin: Soap wash immediately	20 ppm		TLV	
			Ing		Breath: Respiratory support	100 ppm	150 ppm	REL	
			Con		Swallow: Immediate medical attention		*10 min peak per 8hr shift		
Trichloroethylene (TCE, trichloroethene)	9.45	0.5-167 ppm	Inh	Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]	Eye: Irrigate immediately	100 ppm	C200 ppm; 300 ppm*	PEL	Ca
[79-01-6]			Ing		Skin: Soap wash immediately	10 ppm	25 ppm	TLV	(1,000 ppm)
			Con		Breath: Respiratory support	25 ppm (10-hour)	C2 ppm (60 min)	REL	
			Abs		Swallow: Immediate medical attention		*5min peak in any 2hrs		

Chemical Hazard Information

Substance (CAS Number)	IP(eV)	Odor Threshold (ppm)	Route	Symptoms of Exposure	Treatment	TWA	STEL	Source	IDLH (NIOSH)
1,1,1-Trichloroethane	11	16-714 ppm	Inh	Irritated eyes, skin; headache, lassitude, CNS depression, poor equilibrium, dermatitis, cardiac arrhythmia; liver damage	Eye: Irrigate immediately	350 ppm		PEL	700ppm
(methyl chloroform)			Ing		Skin: Soap wash immediately	350 ppm	450 ppm	TLV	
[71-55-6]			Con		Breath: Respiratory support		C 350 ppm*	REL	
					Swallow: Immediate medical attention		*15 min		
Vinyl chloride	9.99	10-20 ppm	Inh	Lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen]	Eye: Frostbite	1 ppm	5 ppm*	PEL	
[75-01-4]			Con		Skin: Frostbite	1 ppm		TLV	
					Breath: Respiratory support	29 CFR 1910.1017		REL	
							* avg not exceeding any 15 min		
Xylene (o-, m-, and p-isomers)	8.56	0.08-40 ppm	Inh	Dizziness, excitement, drowsiness, incoordination, staggering gait; irritated eyes, nose, throat; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately	100 ppm		PEL	900 ppm
[1330-20-7; 95-47-6; 108-38-3; 106-42-3]	8.56		Abs		Skin: Soap wash immediately	100 ppm	150 ppm	TLV	
	8.44		Ing		Breath: Respiratory support	100 ppm	150 ppm	REL	
			Con		Swallow: Immediate medical attention				

4. General Safety Practices

4.1 General Safety Rules

General safety rules for site activities include, but are not limited to, the following:

- At least one copy of this HASP must be in a location at the site that is readily available to personnel, and all project personnel shall review the plan prior to starting work.
- Consume or use food, beverages, chewing gum, and tobacco products only in the SZ or other designated area outside the EZ and CRZ. Cosmetics shall not be applied in the EZ or CRZ.
- Wash hands before eating, drinking, smoking, or using toilet facilities.
- Wear all PPE as required, and stop work and replace damaged PPE immediately.
- Secure disposable coveralls, boots, and gloves at the wrists and legs and ensure closure of the suit around the neck.
- Upon skin contact with materials that may be impacted by COC, remove contaminated clothing and wash the affected area immediately. Contaminated clothing must be changed. Any skin contact with materials potentially impacted by COC must be reported to the SS or HSS immediately. If needed, medical attention should be sought.
- Practice contamination avoidance. Avoid contact with surfaces either suspected or known to be impacted by COC, such as standing water, mud, or discolored soil. Equipment must be stored on elevated or protected surfaces to reduce the potential for incidental contamination.
- Remove PPE as required in the CRZ to limit the spread of COC-containing materials.
- At the end of each shift or as required, dispose of all single-use coveralls, soiled gloves, and respirator cartridges in designated receptacles designated for this purpose.
- Removing soil containing site COC from protective clothing or equipment with compressed air, shaking, or any other means that disperses contaminants into the air is prohibited.

- Inspect all non-disposable PPE for contamination in the CRZ. Any PPE found to be contaminated must be decontaminated or disposed of appropriately.

- Recognize emergency signals used for evacuation, injury, fire, etc.

- Report all injuries, illnesses, near misses, and unsafe conditions or work practices to the SS or HSS.

- Use the "buddy system" during all operations requiring Level C PPE, and when appropriate, during Modified Level D operations.

- Obey all warning signs, tags, and barriers. Do not remove any warnings unless authorized to do so.

- Use, adjust, alter, and repair equipment only if trained and authorized to do so, and in accordance with the manufacturer's directions.

- Personnel are to perform only tasks for which they have been properly trained and will advise their supervisor if they have been assigned a task for which they are not trained.

- The presence or consumption of alcoholic beverages or illicit drugs during the workday (including breaks) is strictly prohibited. Notify your supervisor if you must take prescription or over-the-counter drugs that indicate they may cause drowsiness or, that heavy equipment should not be operated while taking the medication.

- Remain upwind during site activities whenever possible.

4.2 Loss Prevention System (LPS)

LPS is a behavior based safety system meant to prevent or reduce the occurrence of injury, illness, or other incident. This program seeks the prevention or reduction of losses by:

- Emphasizing proactive activities.
- Capitalizing on the on-the-job expertise of field employees.
- Maximizing the use of positive reinforcement.
- Integrating with daily field operations.
- Solving problems from the bottom up while providing direction from the top down.

4.2.1 Safe Performance Self-Assessment

All on-site personnel are required to perform a SPSA prior to beginning any activity. This three-step process requires each individual to:

- *Assess* the risk of the task to be performed. Ask the following questions:
  - What could go wrong?
  - What is the worst thing that could happen if something does go wrong?
- *Analyze* the ways the risk can be reduced. Ask the following questions:
  - Do I have all the necessary training and knowledge to do this task safely?
  - Do I have all the proper tools and PPE?
- *Act* to control the risk and perform the task safely.
  - Take the necessary action to perform the job safely.
  - Follow written procedures, and ask for assistance if necessary.

This process must be performed prior to beginning any activity, and must be performed after any near miss or other incident in order to determine if it is safe to proceed.

4.2.2 Incident Investigation

An incident is any of the following events: first aid cases, injuries, illnesses, near misses, spills/leaks, equipment and property damage, motor vehicle accidents, regulatory violations, fires, and business interruptions. All incidents shall be investigated within 24 hours and reported to the PM and the HSO.

The purpose of an II is to prevent the recurrence of a similar hazardous event. II investigates all incidents in the same manner. Using the information gathered during an II, appropriate measures will be taken to protect personnel from the hazard in question. The II form is included in Attachment B.

4.2.3 Loss Prevention Observation

The SS or the HSS will perform the LPO (see Attachment C for the LPO form). The purpose of the LPO is to identify and correct potential hazards, and to positively reinforce behaviors and practices that are correct. The SS or HSS must identify potential deviations from safe work practices that could possibly result in an incident, and take prompt corrective action. The LPO process steps are:

- Identify tasks that have the greatest potential for hazardous incidents.
- Review the standard procedure for completing the task.
- Discuss with the observed employee the task and the SS/HSS role in observing the task.
- Observe the employee completing the task.
- Reference the LPO form for criteria. Complete the form, documenting positive, as well as areas in need of improvement.
- Discuss the results of the LPO with the employee. Discuss corrective action necessary.
- Implement corrective action.
- Communicate the results of the LPO and corrective action to the PM and the HSO.

4.2.4 Job Safety Analysis

A JSA is a tool used of identifying potential hazards and developing corrective or protective systems to eliminate the hazard. A JSA lists all the potential hazards associated with an activity. Hazards may be physical, such as lifting hazards or eye hazards, or environmental, such as weather or biological (stinging insects, snakes, etc.). Following the identification of the hazards associated with an activity, control measures are evaluated and protective measures or procedures are then instituted. JSAs are reviewed periodically to ensure that the procedures and protective equipment specified for each activity are current and technically correct. Any changes in site conditions and/or the scope of work may require a review and modification to the JSA in question. During this review process, comments on the JSA and its procedures should be obtained from personnel associated with the activity being analyzed. JSAs will be developed and reviewed during SC implementation.

4.3 Buddy System

On-site personnel must use the buddy system as required by operations. Use of the "buddy system" is required during all operations requiring Level C to Level A PPE, and when appropriate, during Level D operations. Crewmembers must observe each other for signs of chemical exposure, and heat or cold stress. Indications of adverse effects include, but are not limited to:

- Changes in complexion and skin coloration.
- Changes in coordination.
- Changes in demeanor.
- Excessive salivation and pupillary response.
- Changes in speech pattern.

Crewmembers must also be aware of the potential exposure to possible safety hazards, unsafe acts, or non-compliance with safety procedures.

Field personnel must inform their partners or fellow crewmembers of non-visible effects of exposure to toxic materials that they may be experiencing. The symptoms of such exposure may include, but are not limited to:

- Headaches.
- Dizziness.
- Nausea.
- Blurred vision.
- Cramps.
- Irritation of eyes, skin, or respiratory tract.

If protective equipment or noise levels impair communications, prearranged hand signals must be used for communication. Personnel must stay within line of sight of another team member.

4.4 Heat Stress

Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, etc., as well as the physical and conditioning characteristics of the individual. Since heat stress is one of the most common illnesses associated with heavy outdoor work conducted with direct solar load and, in particular, because wearing PPE can increase the risk of developing heat stress, workers must be capable of recognizing the signs and symptoms of heat-related illnesses. Personnel must be aware of the types and causes of heat-related illnesses and be able to recognize the signs and symptoms of these illnesses in both themselves and their co-workers.

Heat rashes are one of the most common problems in hot work environments. Commonly known as prickly heat, a heat rash is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Prickly heat occurs in skin that is persistently wetted by unevaporated sweat, and heat rash papules may become infected if they are

not treated. In most cases, heat rashes will disappear when the affected individual returns to a cool environment.

Heat cramps are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. It is important to understand that cramps can be caused both by too much or too little salt.

Cramps appear to be caused by the lack of water replenishment. Because sweat is a hypotonic solution (plus or minus 0.3% NaCl), excess salt can build up in the body if the water lost through sweating is not replaced. Thirst cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments.

Under extreme conditions, such as working for 6 to 8 hours in heavy protective gear, a loss of sodium may occur. Drinking commercially available carbohydrate electrolyte replacement liquids is effective in minimizing physiological disturbances during recovery.

Heat exhaustion occurs from increased stress on various body organs due to inadequate blood circulation, cardiovascular insufficiency, or dehydration. Signs and symptoms include pale, cool, moist skin; heavy sweating; dizziness; nausea; headache, vertigo, weakness, thirst, and giddiness. Fortunately, this condition responds readily to prompt treatment.

Heat exhaustion should not be dismissed lightly, however, for several reasons. One is that the fainting associated with heat exhaustion can be dangerous because the victim may be operating machinery or controlling an operation that should not be left unattended; moreover, the victim may be injured when he or she faints. Also, the signs and symptoms seen in heat exhaustion are similar to those of heat stroke, which is a medical emergency.

Workers suffering from heat exhaustion should be removed from the hot environment, be given fluid replacement, and be encouraged to get adequate rest.

Heat stroke is the most serious form of heat stress. Heat stroke occurs when the body's system of temperature regulation fails and the body's temperature rises to critical levels. This condition is caused by a combination of highly variable factors, and its occurrence is difficult to predict.

Heat stroke is a medical emergency. The primary signs and symptoms of heat stroke are confusion; irrational behavior; loss of consciousness; convulsions; a lack of sweating (usually); hot, dry skin; and an abnormally high body temperature, e.g., a rectal temperature of 41°C (105.8°F). If body temperature is too high, it causes death. The elevated metabolic temperatures caused by a combination of workload and

environmental heat load, both of which contribute to heat stroke, are also highly variable and difficult to predict.

If a worker shows signs of possible heat stroke, professional medical treatment should be obtained immediately. The worker should be placed in a shady area and the outer clothing should be removed. The worker's skin should be wetted and air movement around the worker should be increased to improve evaporative cooling until professional methods of cooling are initiated and the seriousness of the condition can be assessed. Fluids should be replaced as soon as possible. The medical outcome of an episode of heat stroke depends on the victim's physical fitness and the timing and effectiveness of first aid treatment.

Regardless of the worker's protestations, no employee suspected of being ill from heat stroke should be sent home or left unattended unless a physician has specifically approved such an order.

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat stroke or exhaustion, that person may be predisposed to additional heat injuries.

Heat Stress Safety Precautions

Heat stress monitoring and work rest cycle implementation should commence when the ambient adjusted temperature exceeds 72°F. A minimum work rest regimen and procedures for calculating ambient adjusted temperature are described in Table 4-1.

Table 4-1. Work/Rest Schedule

Adjusted Temperature[b]	Work/Rest Regimen Normal Work Ensemble[c]	Work/Rest Regimen Impermeable Ensemble
90ºF (32.2ºC) or above	After each 45 minutes of work	After each 15 minutes of work
87.5º - 90ºF (30.8º-32.2ºC)	After each 60 minutes of work	After each 30 minutes of work
82.5º - 87.5ºF (28.1º - 30.8ºC)	After each 90 minutes of work	After each 60 minutes of work
77.5º - 82.5ºF (25.3º - 28.1ºC)	After each 120 minutes of work	After each 90 minutes of work
72.5º - 77.5ºF (30.8º - 32.2ºC)	After each 150 minutes of work	After each 120 minutes of work

Notes:
a. For work levels of 250 kilocalories/hour (Light-Moderate Type of Work).
b. Calculate the adjusted air temperature (ta adj) by using this equation: ta adj ^{o}F = ta ^{o}F + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)
c. A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.
d. The information presented above was generated using the information provided in the ACGIH Threshold Limit Values (TLV) Handbook.

In order to determine if the work rest cycles are adequate for the personnel and specific site conditions, additional monitoring of individual heart rates will be conducted during the rest cycle. To check the heart rate, count the radial pulse for 30 seconds at the beginning of the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work period by one third and maintain the same rest period.

Additionally, one or more of the following control measures can be used to help control heat stress and are mandatory if any site worker has a heart rate (measure immediately prior to rest period) exceeding 115 beats per minute:

- Site workers will be encouraged to drink plenty of water and electrolyte replacement fluids throughout the day.
- On-site drinking water will be kept cool (50 to 60°F).
- A work regimen that will provide adequate rest periods for cooling down will be established, as required.
- All personnel will be advised of the dangers and symptoms of heat stroke, heat exhaustion, and heat cramps.
- Cooling devices, such as vortex tubes or cooling vests, should be used when personnel must wear impermeable clothing in conditions of extreme heat.
- Employees should be instructed to monitor themselves and co-workers for signs of heat stress and to take additional breaks as necessary.
- A shaded rest area must be provided. All breaks should take place in the shaded rest area.
- Employees must not be assigned to other tasks during breaks.
- Employees must remove impermeable garments during rest periods. This includes white Tyvek®-type garments.

All employees must be informed of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress disorders.

4.5 Cold Stress

Cold stress normally occurs in temperatures at or below freezing, or under certain circumstances, in temperatures of 40°F. Extreme cold for a short time may cause severe injury to exposed body surfaces or result in profound generalized cooling, causing death. Areas of the body that have high surface area-to-volume ratio, such as fingers, toes, and ears, are the most susceptible. Two factors influence the development of a cold weather injury: ambient temperature and the velocity of the wind. For instance, 10°F with a wind of 15 miles per hour (mph) is equivalent in chilling effect to still air at 18°F. An equivalent chill temperature chart relating the actual dry bulb temperature and wind velocity is presented in Table 4-2.

Table 4-2. Chill Temperature Chart

Estimated Wind Speed (in mph)	Actual Temperature Reading (ºF)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (ºF)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	**LITTLE DANGER Maximum danger of false sense of security.**				**INCREASING DANGER Danger from freezing of exposed flesh within one minute.**			**GREAT DANGER Flesh may freeze within 30 seconds.**				
	Trench foot and immersion foot may occur at any point on this chart.											

[This chart was developed by the U.S. Army Research Institute of Environmental Medicine, Natick, MA (Source: ACGIH Threshold Limit Values for Chemical Substances and Physical Agents)].

Local injury resulting from cold is included in the generic term frostbite. There are several degrees of tissue damage associated with frostbite. Frostbite of the extremities can be categorized into:

- *Frost Nip or Incipient Frostbite* - characterized by sudden blanching or whitening of skin.
- *Superficial Frostbite* - skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.
- *Deep Frostbite* - tissues are cold, pale, and solid; extremely serious injury.

Systemic hypothermia is caused by exposure to freezing or rapidly dropping temperature. It can be fatal. Its symptoms are usually exhibited in five stages: 1) shivering; 2) apathy, listlessness, sleepiness, and (sometimes) rapid cooling of the body to less than 95°F; 3) unconsciousness, glassy stare, slow pulse, and slow respiratory rate; 4) freezing of the extremities; and 5) death. Trauma sustained in freezing or sub-zero conditions requires special attention because an injured worker is predisposed to secondary cold injury. Special provisions must be made to prevent hypothermia and secondary freezing of damaged tissues in addition to providing for first aid treatment. To avoid cold stress, site personnel must wear protective clothing appropriate for the level of cold and physical activity. In addition to protective clothing, preventive safe work practices, additional training, and warming regimens may be utilized to prevent cold stress.

Safety Precautions for Cold Stress Prevention

For air temperature of 0°F or less, mittens should be used to protect the hands. For exposed skin, continuous exposure should not be permitted when air speed and temperature results in a wind chill temperature of -25°F.

At air temperatures of 36°F or less, field personnel who become immersed in water or whose clothing becomes wet must be immediately provided with a change of clothing and be treated for hypothermia.

If work is done at normal temperature or in a hot environment before entering the cold, the field personnel must ensure that their clothing is not wet as a consequence of sweating. If wet, field personnel must change into dry clothes prior to entering the cold area.

If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work must be modified or suspended until adequate clothing is made available or until weather conditions improve.

Field personnel handling evaporative liquid (e.g., gasoline, alcohol, or cleaning fluids) at air temperatures below 40°F must take special precaution to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling.

Safe Work Practices

Direct contact between bare skin and cold surfaces (< 20°F) should be avoided. Metal tool handles and/or equipment controls should be covered by thermal insulating material.

For work performed in a wind chill temperature at or below 10°F, workers should be under constant protective observation (buddy system). The work rate should be established to prevent heavy sweating that will result in wet clothing. For heavy work, rest periods must be taken in heated shelters and workers should be provided with an opportunity to change into dry clothing if needed.

Field personnel should be provided the opportunity to become accustomed to cold-weather working conditions and required protective clothing.

Work should be arranged in such a way that sitting or standing still for long periods is minimized.

During the warming regimen (rest period), field personnel should be encouraged to remove outer clothing to permit sweat evaporation or to change into dry work clothing. Dehydration, or loss of body fluids, occurs insidiously in the cold environment and may increase susceptibility to cold injury due to a significant change in blood flow to the extremities. Fluid replacement with warm, sweet drinks and soups is recommended. The intake of coffee should be limited because of diuretic and circulatory effects.

4.6 Biological Hazards

Biological hazards may include poison ivy, snakes, thorny bushes and trees, ticks, mosquitoes, and other pests.

4.6.1 Tick Borne Diseases

Lyme Disease - The disease commonly occurs in summer and is transmitted by the bite of infected ticks. “Hot spots” in the United States include New York, New Jersey, Pennsylvania, Massachusetts, Connecticut, Rhode Island, Minnesota, and Wisconsin.

Erlichiosis - The disease also commonly occurs in summer and is transmitted by the bite of infected ticks. “Hot spots” in the United States include New York, Massachusetts, Connecticut, Rhode Island, Minnesota, and Wisconsin.

These diseases are transmitted primarily by the deer tick, which is smaller and redder than the common wood tick. The disease may be transmitted by immature ticks, which are small and hard to see. The tick may be as small as a period on this page.

Symptoms of Lyme disease include a rash or a peculiar red spot, like a bull's eye, which expands outward in a circular manner. The victim may have headache, weakness, fever, a stiff neck, and swelling and pain in the joints, and eventually, arthritis. Symptoms of erlichiosis include muscle and joint aches, flu-like symptoms, but there is typically no skin rash.

Rocky Mountain Spotted Fever (RMSF) - This disease is transmitted via the bite of an infected tick. The tick must be attached 4 to 6 hours before the disease-causing organism (Rickettsia rickettsii) becomes reactivated and can infect humans. The primary symptom of RMSF is the sudden appearance of a moderate-to-high fever. The fever may persist for two to three weeks. The victim may also have a headache, deep muscle pain, and chills. A rash appears on the hands and feet on about the third day and eventually spreads to all parts of the body. For this reason, RMSF may be confused with measles or meningitis. The disease may cause death, if untreated, but if identified and treated promptly, death is uncommon.

Control - Tick repellant containing diethyltoluamide (DEET) should be used when working in tick-infested areas, and pant legs should be tucked into boots. In addition, workers should search the entire body every three or four hours for attached ticks, before going home and again when showering at night. Ticks should be removed promptly and carefully without crushing, since crushing can squeeze the disease-causing organism into the skin. A gentle and steady pulling action should be used to avoid leaving the head or mouth parts in the skin. Hands should be protected with surgical gloves when removing ticks.

4.6.2 Domestic Dogs

Due to the need to enter private residences for indoor air and sub-slab soil vapor, the issue of interaction with unknown dogs should be reviewed with the occupant to be sure no one is inadvertently bitten by domestic dogs.

4.6.3 Poisonous Plants

Poisonous plants may be present in the work area. Personnel should be alerted to their presence and instructed on methods to prevent exposure. Poison sumac grows as a shrub or small tree with large alternate, compound leaves having 7-13 leaflets without teeth. All plant parts are poisonous. The lack of 1) leaflet glands, 2) "wings" between

the leaflets, and 3) teeth on the leaves, in addition to this species' red stems supporting the leaflets and leaves, help to distinguish this plant from similar-looking nonpoisonous species such as other sumacs and tree-of-heaven. Flowers are shades of green, white and yellow and appear in late spring. Fruits are small white berries that mature in late summer and may last through winter.

Poison ivy is a woody shrub or vine with hairy looking aerial roots. It grows to 10 feet or more, climbing high on trees, walls and fences or trails along the ground. All parts of poison ivy, including the roots, are poisonous at all times of the year.

Poison Sumac

Poison Ivy

The main control for both poison ivy and poison sumac is to avoid contact with the plant, cover arms and hands, and frequently wash potentially exposed skin. Particular attention must be given to avoiding skin contact with objects or protective clothing that have touched the plants. Treat every surface that may have touched the plant as contaminated, and practice contamination avoidance.

Poison ivy and sumac are very easy to treat if you identified your contact with the irritating plant within a few hours of the incident. The urushiol oil present in both plants chemically bonds with the proteins in your skin about 30 minutes after contact. Seventy-five percent (%) of the population is affected by contact with urushiol, although immunity to urushiol today does not assure immunity tomorrow, and vice versa. Rash symptoms can appear within a few hours but can take two to five days to appear. The rash starts as a red, annoyingly itchy area that starts to swell. The area then gets inflamed and will get covered in clusters of tiny pimples, the pimple eventually merge and turn into blisters. The fluid in the blisters turns yellow, dries up, and becomes crusty. Left completely untreated, this cycle can last as short as five days and in severe cases as long as five to six weeks.

If you come in contact with poison ivy, oak or sumac, or a animal exposed to any of these, or tools, gear, or clothing exposed to any of these, you should wash off with hot water (not so hot that it burns) and strong soap as soon as possible. If you can get

washed up in the first six hours, before the first symptoms appear, you have a good chance of avoiding an out break, and an even better chance of minimizing the effects if you do have one.

4.6.4 Snakes

The possibility of encountering snakes exists, specifically for personnel working in wooded/vegetated areas. Snake venoms are complex and include proteins, some of which have enzymatic activity. The effects produced by venoms include neurotoxic effects with sensory, motor, cardiac, and respiratory difficulties; cytotoxic effects on red blood cells, blood vessels, heart muscle, kidneys, and lungs; defects in coagulation; and effects from local release of substances by enzymatic actions. Other noticeable effects of venomous snakebites include swelling, edema, and pain around the bite, and the development of ecchymosis (the escape of blood into tissues from ruptured blood vessels).

Control - *Control* - To minimize the threat of snakebites, all personnel walking through vegetated areas must be aware of the potential for encountering snakes and the need to avoid actions potentiating encounters, such as turning over logs. If a snake bite occurs, an attempt should be made to identify the snake via size and markings. The victim must be transported to the nearest hospital within 30 minutes. First aid consists of applying a constriction band and washing the area around the wound to remove any unabsorbed venom.

4.6.5 Spiders

Personnel may encounter spiders during work activities.

Two spiders are of concern, the black widow and the brown recluse. Both prefer dark sheltered areas such as basements, equipment sheds and enclosures, and around woodpiles or other scattered debris. The black widow is shiny black, approximately one inch long, and found throughout the United States. There is a distinctive red hourglass marking on the underside of the black widows body. The bite of a black widow is seldom fatal to healthy adults, but effects include respiratory distress, nausea, vomiting, and muscle spasms. The brown recluse is smaller than the black widow and gets its name from its brown coloring and behavior. The brown recluse is more prevalent in the southern United States. The brown recluse has a distinctive violin shape on the top of its body. The bite of the brown recluse is painful and the bite site ulcerates and takes many weeks to heal completely.

Control - To minimize the threat of spider bites, all personnel walking through vegetated areas must be aware of the potential for encountering these arachnids. Personnel need to avoid actions that may result in encounters, such as turning over logs, and placing hands in dark places such as behind equipment or in corners of equipment sheds or enclosures. If a spider bite occurs, the victim must be transported to the nearest hospital as soon as possible; first aid consists of applying ice packs and washing the area around the wound to remove any unabsorbed venom.

4.7 Noise

Exposure to noise over the OSHA action level can cause temporary impairment of hearing; prolonged and repeated exposure can cause permanent damage to hearing. The risk and severity of hearing loss increases with the intensity and duration of exposure to noise. In addition to damaging hearing, noise can impair voice communication, thereby increasing the risk of accidents on site.

Control - All personnel must wear hearing protection, with a Noise Reduction Rating (NRR) of at least 20, when noise levels exceed 85 dBA. When it is difficult to hear a co-worker at normal conversation distance, the noise level is approaching or exceeding 85 dBA, and hearing protection is necessary. All site personnel who may be exposed to noise must also receive baseline and annual audiograms and training as to the causes and prevention of hearing loss. Noise monitoring is discussed in Section 6.2, Noise Monitoring.

Whenever possible, equipment that does not generate excessive noise levels will be selected for this project. If the use of noisy equipment is unavoidable, barriers or increased distance will be used to minimize worker exposure to noise, if feasible.

4.8 Spill Control

All personnel must take every precaution to minimize the potential for spills during site operations. All on-site personnel shall immediately report any discharge, no matter how small, to the SS.

Spill control equipment and materials will be located on the site at locations that present the potential for discharge. All sorbent materials used for the cleanup of spills will be containerized and labeled appropriately. In the event of a spill, the SS will follow the provisions in Section 9, Emergency Procedures, to contain and control released materials and to prevent their spread to off-site areas.

4.9 Sanitation

Site sanitation will be maintained according to OSHA requirements.

4.9.1 Break Area

Breaks must be taken in the SZ, away from the active work area after site personnel go through decontamination procedures. There will be no smoking, eating, drinking, or chewing gum or tobacco in any area other than the SZ.

4.9.2 Potable Water

The following rules apply to all field operations:

- An adequate supply of potable water will be provided at each project site. Potable water must be kept away from hazardous materials or media, and contaminated clothing or equipment.
- Portable containers used to dispense drinking water must be capable of being tightly closed, and must be equipped with a tap dispenser. Water must not be consumed directly from the container (drinking from the tap is prohibited) nor may it be removed from the container by dipping.
- Containers used for drinking water must be clearly marked and shall not be used for any other purpose.
- Disposable drinking cups must be provided. A sanitary container for dispensing cups and a receptacle for disposing of used cups is required.

4.9.3 Sanitary Facilities

Access to facilities for washing before eating, drinking, or smoking, or alternate methods such as waterless hand-cleaner and paper towels will be provided.

4.9.4 Lavatory

If permanent toilet facilities are not available, an appropriate number of portable chemical toilets will be provided.

This requirement does not apply to mobile crews or to normally unattended site locations so long as employees at these locations have transportation immediately available to nearby toilet facilities.

4.10 Emergency Equipment

Adequate emergency equipment for the activities being conducted on site and as required by applicable sections of 29 CFR 1910 and 29 CFR 1926 will be on site prior to the commencement of project activities. Personnel will be provided with access to emergency equipment, including, but not limited to, the following:

- Fire extinguishers of adequate size, class, number, and location as required by applicable sections of 29 CFR 1910 and 1926
- Industrial first aid kits of adequate size for the number of personnel on site
- Emergency eyewash and/or shower if required by operations being conducted on site

4.11 Lockout/Tagout Procedures

Only fully qualified and trained personnel will perform maintenance procedures. Before maintenance begins, lockout/tagout procedures per OSHA 29 CFR 1910.147 will be followed.

Lockout is the placement of a device that uses a positive means, such as lock, to hold an energy or material-isolating device such that the equipment cannot be operated until the lockout device is removed. If a device cannot be locked out, a tagout system shall be used. Tagout is the placement of a warning tag on an energy or material isolating device indicating that the equipment controls may not be operated until the tag is removed by the personnel who attached the tag.

4.12 Electrical Safety

Electricity may pose a particular hazard to site workers due to the use of portable electrical equipment. If wiring or other electrical work is needed, a qualified electrician must perform it.

General electrical safety requirements include:

- All electrical wiring and equipment must be a type listed by Underwriters Laboratories (UL), Factory Mutual Engineering Corporation (FM), or other recognized testing or listing agency.
- All installations must comply with the National Electrical Safety Code (NESC), the National Electrical Code (NEC), or USCG regulations.
- Portable and semi-portable tools and equipment must be grounded by a multi-conductor cord having an identified grounding conductor and a multi-contact polarized plug-in receptacle.
- Tools protected by an approved system of double insulation, or its equivalent, need not be grounded. Double insulated tools must be distinctly marked and listed by UL or FM.
- Live parts of wiring or equipment must be guarded to prevent persons or objects from touching them.
- Electric wire or flexible cord passing through work areas must be covered or elevated to protect it from damage by foot traffic, vehicles, sharp corners, projections, or pinching.
- All circuits must be protected from overload.
- Temporary power lines, switchboxes, receptacle boxes, metal cabinets, and enclosures around equipment must be marked to indicate the maximum operating voltage.
- Plugs and receptacles must be kept out of water unless of an approved submersible construction.
- All extension cord outlets must be equipped with ground fault circuit interrupters (GFCI).
- Attachment plugs or other connectors must be equipped with a cord grip and be constructed to endure rough treatment.

- Extension cords or cables must be inspected prior to each use, and replaced if worn or damaged. Cords and cables must not be fastened with staples, hung from nails, or suspended by bare wire.

- Flexible cords must be used only in continuous lengths without splice, with the exception of molded or vulcanized splices made by a qualified electrician.

4.13 Lifting Safety

Using proper lifting techniques may prevent back strain or injury. The fundamentals of proper lifting include:

- Consider the size, shape, and weight of the object to be lifted. A mechanical lifting device or additional persons must be used to lift an object if it cannot be lifted safely alone.

- The hands and the object should be free of dirt or grease that could prevent a firm grip.

- Gloves must be used, and the object inspected for metal slivers, jagged edges, burrs, or rough or slippery surfaces.

- Fingers must be kept away from points that could crush or pinch them, especially when putting an object down.

- Feet must be placed far enough apart for balance. The footing should be solid and the intended pathway should be clear.

- The load should be kept as low as possible, close to the body with the knees bent.

- To lift the load, grip firmly and lift with the legs, keeping the back as straight as possible.

- A worker should not carry a load that he or she cannot see around or over.

- When putting an object down, the stance and position are identical to that for lifting; the legs are bent at the knees, and the back is straight as the object is lowered.

4.14 Ladder Safety

When portable ladders are used for access to an upper landing surface, the ladder side rails shall extend at least 3 feet (0.9 m) above the upper landing surface to which the ladder is used to gain access; or, when such an extension is not possible because of the ladder's length, then the ladder shall be secured at its top to a rigid support that will not deflect, and a grasping device, such as a grabrail, shall be provided to assist employees in mounting and dismounting the ladder. In no case shall the extension be such that ladder deflection under a load would, by itself, cause the ladder to slip off its support.

- Ladders shall be maintained free of oil, grease, and other slipping hazards.
- Ladders shall not be loaded beyond the maximum intended load for which they were built, or beyond their manufacturer's rated capacity.
- Ladders shall be used only for the purpose for which they were designed.
- Non-self-supporting ladders shall be used at an angle such that the horizontal distance from the top support to the foot of the ladder is approximately one-quarter of the working length of the ladder (the distance along the ladder between the foot and the top support).
- Wood job-made ladders with spliced side rails shall be used at an angle such that the horizontal distance is one-eighth the working length of the ladder.
- Fixed ladders shall be used at a pitch no greater than 90 degrees from the horizontal, as measured to the back side of the ladder.
- Ladders shall be used only on stable and level surfaces unless secured to prevent accidental displacement.
- Ladders shall not be used on slippery surfaces unless secured or provided with slip-resistant feet to prevent accidental displacement. Slip-resistant feet shall not be used as a substitute for care in placing, lashing, or holding a ladder that is used upon slippery surfaces, including, but not limited to, flat metal or concrete surfaces that are constructed so they cannot be prevented from becoming slippery.
- Ladders placed in any location where they can be displaced by workplace activities or traffic, such as in passageways, doorways, or driveways, shall be secured to

prevent accidental displacement, or a barricade shall be used to keep the activities or traffic away from the ladder.

- The area around the top and bottom of ladders shall be kept clear.
- The top of a non-self-supporting ladder shall be placed with the two rails supported equally unless it is equipped with a single support attachment.
- Ladders shall not be moved, shifted, or extended while occupied.
- Ladders shall have non-conductive siderails if they are used where the employee or the ladder could contact exposed energized electrical equipment.
- The top, top step, or the step labeled that it or any step above it should not be used as a step.
- Cross-bracing on the rear section of stepladders shall not be used for climbing unless the ladders are designed and provided with steps for climbing on both front and rear sections.
- Ladders shall be inspected by the HSS for visible defects on a daily basis and after any occurrence that could affect their safe use.
- Portable ladders with structural defects, such as, but not limited to, broken or missing rungs, cleats, or steps; broken or split rails; corroded components; or other faulty or defective components shall either be immediately marked in a manner that readily identifies them as defective, or be tagged with “Do Not Use” or similar language, and shall be withdrawn from service.
- Fixed ladders with structural defects, such as, but not limited to, broken or missing rungs, cleats, or steps; broken or split rails; or corroded components; shall be withdrawn from service.
- Ladder repairs shall restore the ladder to a condition meeting its original design criteria, before the ladder is returned to use.
- Single-rail ladders shall not be used.
- When ascending or descending a ladder, the user shall face the ladder.

- Each employee shall use at least one hand to grasp the ladder when progressing up and/or down the ladder.

- An employee shall not carry any object or load that could cause the employee to lose balance and fall.

4.15 Traffic Safety

The project site may be located adjacent to a public roadway where exposure to vehicular traffic is likely. Traffic may also be encountered as vehicles enter and exit the area. To minimize the likelihood of project personnel and activities being affected by traffic, the following procedures will be implemented.

Cones must be placed along the shoulder of the roadway starting 100 feet from the work area to alert passing motorists to the presence of personnel and equipment. A "Slow" or "Men Working" sign must be placed at the first cone. Barricades with flashing lights should be placed between the roadway and the work area.

During activities along a roadway, equipment will be aligned parallel to the roadway to the extent feasible, facing into the oncoming traffic so as to place a barrier between the work crew and the oncoming traffic. All crewmembers must remain behind the equipment and the traffic barrier.

All site personnel who are potentially exposed to vehicular traffic must wear an outer layer of orange warning garments, such as vests, jackets, or shirts. If work is performed in hours of dusk or darkness, workers will be outfitted with reflective garments either orange, white (including silver-coated reflective coatings or elements that reflect white light), yellow, fluorescent red-orange, or fluorescent yellow-orange.

The flow of traffic into and out of the adjacent business must be assessed, and precautions taken to warn motorists of the presence of workers and equipment. Where possible, vehicles should be aligned to provide physical protection of people and equipment.

4.16 Lightning

Outdoors is the most dangerous place to be during a lightning storm. When lightning is seen or thunder is heard, or when dark clouds are observed, quickly move indoors or into a hard-topped vehicle and remain there until well after the lightning storm ends. Listen to forecasts and warnings through NOAA Weather Radio or your TV and radio stations. If lightning is forecast, plan an alternate work activity or know where you can

take cover quickly. Check on client/site specific procedures regarding lightning prior to starting work.

4.16.1 Hazards

Burns, nervous system damage, broken bones, loss of hearing or eyesight, electrocution and/or death from contact with lightning.

4.16.2 Control

1. **Postpone activities promptly. Don't wait for rain.** Many people take shelter from the rain, but most people struck by lightning are not in the rain! Go quickly inside a completely enclosed building, not a carport, open garage or covered patio. If no enclosed building is convenient, get inside a hard-topped all-metal vehicle. A cave is a good option outside but move as far as possible from the cave entrance.

2. **Be the lowest point. Lightning hits the tallest object.** In the mountains if you are above treeline, you ARE the highest object around. Quickly get below treeline and get into a grove of small trees. Don't be the second tallest object during a lightning storm! Crouch down if you are in an exposed area.

3. **Keep an eye on the sky.** Look for darkening skies, flashes of lightning, or increasing wind, which may be signs of an approaching thunderstorm.

4. **Listen for the sound of thunder.** If you can hear thunder, go to a safe shelter immediately.

5. **If you see or hear a thunderstorm coming or your hair stands on end, immediately suspend work and instruct everyone to go inside a sturdy building or car.** Sturdy buildings are the safest place to be. Avoid sheds, picnic shelters, baseball dugouts, and bleachers. If no sturdy building is nearby, a hard-top vehicle with windows closed will offer some protection. The steel frame of the vehicle provides some protection if you are not touching metal.

6. **Listen to the Weather Radio**. Listen for alerts.

7. **If you can't get to a shelter, stay away from trees.** If there is no shelter, crouch in the open, keeping twice as far away from a tree as it is tall.

8. **Avoid leaning against vehicles**. Get off bicycles and motorcycles.

9. **Get out of the water. It's a great conductor of electricity.** Stay off the beach and out of small boats. If caught in a boat, crouch down in the center of the boat away from metal hardware. Wading and scuba diving are NOT safe. Lightning can strike the water and travel some distance beneath and away from its point of contact. Don't stand in puddles of water, even if wearing rubber boots.

10. **Avoid metal!** Drop metal backpacks, stay away from clothes lines, fences, exposed sheds and electrically conductive elevated objects. Don't hold on to metal items such golf clubs, fishing rods, tennis rackets or tools. Large metal objects such as drill rigs or excavators can conduct lightning. Small metal objects can cause burns.

11. **Move away from a group of people.** Stay several yards away from other people. Don't share a bleacher bench or huddle in a group.

Make sure you are not the highest object. Lighting will strike the highest object. Crouch down. Do not lie down! What you most want to avoid is lightning going through your heart. Lightning follows the path of least resistance. If lightning strikes the ground near you, a ground current will set up in the area nearby. If you are lying flat your chances of being "hit" by this ground lightning increases. Not only that, the lightning will run through your whole body including your heart. If you are in a crouching position with your heels together, the ground current will enter one foot but it will then return to the ground through your other foot on the ground. The current does not go through your heart.

4.17 Department of Transportation (DOT) Dangerous Good Shipping Requirements

Hazardous materials and dangerous goods (re: Canadian regulatory term) are those materials that have one or more of the following characteristics: explosives, compressed and liquefied gases, flammable liquids and solids, oxidizing materials, and other substances that are poisonous, infectious, radioactive or corrosive. It is the handling, loading, packing or placing of hazardous materials (dangerous goods) in or from a container or vehicle at any facility for the purpose of transportation (including storing) in the course of transportation. This also includes the packing and transporting for air and ground shipment of laboratory analysis samples.

Regulations governing hazardous materials and dangerous goods exist to protect people, the environment, or property when these goods are being transported by road, rail, sea, or air. Given the increased emphasis of federal (i.e., Federal Aviation Administration and US Department of Transportation, and the Transportation of Dangerous Goods Act) attention to the transport of hazard material-containing goods, it is imperative that all shipments are packaged and transported such that they adhere to all federal requirements. ARCADIS has strict policies in place, whether shipping via ground or air, designed to meet the associated federal requirements. As such, only ARCADIS staff that have been trained in the proper methods to prepare and ship hazardous materials are authorized to do so. If you have not received training on the appropriate preparation and shipping protocols, you are to contact your supervisor or health and safety representative prior to packaging and/or shipping any material that is, or suspected to be, hazardous.

5. Personal Protective Equipment

5.1 Levels of Protection

PPE is required to safeguard site personnel from various hazards. Varying levels of protection may be required depending on the levels of COC and the degree of physical hazard. This section presents the various levels of protection and defines the conditions of use for each level. A summary of the levels is presented in Table 5-1 in this section.

5.1.1 Level D Protection

The minimum level of protection that is required of ARCADIS personnel and subcontractors at the site is Level D, which is worn when activities do not involve potential dermal contact with contaminants and air monitoring indicates that no inhalation hazard exists. Level D protection includes the following equipment:

- Work clothing as prescribed by weather
- Steel-toe work boots, meeting ANSI Z41
- Safety glasses with side shields or goggles, meeting ANSI Z87
- Hard hat, meeting ANSI Z89, when falling object hazards are present
- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used)
- PFD if working on or near the water

5.1.2 Modified Level D Protection

Modified Level D will be used when airborne contaminants are not present at levels of concern, but site activities present the potential for skin contact with contaminated materials. Modified Level D consists of the following equipment:

- Nitrile outer gloves worn over nitrile surgical gloves
- Latex or PVC overboots when contact with COC-impacted media is anticipated
- Steel-toe work boots, meeting ANSI Z41

- Safety glasses with side shields or goggles, meeting ANSI Z87
- Face shield in addition to safety glasses or goggles when projectiles or splash hazards exist
- Tyvek® or KleenGuard® coveralls when skin contact with COC-impacted media is anticipated
- Hard hat, meeting ANSI Z89, when falling object hazards are present
- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used)
- PFD if working on or near the water

5.1.3 Level C Protection

Level C protection will be required when the airborne concentration of COCs reaches one-half of the OSHA Permissible Exposure Limit (PEL) or ACGIH TLV. The following equipment will be used for Level C protection:

- Full-face, NIOSH-approved, air-purifying respirator with combination organic vapor cartridges
- Polyethylene-coated Tyvek® suit with ankles and cuffs taped to boots and gloves
- Nitrile outer gloves worn over nitrile surgical gloves
- Steel-toe work boots, meeting ANSI Z41
- Chemical-resistant boots with steel toes, or latex or polyvinyl chloride (PVC) overboots over steel-toe boots
- Hard hat, meeting ANSI Z89
- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used)
- PFD if working on or near the water

5.2 Selection of PPE

Equipment for personal protection will be selected based on the potential for contact, site conditions, ambient air quality, and the judgment of supervising site personnel and health and safety professionals. The PPE used will be chosen to be effective against the COC present on the site.

5.3 Site Respiratory Protection Program

Respiratory protection is an integral part of employee health and safety at the site due to potentially hazardous concentrations of airborne COC. The site respiratory protection program will consist of the following (as a minimum):

- All on-site personnel who may use respiratory protection will have an assigned respirator.
- All on-site personnel who may use respiratory protection will have been fit tested and trained in the use of a full-face air-purifying respirator within the past 12 months.
- All on-site personnel who may use respiratory protection must within the past year have been medically certified as being capable of wearing a respirator. Documentation of the medical certification must be provided to the HSS, prior to commencement of site work.
- Only cleaned, maintained, NIOSH-approved respirators will be used.
- If respirators are used, the respirator cartridge is to be properly disposed of at the end of each work shift, or when load-up or breakthrough occurs.
- Contact lenses are not to be worn when a respirator is worn.
- All on-site personnel who may use respiratory protection must be clean-shaven. Mustaches and sideburns are permitted, but they must not touch the sealing surface of the respirator.
- Respirators will be inspected, and a negative pressure test performed prior to each use.
- After each use, the respirator will be wiped with a disinfectant, cleansing wipe. When used, the respirator will be thoroughly cleaned at the end of the work shift.

The respirator will be stored in a clean plastic bag, away from direct sunlight in a clean, dry location, in a manner that will not distort the face piece.

5.4 Using PPE

Depending upon the level of protection selected, specific donning and doffing procedures may be required. The procedures presented in this section are mandatory if Modified Level D or Level C PPE is used. All personnel entering the EZ must put on the required PPE in accordance with the requirements of this HASP. When leaving the EZ, PPE will be removed in accordance with the procedures listed, to minimize the spread of COC.

5.4.1 Donning Procedures

These procedures are mandatory only if Modified Level D or Level C PPE is used on the site:

- Remove bulky outerwear. Remove street clothes and store in clean location.
- Put on work clothes or coveralls.
- Put on the required chemical protective coveralls.
- Put on the required chemical protective boots or boot covers.
- Tape the legs of the coveralls to the boots with duct tape.
- Put on the required chemical protective gloves.
- Tape the wrists of the protective coveralls to the gloves.
- Don the required respirator and perform appropriate fit check (Level C).
- Put hood or head covering over head and respirator straps and tape hood to facepiece (Level C).
- Don remaining PPE, such as safety glasses or goggles and hard hat.

When these procedures are instituted, one person must remain outside the work area to ensure that each person entering has the proper protective equipment.

5.4.2 Doffing Procedures

The following procedures are only mandatory if Modified Level D or Level C PPE is required for the site. Whenever a person leaves the work area, the following decontamination sequence will be followed:

- Upon entering the CRZ, rinse contaminated materials from the boots or remove contaminated boot covers.
- Clean reusable protective equipment.
- Remove protective garments, equipment, and respirator (Level C). All disposable clothing should be placed in plastic bags, which are labeled with contaminated waste labels.
- Wash hands, face, and neck (or shower if necessary).
- Proceed to clean area and dress in clean clothing.
- Clean and disinfect respirator for next use.

All disposable equipment, garments, and PPE must be bagged in plastic bags, labeled for disposal. See Section 7, Decontamination, for detailed information on decontamination stations.

5.5 Selection Matrix

The level of personal protection selected will be based on air monitoring of the work environment and an assessment by the SS and HSS of the potential for skin contact with COC. The PPE selection matrix is presented in Table 5-1. This matrix is based on information available at the time this plan was written. The Airborne Constituent Action Levels in Table 6-1 should be used to verify that the PPE prescribed in these matrices is appropriate.

Table 5-1. PPE Selection Matrix

Task	Anticipated Level of Protection
Mobilization	Level D
Installation of Groundwater Monitoring Wells and Soil Borings	Level D/Modified Level D
Surface and Subsurface Soil Sampling	Level D/Modified Level D
Decontamination	Level D/Modified Level D
Demobilization	Level D

6. Air Monitoring

6.1 Air Monitoring

Air monitoring will be conducted continuously at the site during any land-based intrusive work to determine employee exposure to airborne constituents. The monitoring device to be used is a Rae Systems MultiRAE detector (PID w/ 10.6 eV bulb, oxygen/ LEL/ Hydrogen Sulfide Sensors). All work activity must stop where tests indicate the concentration of flammable vapors exceeds 10% of the LEL at a location with a potential ignition source. Such an area must be ventilated to reduce the concentration to an acceptable level. Vinyl chloride detector tubes (0.5 – 5.0 ppm) will be used when PID readings are greater than 1ppm above background.

The ARCADIS HSS will be responsible for utilizing the air monitoring results to determine appropriate health and safety precautions for ARCADIS personnel and subcontractors. Air monitoring results will be recorded in the field notebook or on an air monitoring log (see Attachment F).

6.2 Noise Monitoring

Noise monitoring may be conducted as required. Hearing protection is mandatory for all employees in noise hazardous areas, such as around heavy equipment. As a general rule, sound levels that cause speech interference at normal conversation distance should require the use of hearing protection.

6.3 Monitoring Equipment Maintenance and Calibration

All direct-reading instrumentation calibrations should be conducted under the approximate environmental conditions the instrument will be used. Instruments must be calibrated before and after use, noting the reading(s) and any adjustments that are necessary. All air monitoring equipment calibrations, including the standard used for calibration, must be documented on a calibration log or in the field notebook. All completed documentation/forms must be reviewed by the HSS and maintained by the SS.

All air monitoring equipment will be maintained and calibrated in accordance with the specific manufacturer's procedures. Preventive maintenance and repairs will be conducted in accordance with the respective manufacturer's procedures. When applicable, only manufacturer-trained and/or authorized personnel will be allowed to perform instrument repairs or preventive maintenance.

If an instrument is found to be inoperative or suspected of giving erroneous readings, the HSS must be responsible for immediately removing the instrument from service and obtaining a replacement unit. If the instrument is essential for safe operation during a specific activity, that activity must cease until an appropriate replacement unit is obtained. The HSS will be responsible for ensuring a replacement unit is obtained and/or repairs are initiated on the defective equipment.

6.4 Action Levels

Table 6-1 presents airborne constituent action levels that will be used to determine the procedures and protective equipment necessary based on conditions as measured at the site.

6.5 Odor Control

If any odor complaints are received from members of the surrounding community and are related to the field investigation activities described herein, then the potentially odor-causing activity will be suspended, subsurface openings will be covered, and on-site personnel (in consultation with Ashland and ARCADIS PM) will evaluate an alternative course of action.

Table 6-1. Airborne Constituent Action Levels

Parameter	Reading in Breathing Zone (BZ)	Action
Total Organic Vapors	0 ppm to < 1 ppm	Normal operations; record breathing zone monitoring measurements every hour
	> 1 ppm to 5 ppm	Increase recording frequency to at least every 15 minutes and use Vinyl Chloride Drager tube to screen for the presence of Vinyl Chloride
	≥ 5 ppm to ≤ 25 ppm	Normal operations, continue screening for Vinyl Chloride
	> 25 ppm	Stop work; evacuate work area, investigate cause of reading, reduce through engineering controls, contact HSO
Vinyl Chloride (as determined by colorimetric tube)	≥ 1 ppm	Stop work; evacuate confined spaces/work area, investigate cause of reading; contact HSO

Parameter	Reading in Breathing Zone (BZ)	Action
Oxygen	≤ 19.5 %	Stop work; evacuate confined spaces/work area, investigate cause of reading; ventilate area; contact HSO
	> 19.5% to < 23.5 %	Normal operations
	≥ 23.5 %	Stop work; evacuate confined spaces/work area, investigate cause of reading; ventilate area; contact HSO
Carbon Monoxide	0 ppm to ≤ 20 ppm	Normal operations
	> 20 ppm	Stop work; evacuate confined spaces/work area, investigate cause of reading; ventilate area; contact HSO
Hydrogen Sulfide	0 ppm to ≤ 5 ppm	Normal operations
	> 5 ppm	Stop work; evacuate confined spaces/work area, investigate cause of reading; ventilate area; contact HSO
Flammable Vapors (LEL)	< 10% LEL	Normal operations
	≥ 10% LEL	Stop work; ventilate area; investigate source of vapors

Notes:

If action levels in the worker breathing zone are exceeded for organic vapors or particulates, air monitoring will be required at various on-site/perimeter locations to determine appropriate response activities that are protective of personnel on site who are not directly involved with the investigation, personnel at adjacent commercial sites, and the surrounding community, as detailed in Section 6.5 of this HASP.

ppm= parts per million.

mg/m3= milligrams per cubic meter.

LEL= Lower explosive limit.

7. Work Zones and Decontamination

7.1 Work Zones

7.1.1 Authorization to Enter

Only personnel with the appropriate training and medical certifications (if respirators are required) will be allowed to work at the project site. The SS will maintain a list of authorized persons; only personnel on the authorized persons list will be allowed to enter the site work areas.

7.1.2 Site Orientation and Hazard Briefing

No person will be allowed in the work area during site operations without first being given a site orientation and hazard briefing. This orientation will be presented by the SS or HSS, and will consist of a review of this HASP. This review must cover the chemical, physical, and biological hazards, protective equipment, safe work procedures, and emergency procedures for the project. Following this initial meeting, daily safety meetings will be held each day before work begins.

All people entering the site work areas, including visitors, must document their attendance at this briefing, as well as the daily safety meetings on the forms included with this plan.

7.1.3 Certification Documents

A training and medical file may be established for the project and kept on site during all site operations. Specialty training, such as first aid/cardiopulmonary resuscitation (CPR) certificates, as well as current medical clearances for all project field personnel required to wear respirators, will be maintained within that file. All ARCADIS and subcontractor personnel must provide their training and medical documentation to the HSS prior to starting work.

7.1.4 Entry Log

A log-in/log-out sheet will be maintained at the site by the SS. Personnel must sign in and out on a log sheet as they enter and leave the work area, and the SS may document entry and exit in the field notebook.

7.1.5 Entry Requirements

In addition to the authorization, hazard briefing, and certification requirements listed above, no person will be allowed in any ARCADIS work area unless they are wearing the minimum PPE as described in Section 5, Personal Protective Equipment.

7.1.6 Emergency Entry and Exit

People who must enter the work area on an emergency basis will be briefed of the hazards by the SS. All activities will cease in the event of an emergency. People exiting the work area because of an emergency will gather in a safe area for a head count. The SS is responsible for ensuring that all people who entered the work area have exited in the event of an emergency.

7.1.7 Contamination Control Zones

Contamination control zones are maintained to prevent the spread of contamination and to prevent unauthorized people from entering hazardous areas.

7.1.7.1 Exclusion Zone

An EZ may consist of a specific work area, or may be the entire area of potential contamination. All employees entering an EZ must use the required PPE, and must have the appropriate training and medical clearance for hazardous waste work. The EZ is the defined area where there is a possible respiratory and/or contact health hazard. Cones, caution tape, or a site diagram will identify the location of each EZ.

7.1.7.2 Contamination Reduction Zone

The CRZ or transition area will be established, if necessary, to perform decontamination of personnel and equipment. All personnel entering or leaving the EZ will pass through this area to prevent any cross-contamination. Tools, equipment, and machinery will be decontaminated in a specific location. The decontamination of all personnel will be performed on site adjacent to the EZ. Personal protective outer garments and respiratory protection will be removed in the CRZ and prepared for cleaning or disposal. This zone is the only appropriate corridor between the EZ and the SZ.

7.1.7.3 Support Zone

The SZ is a clean area outside the CRZ located to prevent employee exposure to hazardous substances. Eating and drinking will be permitted in the support area only

after proper decontamination. Smoking may be permitted in the SZ, subject to site requirements.

7.1.8 Posting

Work areas will be prominently marked on the ground and delineated using cones, caution tape. Work areas may also be shown on a site diagram.

7.1.9 Site Inspections

The SS will conduct a daily inspection of site activities, equipment, and procedures to verify that the required elements are in place. The Safety Inspection Form in Attachment D may be used as a guide for daily inspections. A monthly LPO must also be completed and forwarded to the PM for review.

7.2 Decontamination

7.2.1 Personnel Decontamination

All personnel wearing Modified Level D or Level C protective equipment in the EZ must undergo personal decontamination prior to entering the SZ. The personnel decontamination area will consist of the following stations at a minimum:

- *Station 1*: Personnel leaving the contaminated zone will remove the gross contamination from their outer clothing and boots.

- *Station 2*: Personnel will remove their outer garment and gloves and dispose of it in properly labeled containers. Personnel will then decontaminate their hard hats, and boots with an aqueous solution of detergent or other appropriate cleaning solution. These items are then hand carried to the next station.

- *Station 3*: Personnel will thoroughly wash their hands and face before leaving the CRZ. Respirators will be sanitized and then placed in a clean plastic bag.

7.2.2 Equipment Decontamination

All vehicles that have entered the EZ will be decontaminated at the decontamination pad prior to leaving the zone. If the level of vehicle contamination is low, decontamination may be limited to rinsing of tires and wheel wells with water. If the vehicle is significantly contaminated, steam cleaning or pressure washing of vehicles and equipment may be required.

7.2.3 Personal Protective Equipment Decontamination

Where and whenever possible, single-use, external protective clothing must be used for work within the EZ or CRZ. This protective clothing must be disposed of in properly labeled containers. Reusable protective clothing will be rinsed at the site with detergent and water. The rinsate will be collected for disposal.

When removed from the CRZ, the respirator will be thoroughly cleaned with soap and water. The respirator face piece, straps, valves, and covers must be thoroughly cleaned at the end of each work shift, and ready for use prior to the next shift. Respirator parts may be disinfected with a solution of bleach and water, or by using a spray disinfectant.

8. Training and Medical Surveillance

8.1 Training

8.1.1 General

All on-site project personnel who work in areas where they may be exposed to site contaminants must be trained as required by OSHA Regulation 29 CFR 1910.120 (HAZWOPER). Field employees exposed or potentially exposed over the PEL receive 40 hours of initial training and three days of actual field experience under the direct supervision of a trained, experienced supervisor. Field employees on site for a specific limited task such as groundwater monitoring/sampling, surveying, etc. and who are unlikely to be exposed over the PEL receive 24 hours of initial training and one day of actual field experience under the direct supervision of a trained, experienced supervisor. Personnel who completed their initial training more than 12 months prior to the start of the project must have completed an eight-hour refresher course within the past 12 months. The SS must have completed an additional eight hours of supervisory training, and must have a current first-aid/CPR certificate.

8.1.2 Basic 40-Hour Course

The following is a list of the topics typically covered in a 40-hour HAZWOPER training course:

- General safety procedures
- Physical hazards (fall protection, noise, heat stress, cold stress)
- Names and job descriptions of key personnel responsible for site health and safety
- Safety, health, and other hazards typically present at hazardous waste sites
- Use, application, and limitations of PPE
- Work practices by which employees can minimize risks from hazards
- Safe use of engineering controls and equipment on site
- Medical surveillance requirements
- Recognition of symptoms and signs which might indicate overexposure to hazards
- Worker right-to-know (Hazard Communication OSHA 1910.1200)
- Routes of exposure to contaminants
- Engineering controls and safe work practices
- Components of a health and safety program and a site-specific HASP
- Decontamination practices for personnel and equipment
- Confined-space entry procedures
- General emergency response procedures

8.1.3 Supervisor Course

Management and supervisors must receive an additional eight hours of training, which typically includes:

- General site safety and health procedures.
- PPE programs.
- Air monitoring techniques.

8.1.4 Site-Specific Training

Site-specific training will be accomplished by on-site personnel reading this HASP, or through a thorough site briefing by the PM, SS, or HSS on the contents of this HASP before work begins. The review must include a discussion of the chemical, physical, and biological hazards; the protective equipment and safety procedures; and emergency procedures.

8.1.5 Daily Safety Meetings

Twice daily safety meetings will be held to cover the work to be accomplished, the hazards anticipated, the PPE and procedures required to minimize site hazards, and emergency procedures. The SS or HSS should present these meetings prior to beginning the day's fieldwork and again after lunch. No work will be performed in an EZ before a safety meeting has been held. A safety meeting must also be held prior to new tasks, and repeated if new hazards are encountered. The Daily Safety Meeting Log is included in Attachment E.

8.1.6 First Aid and CPR

At least one employee current in first aid/CPR will be assigned to the work crew and will be on the site during operations. Refresher training in first aid (triennially) and CPR (annually) is required to keep the certificate current. These individuals must also receive training regarding the precautions and protective equipment necessary to protect against exposure to blood-borne pathogens.

8.2 Medical Surveillance

8.2.1 Medical Examination

All personnel who are potentially exposed to site contaminants must participate in a medical surveillance program as defined by OSHA at 29 CFR 1910.120 (f).

8.2.2 Pre-Placement Medical Examination

All potentially exposed personnel must have completed a comprehensive medical examination prior to assignment, and periodically thereafter as defined by applicable regulations. The pre-placement and periodic medical examinations typically include the following elements:

- Medical and occupational history questionnaire
- Physical examination
- Complete blood count, with differential
- Liver enzyme profile
- Chest X-ray, at a frequency determined by the physician
- Pulmonary function test
- Audiogram
- Electrocardiogram for persons older than 45 years of age, or if indicated during the physical examination
- Drug and alcohol screening, as required by job assignment
- Visual acuity
- Follow-up examinations, at the discretion of the examining physician or the corporate medical director

The examining physician provides the employee with a letter summarizing his findings and recommendations, confirming the worker's fitness for work and ability to wear a respirator. Documentation of medical clearance will be available for each employee during all project site work.

Subcontractors will certify that all their employees have successfully completed a physical examination by a qualified physician. The physical examinations must meet the requirements of 29 CFR 1910.120 and 29 CFR 1910.134. Subcontractors will supply copies of the medical examination certificate for each on-site employee.

8.2.3 Other Medical Examinations

In addition to pre-employment, annual, and exit physicals, personnel may be examined:

- At employee request after known or suspected exposure to toxic or hazardous materials.
- At the discretion of the HSS, HSO, or occupational physician in anticipation of, or after known or suspected exposure to toxic or hazardous materials.

8.2.4 Periodic Exam

Following the placement examination, all employees must undergo a periodic examination, similar in scope to the placement examination. For employees potentially exposed over 30 days per year, the frequency of periodic examinations will be annual. For employees potentially exposed less than 30 days per year, the frequency for periodic examinations will be 24 months.

8.2.5 Medical Restriction

When the examining physician identifies a need to restrict work activity, the employee's supervisor must communicate the restriction to the employee and the HSS. The terms of the restriction will be discussed with the employee and the supervisor.

9. Emergency Procedures

9.1 General

Prior to the start of operations, the work area will be evaluated for the potential for fire, contaminant release, or other catastrophic event. Unusual conditions or events, activities, chemicals, and conditions will be reported to the SS/HSS immediately.

The SS/HSS will establish evacuation routes and assembly areas for the site. All personnel entering the site will be informed of this route and the assembly area.

9.2 Emergency Response

If an incident occurs, the following steps will be taken:

- The SS/HSS will evaluate the incident and assess the need for assistance and/or evacuation.
- The SS/HSS will call for outside assistance as needed.
- The SS/HSS will ensure the PM is notified promptly of the incident.
- The SS/HSS will take appropriate measures to stabilize the incident scene.

9.2.1 Fire

In the case of a fire at the site, the SS/HSS will assess the situation and direct fire-fighting activities. The SS/HSS will ensure that the PM is immediately notified of any fires. Site personnel will attempt to extinguish the fire with available extinguishers, if safe to do so. In the event of a fire that site personnel are unable to safely extinguish with one fire extinguisher, the local fire department will be summoned.

9.2.2 Contaminant Release

In the event of a contaminant release, the following steps will be taken:

- Notify SS/HSS immediately.
- Evacuate immediate area of release.

- Conduct air monitoring to determine needed level of PPE.
- Don required level of PPE and prepare to implement control procedures.

The SS/HSS has the authority to commit resources as needed to contain and control released material and to prevent its spread to off-site areas.

9.3 Medical Emergency

All employee injuries must be promptly reported to the HSS/SS, who will:

- Ensure that the injured employee receives prompt first aid and medical attention.

- In emergency situations, the worker is to be transported by appropriate means to the nearest urgent care facility (normally a hospital emergency room).

- If the injured person is an ARCADIS employee, notify Pat Bullock, ARCADIS Workers Comp Administrator, at 1-720-344-3844 as soon as possible after the employee has been safely evacuated from the scene.

Emergency Care Steps

Survey the scene. Determine if it is safe to proceed. Try to determine if the conditions that caused the incident are still a threat. Protect yourself from exposure before attempting to rescue the victim.

- Do a primary survey of the victim. Check for airway obstruction, breathing, and pulse. Assess likely routes of chemical exposure by examining the eyes, mouth, nose, and skin of the victim for symptoms.

- Phone Emergency Medical Services (EMS). Give the location, telephone number used, caller's name, what happened, number of victims, victim's condition, and help being given.

- Maintain airway and perform rescue breathing as necessary.

- Perform CPR as necessary.

- Do a secondary survey of the victim. Check vital signs and do a head-to-toe exam.

Treat other conditions as necessary. If the victim can be moved, take him/her to a location away from the work area where EMS can gain access.

9.4 First Aid - General

All persons must report any injury or illness to their immediate supervisor or the SS. Trained personnel will provide first aid. Injuries and illnesses requiring medical treatment must be documented. The SS and HSS must conduct an II as soon as emergency conditions no longer exist and first aid and/or medical treatment has been ensured. IIs must be completed and submitted to the PM within 24 hours after the incident.

If first-aid treatment is required, first aid kits are kept at the CRZ. If treatment beyond first aid is required, the injured person(s) should be transported to the medical facility. If the injured person is not ambulatory, or shows any sign of not being in a comfortable and stable condition for transport, then an ambulance/paramedics should be summoned. If there is any doubt as to the injured worker's condition, it is best to let the local paramedic or ambulance service examine and transport the worker.

9.4.1 First Aid - Inhalation

Any employee complaining of symptoms of chemical overexposure as described in Section 4, General Site Safety Procedures, will be removed from the work area and transported to the designated medical facility for examination and treatment.

9.4.2 First Aid - Ingestion

Call EMS and consult a poison control center for advice. If available, refer to the MSDS for treatment information. If the victim is unconscious, keep them on their side and clear the airway if vomiting occurs.

9.4.3 First Aid - Skin Contact

Project personnel who have had skin contact with contaminants will, unless the contact is severe, proceed through the CRZ, to the wash area. Personnel will remove any contaminated clothing, and then flush the affected area with water for at least 15 minutes. The worker should be transported to the medical facility if he/she shows any sign of skin reddening, irritation, or if he/she requests a medical examination.

9.4.4 First Aid - Eye Contact

Project personnel who have had contaminants splashed in their eyes or who have experienced eye irritation while in the EZ, must immediately proceed to the eyewash station in the CRZ. Do not decontaminate prior to using the eyewash. Remove

whatever protective clothing is necessary to use the eyewash. Flush the eye with clean running water for at least 15 minutes. Arrange prompt transport to the designated medical facility.

9.5 Reporting Injuries, Illnesses, and Near Miss Incidents

Injuries and illnesses, however minor, will be reported to the SS and Ashland immediately. The SS will complete an injury report and submit it to the HSM/HSO, PIC, and the PM within 24 hours.

Near miss incidents are situations in which no injury or property damage occurred, but under slightly different circumstances an injury or property damage could have occurred. Near misses are caused by the same factors as injuries; therefore, they must be reported and investigated in the same manner. A SPSA must be done immediately after an injury, illness, near miss, or other incident to determine if it is safe to proceed with the work.

9.6 Non-Emergency, Non-Life Threatening Work Related Injury or Illness

For minor illnesses or injuries that may be work-related and are **not** life threatening or emergencies (e.g., you're in your hotel room and your lower back tightens up, earlier in the day you hand-augured 50 borings; you cut your hand in the office, put a band-aid on the cut, and go back to work, but when you get home you realize the cut is deep and is still bleeding; you hit your head on a cabinet while loading paper, and later on that day you suddenly feel dizzy.) employees will take the following steps **before** seeking medical treatment at a medical treatment facility:

CALL 1-800-ASHLAND for any incident related to safety on site, then proceed with the following:

As soon as possible, contact WorkCare at 1.800.455.6155 (Once you've spoken with WorkCare, you can let your supervisor know).

- WorkCare will discuss the medical issues with you and provide appropriate medical guidance.

- If WorkCare feels that you should see a physician:

    - They will help you locate a physician/clinic and will contact the clinic to discuss the treatment plan. If they have a concern about the treatment plan, one of the

WorkCare physicians will attempt to contact the treating physician to discuss the plan and will keep you advised.

- If WorkCare feels that first-aid/self-treatment is medically appropriate:

  - They will provide the treatment information to you and will follow up with you to determine effectiveness.

  - If the medical issue persists, WorkCare will advise alternative treatment or will refer you to a physician.

  - Keep your supervisor informed on what action you will be taking. If you are seen by a physician, keep them advised as to your work status and upcoming medical appointments.

If an injury or illness is life-threatening or an emergency, please seek medical attention immediately. As soon as possible, notify your supervisor.

9.7 Emergency Information

The means to summon local public response agencies such as police, fire, and ambulance will be reviewed in the daily safety meeting. These agencies are identified in Table 9-1.

Table 9-1. Emergency Contacts

Local Emergency Contacts	Telephone No.
Fire	911
Police	911
Ambulance	911
Hospital: Albany Medical College	518.262.3131
Project Emergency Contacts	**Telephone No.**
ARCADIS Field Task Manager: Katherine Murray	315.671.9199
ARCADIS Site Supervisor: Ricardo Jaimes	315.671.9645
ARCADIS Health and Safety Manager: Charles Webster	315.671.9297
Ashland: Jim Vondracek	614.790.6146
USEPA : Mike Infurna	212.637.4177

9.7.1 Directions to Hospital (Non-Emergency)

A	**130 South Street, Rennselaer, NY**
1.	Start at **130 SOUTH ST, RENSSELAER** - **go 0.2** mi
2.	Bear **R** on **COLUMBIA TPKE(US-20)** - **go 0.3** mi
3.	Continue to follow **US-20** - **go 1.0** mi
4.	Take ramp toward **SO PEARL ST** - **go 0.3** mi
5.	Continue on **MARKET ST** - **go 0.1** mi
6.	Take ramp onto **EAGLE ST** toward **EAGLE STREET** - **go 0.3** mi
7.	Bear **L** on **WASHINGTON AVE** - **go 0.1** mi
8.	Arrive at the center of **ALBANY, NY**
B	**Albany Medical College, 47 New Scottland Avenue, Albany, NY**

Total Distance: 2.3 miles, Total Travel Time: 6 mins

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ATTACHMENTS

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Attachment A

Job Safety Analysis Forms

Loss Prevention

JSA

*** The LPS system is designed to be used with Internet Explorer 6.0 or higher ***

copy

SECTION 1

JSA No: JSA002516 **Status:** Under Review **Version:** In Progress
JSA Template: **No**
JSA Type: Environmental Operations
Date: 3/6/09
Work Type: Const/Remediation - Clearing and Grubbing
Work Activity: Brush Clearing
Project No: OH002000NY41 - RENSSELAER, NEW YORK (RENSSELAER, NEW YORK)

SECTION 2

Development Team	Position / Title	PC	Reviewed By	Position / Title
Jaimes Palomera, Luis Ricardo .	Geologist 2	☑	Thomas, George M.	Principal Geologist

SECTION 3

No	Job Step	Potential Hazard(s)	Critical Action(s)	SOP Refere
1	Travel to site	Vehicle accident	Smith Defensive Course. Follow safe driving procedures (following distances, speed, headlights, safety belts, 'give the other driver a break'). Do not use cell phone when driving.	ARCADIS H& Procedure ARCHSGE02
2	Working outdoors	Heat/cold stress, sunburn, severe weather, lightning.	Avoid/stop work in extreme weather conditions or if extreme weather is imminent, seek shelter as needed; take breaks and consume fluids as needed; use sunscreen and wear clothing to cover body for protection.	
3	Property access	Vehicle traffic. Trip and fall.	Wear safety vest and face oncoming traffic. Be aware of vehicle traffic on-site. Be aware of surroundings.	
4	Determine removal locations.	A. Slips, trips or falls. B. Dense growth. C. Thorns in brush (poison ivy). D. Crossing barbed wire fence. E. Bees, ticks, ect.	A. Wear rubber overshoes. Watch for trip/fall. B. Access after clearing area. C. Wear protective gloves and long sleeves. D. Use buddy system for crossing and go through, not over, have buddy assist in spreading barbed wire. Hand equipment over. E. Looking in path of travel.	
5	Clearing/grubbing.	A. Chainsaw. B. Hand cutting. C. Falling brush/trees. D. Moving heavy brush. E. Bees.	A. Hand, eye/face, hearing protection. Stay out of radius of chips and debris. Good balance and control with saw or other cutting equipment. B. Leather glove protection and keeping clear of work area. C. Stay clear of work falling zone. Chain saw cutter to clear area also. D. Cut pieces into easily manageable sizes. E. Check for bees before cutting. F. Follow all equipment manufacturer's instructions and warnings.	

SECTION 4

Personal Protective Equipment (PPE)	
Ear plugs	
Hard Hat	
Hearing Protection	
Level D	
Long Sleeves	
Orange Traffic Safety Vest	
Protective Gloves	- Leather
Safety Glasses	
Safety Shoes	

Required and/or Recommended Equipment and Supplies:
Face shield, consider the use of leg protection (chaps) and protective vest when using chain saw

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Last updated on 03/06/2009 at 04:31:25 by RJAIMES

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JOB SAFETY ANALYSIS

SECTION 1	
JSA Type:	Environmental Operations
JSA No:	JSA002517
Date:	3/9/2009
Work Type:	Const/Remediation - Chain Link Fence Installation
Work Activity:	Chain Link Fence temporary removal and re-installation
Project No.:	OH002000NY41 - RENSSELAER, NEW YORK (RENSSELAER, NEW YORK)

SECTION 2

Development Team	Position / Title	PC	Reviewed By	Position / Title	Date
Jaimes Palomera, Luis Ricardo .	Geologist 2	☑	Thomas, George M.	Principal Geologist	

SECTION 3

Job Steps	Potential Hazard(s)	Critical Action(s)	SOP Reference
Load required sampling equipment and supplies into vehicle	Lifting hazards and back strain. Appropriate PPE or equipment not on-site.	Review HASP for proper PPE and Work Plan for necessary equipment. Also refer to the HASP for required traffic control and emergency procedures. Use proper lifting technique. Request assistance when lifting heavy equipment. Use dolly to transport equipment.	
Working outdoors	Heat/cold stress, sunburn, severe weather, lightning.	Avoid/stop work in extreme weather conditions or if extreme weather is imminent, seek shelter as needed; take breaks and consume fluids as needed; use sunscreen and wear clothing to cover body for protection.	
Travel to site	Vehicle accident	Smith Defensive Course. Follow safe driving procedures (following distances, speed, headlights, safety belts, 'give the other driver a break'). Do not use cell phone when driving.	ARCADIS H&S Procedure ARCHSGE024
Property access	Vehicle traffic. Trip and fall.	Wear safety vest and face oncoming traffic. Be aware of vehicle traffic on-site. Be aware of surroundings.	
Chain-Link fence temporary removal and re-installation	Hand Cutting falling fabric fence, Post and terminal post	hand and eye protection. Good control and balance with hand tools and the fence stretcher, Leather glove protection	

SECTION 4
Personal Protective Equipment (PPE):
Long Sleeves
Orange Traffic Safety Vest
Protective Gloves - Leather
Safety Glasses
Safety Shoes
Required and/or Recommended Equipment and Supplies: Sunscreen whistle Rain gear/inclement weather clothing First Aid Kit eyewash bottle 2-way radio/cell phones Trafic cones as needed

JSA002517 - Under Review - In Progress - 03/09/2009 05:13 PM EST

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JOB SAFETY ANALYSIS

SECTION 1	
JSA Type:	Environmental Operations
JSA No:	JSA002508
Date:	3/6/2009
Work Type:	Environmental - Monitoring Well/Piezometer Installation
Work Activity:	Drilling usig Power Probe, Soil Sampling, Temporary Monitoring Well Installation, Well development, Groundwater sampling
Project No.:	OH002000NY41 - RENSSELAER, NEW YORK (RENSSELAER, NEW YORK)

SECTION 2

Development Team	Position / Title	PC	Reviewed By	Position / Title	Date
Jaimes Palomera, Luis Ricardo .	Geologist 2	☑	Thomas, George M.	Principal Geologist	

SECTION 3

Job Steps	Potential Hazard(s)	Critical Action(s)	SOP Reference
Load required sampling equipment and supplies into vehicle	Lifting hazards and back strain. Appropriate PPE or equipment not on-site.	Review HASP for proper PPE and Work Plan for necessary equipment. Also refer to the HASP for required traffic control and emergency procedures. Use proper lifting technique. Request assistance when lifting heavy equipment. Use dolly to transport equipment.	
Working outdoors	Heat/cold stress, sunburn, severe weather, lightning.	Avoid/stop work in extreme weather conditions or if extreme weather is imminent, seek shelter as needed; take breaks and consume fluids as needed; use sunscreen and wear clothing to cover body for protection.	
Travel to site	Vehicle accident	Smith Defensive Course. Follow safe driving procedures (following distances, speed, headlights, safety belts, 'give the other driver a break'). Do not use cell phone when driving.	ARCADIS H&S Procedure ARCHSGE024
Property access	Vehicle traffic. Trip and fall.	Wear safety vest and face oncoming traffic. Be aware of vehicle traffic on-site. Be aware of surroundings.	
Locate drilling area. Set up necessary traffic control at drilling location.	Struck by vehicle during locating and traffic control placement. Vehicle accident as result of improper vehicle control placement. Slips from uneven terrain, frozen or	Wear Class II traffic vest if drilling location is located proximal to vehicular traffic. Use appropriate traffic control measures (barricades and cones) to direct traffic around work area. To the extent possible, stay out of the way of other traffic. Scan the ground ahead of the walking path for	

	wet ground.	obstacles or wet/treacherous conditions. Use alternate route when conditions appear to be hazardous.	
Set up drill rig	Contact with overhead power lines. Pinches from moving hydraulics. Contact with hydraulic fluid from hose rupture. Uneven ground that could cause rig to roll over.	Minimum distance is 10 ft from overhead power lines. Visually inspect hydraulic/air hoses for signs of wear or deterioration. Ensure whip checks in place on air lines. Visually inspect hoisting cables for wear, replace as needed. Have driller check kill switch at beginning of job. Keep hands, feet, and clothing a minimum of 5 ft from moving parts (e.g., leveling jacks, rotating augers, drill rods, etc.). Set parking brake, chock wheels, level drill rig. Visually scan the location to identify areas that may be soft or where the drill rig could get stuck. Set up cones around perimeter of work area.	ARCADIS H&S Procedure ARCHSFS019
Utility Clearance	Potential to encounter underground or aboveground utilities while drilling. Back strain, repetitive motion strain, exhaustion, muscle sprains/strains.	Complete utility clearance in accordance with the ARCADIS H&S procedure. Contact Nation-wide Utility Locate Call Number 811. Hand auger/post-hole dig no more than 15 minutes per person before taking break and switching diggers.	ARCADIS H&S Procedure ARCHSFS019
Drilling/borehole advancement	Moving parts of the drilling rig can pull you in, causing injury. Pinch points on the rig and probe rod connections can cause pinching or crushing of body parts. Soil cores and/or water could contain chemicals of concern. Dust and debris can cause eye injury. Drilling equipment laying on the ground (i.e. probe rods, soil samplers, decon equipment, coolers, etc.) could create a tripping hazard. Water from decon buckets generate mud and cause a slipping hazard. Excessive noise is generated by rig operation. Direct Push drill rigs such Geoprobe or Power Probe possess many pressurized hoses/lines.	Conduct tailgate safety briefing. The drill rig should only be moved with the mast down. Set-up rig on level surface where possible. Stay at least 5 feet away from moving parts of the drill rig. Know where the kill switch is, and have the drillers test it to verify that it is working. Do not wear loose clothing, and tie long hair back. Avoid wearing jewelry while drilling. Wear appropriate gloves to protect from COCs and safety glasses and hard hat to protect from flying dust, water and debris. Keep equipment neatly stored and pick up trash, and store away from the primary work area. Wear ear plugs, steel-toe boots with good tread, and maintain proper footing in muddy areas. Inspect the integrity of drill rig hoses and cables/lines before operation. Stay clear of any material being hoisted from the rig or support truck. Stay clear of settling pits and cordon off upon completion of daily activities. Implement air monitoring and action levels per HASP.	
	Injuries can result from pinch points on soil sampler, cutting acetate sampler liner, and from	Care should be taken when opening soil sampler. Have driller cut open acetate sample liner using appropriate liner cutter. Look at empty containers before picking them up, and do	

Soil Sample Collection and Processing	sample container breakage. Workers can be exposed to COCs. Lifting heavy objects (e.g., coolers) can cause back injuries.	not over-tighten container caps. Use dividers to store containers in the cooler so they do not break. Wear appropriate gloves as designated by the HASP. Lift with knees and minimize bending and twisting while lifting. Use two people to lift heavy objects.	
decontamination	Exposure to COCs.	Wear PPE in accordance with HASP during decon activities.	
Monitoring well installation	Same hazards as Step 8 with respect to drill rig operation. Additionally, monitoring well construction materials can clutter the work area causing tripping hazards. Well finishing material (i.e., sand, grout, bentonite) can become airborne and get in your eyes. Cutting the top of the well can cause jagged/sharp edges on the top of the well casing. Silicosis from mixing Portland cement. Strains from handling sand, bentonite, and Portland cement bags.	Same critical actions as Step 8 with respect to drill rig operation. Wear safety glasses for protection from airborne sand and dust. Well construction materials should be picked up during the well installation process. Wear gloves when working with the top of the well casing, and file any sharp jagged edges that resulted from cutting the well. If visible dust is present, wear dust masks when mixing Portland cement. Use rig cable to lift heavy loads, when possible. Two man lift for bagged materials > 50 lbs.	
Well Development	Injuries (e.g., sprains, strains) from handling peristaltic pump. Electrical shock hazard from batteries acid/water use. Exposure to COCs in groundwater. Purge water can splash and cause eye injury. Improper storage or disposal.	Wear PPE in accordance with HASP during development activities. Have proper containment and labeling available on site. Stage drums/containers in isolated and/or secure location away from public interference. Coordinate proper off-site disposal as needed.	
Soil cutting and purge water management	Exposure to COCs in both soil and groundwater. Moving full drums can cause back injury, or pinching/crushing injury. Purge water can splash and cause eye injury. Improper storage or disposal.	Wear PPE in accordance with HASP. Have the drilling contractor move full drums with their equipment. If this is not practicable, use lift assist devices such as drum dollys, lift gates, etc. Employ proper lifting techniques, and perform SPSA to identify pinch/crush points. Wear leather work gloves, and clear all walking and work areas of debris prior to moving a drum. Have proper containment and labeling available on site. Stage drums in isolated and/or secure location away from public interference. Coordinate proper off-site disposal as needed.	
Gauge water levels in wells	back strain, repetitive motion. Contact with contaminated water	Use appropriate PPE. bend at knees, not waist. Use PID during initial well opening.	
		Decontaminate purging equipment between each sampling location. Use proper	

Purge wells and collect purge water	Cross contamination. back strain, slip and fall. Contact with contaminated water.	lifting techniques. Use field cart or truck for transporting heavy equipment (battery, pump, water, etc.). Use PPE and monitoring in accordance with HASP. Keep work area clear of trip and fall hazards. Store purge water in appropriate containers where containment is required. When using a pump make sure all tubing/hose fittings are secure.	
Containerize and store water IDW	Splashing. Exposure to chemical hazards. Back strains from moving water containers, spills.	1)Use PPE and proper equipment to transport water (i.e., containers with lids, drum dolly, etc.) Label storage containers and locate in designated area, protected from trafic and weather. 2) Use proper lifting techniques when transferring water or moving containers. 3) Verify that lids are secure.	
Collect samples in accordance with sampling plan.	Cross contamination, Back strain, slip and fall. Omproper labeling or storage, injury from broken sample bottles (cuts or acid burns). Contact with contaminated water.	Decontaminate sampling equipment (if disposable, use new for each well). use proper lifting techniques. Use PPE in accordance with HASP. Label samples in accordance with sampling plan. Keep samples stored in proper containers, at correct temperature, and away from work area. Handle bottles carefully.	
Package samples.	Bottle breakage. Injury from broken sample bottles (cuts or acid burns). Back strain when lifting samples.	Handle and pack bottles carefully (proper PPE, bubble wrap, etc.). Use proper lifting techniques.	
Decontaminate sampling equipment.	Chemical exposure to impacted water. Cross-contamination. spills.	Establish decon station. Wear gloves and splash protection. thoroughly decon tools and equipment after each sample is collected.	
Break down exclusion zone and work area	Struck by vehicle due to improper traffic controls	Use a buddy system for removing site control cones. Wear Class II traffic vest.	

SECTION 4
Personal Protective Equipment (PPE):
Ear plugs
Hard Hat
Level D
Long Sleeves
Orange Traffic Safety Vest
Protective Gloves - Nitrile or Latex
Safety Glasses
Safety Shoes
Required and/or Recommended Equipment and Supplies: PID and 4 gas monitor

Sunscreen
whistle
Rain gear/inclement weather clothing
First Aid Kit
Fire Extinguisher
eyewash bottle
2-way radio/cell phones
Trafic cones as needed

JSA002508 - Under Review - In Progress - 03/06/2009 03:46 PM EST

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Attachment B

ARCADIS Utility Clearance
Standard Operating
Procedure/Checklist

ARCADIS
Infrastructure, environment, facilities

Imagine the result

Utility Location Policy and Procedure

ARCADIS SOP: ARCHSFS019

Revision #3

Revision Date: 16 April 2007

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Exhibit B – Utility Location Decision Tree B-1

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Utility Location Policy and Procedure

Approval Signatures

Approved by: Michael A Thomas

Michael A. Thomas, CIH, Corporate HS Director

Approved by: Patricia A. Vollertsen

Patricia A. Vollertsen, Corporate HS Manager

Revision Date	Revision Number	Reason for change
13 December 2007	01	Original document
26 March 2007	02	Put in new company format
15 May 2007	03	Added nation-wide 811 number

1.0 PURPOSE

This procedure directs general safety procedures associated with the identification and management of above ground and subsurface utility locations on project sites.

2.0 SCOPE

2.1 Management Requirements - ARCADIS personnel managing or working on any project requiring subsurface work and/or investigations (SWI) and requiring work in the vicinity of above ground utilities must incorporate this procedure into their project planning and field work activities to ensure that all reasonable means to identify utilities are implemented and that appropriate controls have been put in place to minimize or eliminate damage to these utilities and the hazards associated with these utilities. All applicable procedures described in this document must be completed prior to initiating intrusive field work or field work in the vicinity of above ground utilities, or the work cannot proceed.

2.2 Project Management Requirements - Where SWI are required to be performed by a subcontractor to ARCADIS under its subcontract, project management shall require the subcontractor to adequately incorporate SWI procedures described herein into the subcontractor's scope of work.

3.0 DEFINITIONS

Above Ground Utilities - For the purpose of this procedure, above ground utilities include, but are not limited to: any above ground line, system, or facility used for producing, storing, conveying, transmitting or distributing communication or telecommunications, electricity, gas, petroleum and petroleum products, coal slurry, hazardous liquids or gases, water under pressure, steam, or other hazardous materials.

Subsurface Utilities - For the purposes of this procedure, subsurface utilities include, but are not limited to: any underground line, system, or facility used for producing, storing, conveying, transmitting or distributing communication or telecommunications, electricity, gas, petroleum and petroleum products, coal slurry, hazardous liquids or gases, water under pressure, steam, or sanitary sewage; underground storage tanks; tunnels and cisterns; and septic tanks.

4.0 RESPONSIBILITIES

4.1 Project Manager Responsibilities

To prevent injury to employees, avoid disruption to utility services, and help eliminate damage to subsurface and above ground utilities, project managers have the responsibility for utility identification, location, and marking prior to initiating field activities. Most states, provinces, municipalities, and clients have rules, general statutes, or laws that specify the requirements of subsurface utility location prior to intrusive subsurface field activities (i.e., excavation, trenching, boring, and all forms of drilling operations, etc.). The project manager ensures that these laws are followed, and that the directives outlined in this procedure are met for every project involving SWI and work in the vicinity of above ground utilities.

In addition, if field activities are completed in the vicinity of above ground utilities, the project manager is responsible for working with the client to identify the nature of the utilities, and to determine what control processes need to be implemented to prevent damage to these utilities and to minimize any injury in the event there is damage.

4.2 Field Personnel Responsibilities

Field personnel conducting SWI activities and activities where above ground utilities are in the vicinity of the work have the responsibility to read, understand, and follow this procedure and complete the appropriate checklists during the on-site utility locate process. ARCADIS personnel assisting in the identification of underground utilities have previous related experience of a minimum of 1 year. Those implementing remote sensing technologies have completed training in those techniques and have 6 months experience operating and interpretation results.

If utilities cannot be located to eliminate any reasonable concern, field personnel use their Stop Work authority until utility locations can be identified. Field personnel review this procedure onsite with ARCADIS subcontractors, and ensure they follow the procedures detailed in this document. Any ARCADIS subcontractor not following these procedures are asked to stop work, and the project manager contacted. Any diversion from this procedure by ARCADIS field personnel is approved by the project manager with input from Corporate Health and Safety as necessary.

5.0 POLICY AND PROCEDURES

5.1 Policy

It is the practice of ARCADIS and its affiliated companies to implement appropriate, reasonable and practical procedures within acceptable and customary industry practices to promote the health and safety of its employees, and avoid and mitigate exposure of risk in the performance

of their work. In furtherance of this policy, ARCADIS promotes and encourages compliance by all employees with this policy and procedures relating to SWI and working in the vicinity of above ground utilities.

- This procedure is followed by all responsible ARCADIS personnel. Such procedures are included in the Project Planning processes utilized by ARCADIS personnel.

- Project Management procedural requirements are outlined in Section 5.1. All employees included in SWI and above ground utility work are familiar with these procedures.

- For all SWI, it is required to contact the locality One Call number and/or a privately contracted utility location company, and to conduct a visual inspection of the site for subsurface utility locating. In addition, for non-greenfield sites, ARCADIS obtains from the client, a detailed site utility map. Additional lines of evidence may be required based on field conditions and client requirements for subsurface utility location. The project manager or designated representative in cooperation with the H&S staff and SWI contractor determine when and if additional lines of evidence are required. Additional lines of evidence include but are not limited to the following:

  - Detailed site utility maps, preferably “As-Built” drawings (drawn to scale)
  - Hand augering or digging
  - Hydro-knife
  - Air-knife
  - Radio Frequency Detector (RFD)
  - Ground Penetrating Radar (GPR)

- Contract Terms: In agreements for SWI with a client, prime contractor, or subcontractors, required terms (Exhibit 1) shall be included for the appropriate allocation of risk of damage to subsurface facilities. If such provisions cannot be agreed upon, the reasons are documented and other risk-management actions identified, such as limits of liability, additional physical investigations, additional lines of evidence of utility location, assignment of risk to subcontractors, etc.

- The policy of ARCADIS encourages and empowers all employees to take such action as they deem appropriate to assure compliance with this policy and procedures both in project planning and field site operations. Such authority is delegated to those on the project site to immediately stop any SWI work or work in the vicinity of above ground utilities where the employee believes that injury to persons or damage to property could occur. Such action is taken without regard to costs or schedule. Personnel immediately notify their supervisor of any concerns that they have in observing any SWI work or work in the vicinity of above ground utilities. In all agreements between ARCADIS and SWI subcontractors, (e.g., drilling

subcontractors), provisions shall be included in the subcontract, work authorization or purchase order. These provisions (Exhibit 1) are found on the ARCADIS intranet at the Legal Department team site.

All ARCADIS personnel involved in SWI work or work in the vicinity of above ground utilities are appropriately trained on this procedure and have the appropriate professional experience for oversight of or involvement in SWI work or work in the vicinity of above ground utilities. ARCADIS Corporate Health & Safety can answer further questions about this policy or the hazards associated with and the control procedure for work in the vicinity of subsurface or above ground utilities.

Again, to support the efforts of ensuring the health and safety of its employees and mitigating risk to ARCADIS, ARCADIS requires that these policies and procedures be followed and implemented at all levels of project management and field implementation.

5.2 Procedures

A flow chart/decision tree of these procedures is presented in Exhibit 2 of this document.

5.2.1 Project Management Procedural Requirements

5.2.1.1 Planning and Information Request

Field activities are planned and designed to avoid contact with and damage to, and minimize interference with subsurface and above ground utilities in the vicinity of ARCADIS work activities. During the planning phase of a project the project manger contacts the client and/or property owner to request the following information for the area of the Site where the work will occur:

- A list of known or suspected existing and historical subsurface and above ground utilities present on a subject property;
- An accurate site plan (drawn to scale) illustrating subsurface and above ground utilities; and
- Construction, diameter, volume, depth, contents, and physical properties, etc. of each subsurface and above ground utility.

In the event that the client and/or property owner is not aware of the utilities at the subject property, can only provide a partial list, or cannot provide an otherwise accurate, scaled map, plan or drawing of utilities on the site, then additional resources are utilized to identify utilities at the subject property. This may include but are not limited to:

- Contacting utility provider billing departments directly to inquire if a bill is generated for the property address;

- Utilizing city/county computer-drawn maps, or geographical information systems (GIS) data containing utility information; and/or

- A site walk to visually inspect the subject property for evidence of subsurface and above ground utilities (i.e., manhole covers, meters, warning signs, vent pipes, fill ports, pipe runs, utility lines, etc.).

In the project planning process, the project manager and /or task manager determines the reasonable methods to be used to locate subsurface utilities prior to SWI. It is required to contact the state or province One Call number and/or a private utility locator if on private property as appropriate to the site. Also, an additional two lines of evidence are used for subsurface utility line location at all sites. If scaled and accurate site utility maps are not provided by the client, additional lines of evidence are used (see Section 5.0 for lines of evidence options). Increased flexibility is built into subsurface sampling and/or extraction programs when confidence in utility identification, location, and marking is less than optimal.

5.2.1.2 Communication and Coordination

Using list of identified and suspected utilities, the PM or their designated Task Manager:

- Notifies a public one-call service centers and/or private utility contractors prior to initiating intrusive subsurface field activities;

- Provides the list to the site safety officer for inclusion in the site-specific health and safety plan (HASP);

- Communicates potential hazards to field staff prior to mobilization;

- Instructs field staff to be aware of and implement the procedures in the Section 6.2 of this procedure and utilize the appropriate utility location checklists.

- When practical, schedules a joint meeting between the public/private utility locators and field staff to oversee the subsurface utility locating and marking in the field.

- Communicates with and provides utility location documentation to the subcontractors to inform them of the utility locations and discusses methods to be used to protect those utilities.

- Understands the subcontractor's methods for utility location and documenting the process with a clear delineation of responsibilities for utility location.

In general, subsurface utility locations marked by public utility locators are only good for 2 weeks (research your state-specific requirements). If SWI activities are not conducted during this time period, the site is remarked. At no time is SWI conducted based on old markings, hand-drawn maps/sketches, photographs, or by recollection/memory of field staff. If markings are smeared, removed, damaged, or impacted in any way, the site must be remarked before SWI begins. Flag markings are used in addition to paint markings wherever possible.

5.2.1.3 Utility Request Notifications for Public Property

Prior to intrusive work on public property (i.e., right-of-ways, easements, etc.), notification of a public one-call service center is completed a minimum of 48-72 hours (states/localities requirements vary, so the PM is responsible for verifying this) prior to initiating field activities (excluding Saturdays, Sundays, and legal holidays). Specific state or local laws related to utility location are evaluated with respect to notification and liability in the event of utility damage. During the call, ARCADIS:

- Provides accurate description of the location of all areas of the SWI;
- Documents the utility locate request to record the time and date of the call, the area to be marked, the list of utility companies and municipalities that the one call service center will notify;
- Records the associated ticket (or dig) number provided by the one call service center;
- Cross references the notification list provided by the one-call service center with the list of known or suspected utilities for the property; and
- Provides accurate contact (PM name and phone numbers) information for the one call service center so they can subsequently communicate potential questions and/or delays related to the utility location and marking.

After receiving a request, the one-call service center sends requests to participating utility operators who have utilities in the area of the intrusive field activities. Each underground utility operator dispatches their own locators to mark their facilities with paint or flags. The project manager attempts to have field staff present during the marking of the utilities by the locator organization to ensure that the area of the SWI is included in the locating activities. It is important to note:

- Not all utility operators and municipalities participate in one call programs. In some instances, one-call programs provide a list of utility providers that participate, and a list of those that do not. The utility providers that do not participate are contacted individually so that they can mark their own lines, and ARCADIS documents this call (date of call, person receiving call, date lines will be marked, etc.);

- Public utility locators are usually only required to mark utilities within the public spaces (i.e., right of ways) or at most up to a meter on private property; and

- Knowledge of existing or suspected, but unmarked utilities are documented and communicated to the site safety officer, field staff, and the client prior to implementing field activities.

If a known or suspected subsurface utility does not participate in the state one-call program, and that provider has not been individually contacted prior to the start of SWI, then the field activities are postponed. If these utility providers are contacted and do not provide utility location services, then SWI are not performed until a private utility locating company is contracted and the locating tasks completed. If utility locates are not completed by public or private utility locating companies, then the subsurface activities are performed with extreme care using hand tools, or other means of utility location are used (air knife/hydro-knife technologies, or GPR), but only upon receiving approval from the ARCADIS Health & Safety department and the client.

5.2.1.4 Utility Request Notifications for Private Property, Military Installations, or Other Government Facilities

Prior to intrusive work on private property, military installations, or other government facilities the public one call service center is contacted as previously described, to identify utilities that enter and/or are in the vicinity of the subject property. In addition,

- A private utility contractor may be required to locate and mark utilities that transect the property beyond meters and/or additional utilities that property owner has installed, which may or may not be maintained and serviced by a utility or municipality

- Where appropriate, or at a client's request, a facility or plant engineer familiar with the subsurface utilities is contacted to request marking and location of utilities

- One or more weeks of advanced notice is usually required to subcontract a private contractor or coordinate with a facility or plant engineer to locate and mark utilities

- Verbal or written requests to private contractors or onsite personnel for utility location and marking is documented to record the time and date of the request, the area to be marked, and the list of utilities to be marked

- The project manager attempts to have field staff present during the marking of the utilities by the locator organization to ensure that the area of the SWI is included in the locating activities

- Knowledge of existing or suspected, but unmarked utilities is documented and communicated to the site safety officer, field staff, and the client prior to implementing field activities

- If a known or suspected utility is not located and marked by the private utility company or facility engineer, then sampling and/or excavation activities is performed with extreme care using hand tools, hydro-knife or other method that does not damage the utility; postponed until utilities are clearly marked; or canceled. If work proceeds, it can only be completed with the approval of the ARCADIS Health and Safety department and the client.

5.2.1.5 New Nation-wide Utility Locate Call Number 811

Several state and local utility notification centers have launched a new "Call before you Dig" number to help save lives and protect underground infrastructure. This new, national number is: **811**. The number is designed to help prevent professional excavators, drillers, etc. and homeowners, from damaging underground utility lines while digging/drilling and causing injury or service outage. For more information about the 811 services, visit www.call811.com

The number 811 is a new FCC designated national n-11 number created to eliminate confusion of multiple calls before you dig numbers across the country. This quick and efficient one call service will notify the appropriate utilities, who participate in the one call program. **However,** ARCADIS callers must still verify who the one call service contacts, and then determine which utilities may need to be contacted directly (e.g. those utilities not participating in the one call service) by following the requirements outlined in this procedure.

5.2.2 FIELD PROTOCOL

At no time do field activities that involve SWI or work in the vicinity of above ground utilities commence without the field staff having knowledge of the location of subsurface and above ground utilities. In addition, as stated above and in general, subsurface utility locations marked by public utility locators are only good for 2 weeks (research your state-specific requirements). If SWI activities are not conducted during this time period, the site is remarked. At no time is SWI

conducted based on old markings, hand-drawn maps/sketches, photographs, or by recollection/memory of field staff. If markings are smeared, removed, damaged, or impacted in any way, the site must be remarked before SWI begins. Flag markings are used in addition to paint markings wherever possible.

5.2.2.1 SWI and Subsurface Utilities

Prior to the start of intrusive activities, all utilities are located and measures instituted to avoid subsurface utility hazards. If intrusive work must take place within close proximity to a utility line, the utility line can also be rendered controlled (i.e. through lockout/tagout procedures).

Prior to mobilizing to the site for SWI work, field staff reviews the task details with the project manager or their designated authorized TM. This may include but is not limited to review of boring logs, excavation permits, etc. Any special site or client requirements are also discussed. Prior to initiation of any intrusive activities, the utilities and structures checklist (Exhibit 3) is reviewed and completed. Generally, the following colors apply for different types of utilities/operations:

Red – Electric;
Yellow – Natural gas/oil;
Orange – Communication/cable television;
Blue – Water;
Green – Sewer;
Pink – Temporary survey marking;
White – Proposed excavation; and
Purple – Reclaimed water

In addition, the SWI subcontractor marks (i.e., paint, stakes, etc.) the location of their operations to ensure they fall within the area that has been investigated for utilities.

Once the checklist is completed and all utilities identified, any client/site specific utility location or other utility (subsurface or above ground utilities) protection procedures (i.e. such as hand digging to a specified depth, covering or shielding lines, etc.) is completed at each location where work will be completed. If a known or suspected public subsurface utility has not been marked or the markings are not clear, the state one-call number is contacted to determine if an “emergency” locate can be requested. If so, follow the procedures outlined by the locate service and contact the project manager. If it is a private utility that is not marked, the facility manager and/or the project manager should be contacted.

If uncertainty remains on utility location, and/or more precise locations of utilities are required, and where field staff determine the circumstances warrant it, additional lines of evidence are

implemented including air or hydro knifing, or ground penetrating radar. Descriptions of the use and limitations of these methods are included in Exhibit 4.

If unexpected conditions are encountered (refusal, debris, pea gravel, etc.) while completing the intrusive activity, all work is immediately halted. Note that subsurface utilities at many industrial facilities are often placed in conduits or concrete to prevent damage. If a utility or subsurface structure is compromised, the field staff initiates the Emergency Action Plan Guidelines (Exhibit 5); however, more detailed emergency action procedures should be reviewed with the client and documented in the site specific health and safety plan prior to initiating work.

5.2.2.2 Work in the Vicinity of Above Ground Utilities

If activities take place in the vicinity of an above ground utility, the utility line can be rendered controlled (i.e. through lockout/tagout procedures) or protected from damage (i.e. covering overhead power lines). The following table is used to develop acceptable work distances for work involving machinery with high extensions (backhoes, drilling rig masts, etc.) in the vicinity of overhead power lines:

Power Line Voltage Phase to phase (kV)	Minimum Safe Clearance (feet)
50 or below	10
Above 50 to 200	15
Above 200 to 350	20
Above 350 to 500	25
Above 500 to 750	35
Above 750 to 1,000	45

ANSI Standard B30.5-1994, 5-3.4.5

The distance may be lengthened if directed by the client or the electric company, and any specified distances are strictly followed. In addition, work involving machinery, vehicles or equipment that may come in contact with above ground utilities is not completed until those utilities are protected or control processes are in place to avoid damage to those utilities.

If an above ground utility is discovered that has not been previously identified prior to mobilizing to the field, the field staff notifies the project manager who requests the client to assist in the identification of the utility and the implementation of control procedures as appropriate. In addition, if a utility or subsurface structure is compromised, the field staff initiates the Emergency Action Plan Guidelines (Exhibit 5); however, more detailed emergency action procedures should

be reviewed with the client and documented in the site specific health and safety plan prior to initiating work.

6.0 RECORDS

6.1 Checklist Records

Exhibit A - Contract Term Language

INSERT INTO ALL CLIENT CONTRACTS OR WORK ORDERS WHERE DRILLING, EXCAVATION, INTRUSIVE WORK IS TO BE PERFORMED.

Site Conditions: ARCADIS shall not be liable for: (i) damage or injury to any subterranean structures (including, but not limited to, utilities, mains, pipes, tanks, and telephone cables) or any existing subterranean conditions; or the consequences of such damage or injury, if (with respect to this clause (i)) such structures or conditions were unknown and were not identified or shown, or were incorrectly shown, in information or on plans furnished to or obtained by ARCADIS in connection with the Services; (ii) concealed conditions encountered in the performance of the Services; (iii) concealed or unknown conditions in an existing structure at variance with the conditions indicated by the Scope of Services or Work Authorization; or (iv) unknown physical conditions below the surface of the ground that differ materially from those ordinarily encountered and are generally recognized as inherent in work of the character provided under this Agreement.

Client shall provide to ARCADIS all plans, maps, drawing and other documents identifying the location of any subterranean structures on the Site. Prior to location of any drilling or excavation below the ground surface, ARCADIS shall obtain the concurrence of the Client as to the location for such drilling or excavation.

Should: (i) concealed conditions be encountered in the performance of the Services; (ii) concealed or unknown conditions in an existing structure be at variance with the conditions indicated by the Scope of Services or Work Authorization; or (iii) unknown physical conditions below the surface of the ground differ materially from those ordinarily encountered and generally recognized as inherent in work of the character provided under this Agreement; then the amount of this Agreement and/or time for performance shall be equitably adjusted by change order upon timely notice.

INSERT INTO ALL DRILLING, EXCAVATION, INTRUSIVE WORK SUBCONTRACTS.

Site Conditions: SUBCONTRACTOR acknowledges that time is of the essence with respect to the performance and completion of its work under this Contract. SUBCONTRACTOR shall adhere to, commence and complete its work in accordance with any schedule incorporated into this Contract, or any schedule submitted by SUBCONTRACTOR or attached hereto; and with respect to any Changes, out of scope or additional work, SUBCONTRACTOR shall expeditiously perform such work according to any schedule therefore agreed to by the parties. In the event any schedule is incorporated in this Contract or attached to this Contract, SUBCONTRACTOR acknowledges and agrees that such schedule has accounted for all inherent or reasonably anticipated delays, including but not limited to those inherent in obtaining site information, access sufficient labor, supplies, tools, equipment and utilities required for the

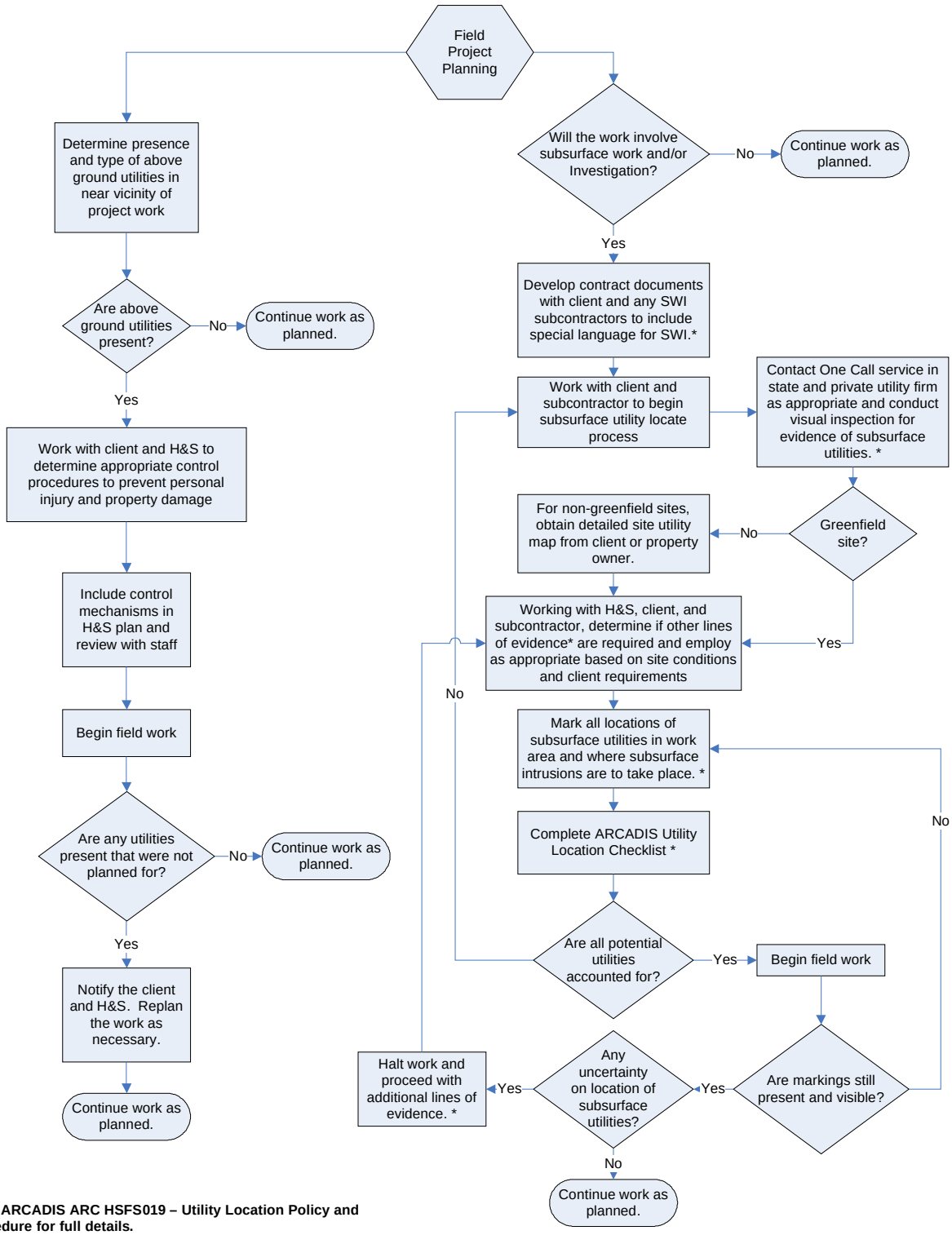
project work, and SUBCONTRACTOR waives any claim of extra compensation or damages therefore.

Subcontractor represents and warrants that it has had an opportunity to review and/or has carefully examined all necessary drawings, maps, schematics, specifications, governmental restrictions, permits and license requirements, and all applicable laws, regulations and rules relating to the Work to be done and the Site, it surroundings and local conditions, and has made all investigations based on reasonably available information that are necessary to develop a full understanding of the hazards and difficulties which can be encountered and are likely to impact the cost or schedule to perform the Work. SUBCONTRACTOR is thus familiar with conditions at the Site as are pertinent to or which may affect the Work and has been granted the right to conduct, and has conducted, all investigations it deems appropriate to determine that it can fulfill the requirements of this Contract. Notwithstanding any other provision of this Contract, SUBCONTRACTOR assumes the risk of all conditions, as specified in this Contract, that may affect SUBCONTRACTOR'S ability to perform the Work and will, regardless of such conditions, or the expense or difficulty of performing the Work or the negligence, if any, of ARCADIS, with respect to same, fully complete the Work for the stated price without further recourse to ARCADIS. Information on the Site and local conditions at the Site furnished by ARCADIS are not guaranteed by ARCADIS to be accurate, and is furnished only for the convenience of SUBCONTRACTOR.

The discovery of concealed conditions which could not reasonably have been anticipated by the SUBCONTRACTOR from information available to SUBCONTRACTOR may constitute a changed condition, which, to the extent such condition materially affects the cost or schedule to perform the Work, would entitle the SUBCONTRACTOR to a change and an equitable adjustment of the Contract price or time. SUBCONTRACTOR warrants that it shall conduct appropriate investigations to determine, with reasonable certainty, the location of utility and service lines, underground storage systems, and other subsurface structures of any kind before commencement of any drilling, excavation, or other work that has the potential to disturb these structures. SUBCONTRACTOR further warrants that it shall conduct independent field investigations to confirm the location of subsurface structures before commencement of subsurface work and shall not relay exclusively on plot plans or other drawings provided to SUBCONTRACTOR in conducting these investigations.

Exhibit B – Utility Location Decision Tree

Exhibit B- Utility Location Decision Tree*
(PMs or TMs are required to follow both sides of flowchart)



*** See ARCADIS ARC HSFS019 – Utility Location Policy and Procedure for full details.**

Exhibit C - Utilities and Structures Checklist

Project:	**Project Number:**
Site Location:	**Date:**

Instructions: This checklist will be used as a safety measure to insure that all underground utility lines, other underground structures as well as above ground utilities are clearly marked out and identified in the area selected for boring or excavation. **DRILLING, EXCAVATION, OR ANY TYPE OF GROUND INTRUSIVE WORK MAY NOT PROCEED UNTIL LINES ARE MARKED AND THIS CHECKLIST HAS BEEN COMPLETED.**

Pre-Field Work Requirements		
Was the state one-call notified with the required advanced notice (usually 48 to 72 hours)	YES	NO
State one-call confirmation number		
What are the 2 lines of evidence used for utility clearance?		
Was a plot plan showing site features and subsurface utilities provided by the PM/TM?	YES	NO
Was the Nation-wide 811 Number called? If no, why not?	YES_____	NO_____
If yes, what information was provided?		

Subgrade Utility Line Location	
Where is the gas line located?	
Where is the gas meter located on the site building(s)?	
Are the electric lines subsurface or overhead? Where are they located?	
Where is electric meter located on the site building(s)?	
Where are the telephone/cable lines located? Are there any overhead lines?	

Where do these lines enter the site building(s)?	
Where are the water lines located?	
Does the site occupant use water (bathrooms, industrial uses, fire suppression, etc.)? If so where do the water lines enter the building for these purposes?	
Are there small manholes/vault covers indicating water lines? If so, where?	
Was the local municipality contacted to mark sanitary lines?	
Where are the sanitary lines located?	
Where might the sanitary lines enter the building? (i.e. what side of the building are the bathrooms, kitchens, water treatment plant, etc?)	
Where are the storm sewer lines located?	
Are there storm sewer inlets located on the property? Check inlets for direction of subsurface lines.	
Are there any gutters directing storm water to the subsurface? Evaluate for direction of lines.	
Underground Storage Tank Sites	
Where are the USTs located? How many USTs are at the site (very number of USTs by counting fill ports and vent lines)?	
Where do the vent lines run?	
Where does the piping run? (Evaluate the path between USTs to dispenser islands).	
Where are the sub-surface electrical lines located which feed power to the UST system?	
General Underground Utility Location Signs	
Are there any cracks resembling straight lines that may indicate the settling of utility lines?	
Are there any patched areas where subsurface repairs may have been conducted?	

Are there any manhole covers or valve boxes that are not associated with marked lines?	
Above ground Utility Line Location	
Are there overhead power lines? If, so where are they located?	
What is the voltage of the overhead power lines?	
Are there any above ground structures (utilities, piping, etc.) that are used by the client? If so, are they located proximal to the work area?	
Do these lines need controlled (locked out) or protected prior to starting work?	
Interviews: Site Owners/Occupants MUST be interviewed for location of private utility lines at the site (if practicable) before start of work	
Name of Owner/Occupant.	
How is this person affiliated with the Site?	
Who interviewed Owner/Occupant?	
Date of Interview	
Specific comments that should be noted from the interview:	

NOTE: If any subsurface utilities listed above are not located, do not proceed with subsurface activities. Contact PM/TM immediately.

Name and signature of person who conducted utility line checklist

Name (print)	Signature	Date

Exhibit D - Use and Limitations of Utility Locating Methods
Ground Penetrating Radar (GPR)

The GPR system transmits high frequency electromagnetic waves into the ground and detects the energy reflected back to the surface. Energy is reflected along boundaries that possess different electrical properties. Reflections typically occur at lithologic contacts or where subsurface materials have high electrical contrasts, including metal objects such as underground storage tanks (USTs), drums, and utility pipes. These reflections are detected by the antenna and are processed into an electrical signal that can be used to image the subsurface feature. The GPR data will be reviewed in the field to assist in the delineation of potential piping or other subsurface structures.

The detection of subsurface structures located at the site depends on the electrical properties of the soil and the structure's depth, diameter, and composition. GPR is limited to the detection of smaller diameter pipes with depth. Generally, a pipe must increase in diameter by one 1 inch for each foot in depth to be seen using GPR. Also, plastic piping is more difficult to detect than metal piping using GPR, and caution should be used if plastic utility lines are suspected.

Radio Frequency Detection (RFD)

This instrument operates on the principle of radio frequency transmission and detection. The transmitter applies a known frequency to the pipe and the receiver is able to detect this frequency along the length of the structure. The success of RFD in tracing underground utilities is based on the composition of the structure (metal or plastic) and the ability to accurately position the transmitter unit so that it can be attached to, or placed directly over the structure. RFD should only be used to verify the location of utility mark-outs, and not as the primary method of utility identification.

Soil Vacuum Excavation

This method uses nondestructive vacuum excavation methods to create a visual test hole allowing the confirmation of buried utilities. This method is very accurate and relatively fast and can be performed prior to or during the drilling program. The limiting factors for this method are cost and availability. As with specialty drilling methods, a limited number of firms have the equipment to perform vacuum excavation.

The location of the structures to be cleared relative to the source and depth of impacted soil or groundwater is considered. If the zone to be cleared is known not to contain hazardous vapors or petroleum hydrocarbons via previous testing, continuous air monitoring is implemented using a lower explosive level (LEL)/O2 meter and photoionization detector (PID) or flame ionization

detector (FID) to the depth of the boring. Also consistent with the site health and safety plan (HASP), air monitoring should be conducted continuously with the LEL/O2 meter during any activity if flammable or explosive vapors are suspected to be present. Prior to any subsurface investigation activities, air monitoring should be conducted to establish background levels for total organic vapors using a PID or FID. All work activity must STOP where tests indicate the concentration of flammable vapors exceeds 10% of the LEL, and the source of vapors must be investigated.

Vacuum-assisted soil excavation utility clearance will not be used in areas know to contain hazardous vapors or petroleum hydrocarbons unless the equipment to be used is suitable for flammable/explosive atmospheres. There is a significantly increased risk of explosion if these materials are encountered while performing this type of utility clearance. Cautions will be performed, as identified below.

Cautions

Many vacuum systems that are commonly used for utility clearance are considered unsuitable for use for environmental investigation sites. Most vacuum units are “Not for use with Hydrocarbons, Explosives, Corrosive or Toxic Material,” and are “Not Intrinsically Safe.”

Given that many units and associated tanking are not explosion-proof, the following steps will be considered prior to using vacuum- assisted utility clearance units where soils could be impacted with petroleum hydrocarbons or flammable vapors.

1. Request from the manufacturer and/or the contractor doing the work to supply manufacturers’ documentation and specifications for use of the unit at environmental sites.

2. Request documentation that the unit is intrinsically safe and may be used in areas where petroleum hydrocarbon may be present.

3. Obtain the procedures for grounding portable units to discharge potential static electricity during operation.

4 If none of the above are available, then hand auger instead and do not use vacuum-assisted methods.

Exhibit E - Emergency Action Plan Guidelines

When work activities result in the contact or compromise of a utility line, an appropriate response is critical to prevent injury, death or significant property damage. Although circumstances and response vary depending on site specific conditions, the following guidelines provide information that is factored into emergency action planning associated with utility damage. In any event, emergency planning is coordinated with the entity that owns the utility and the client prior to the start of work. This planning and the appropriate response actions are documented in the project health and safety plan and reviewed with all field staff.

Contact with Above or Underground Electric

Contact with above ground or underground electric lines may result in the equipment being energized. Field personnel do not assume rubber tires on equipment are insulating the equipment from the ground. For underground electric strikes, contact with the line may not be immediately noticeable but indications of a strike include: power outage, smoke, explosion, popping noises, or arching electricity. If contact with an electric line is made or is suspected, the following guidelines are followed:

- Under most circumstances, the equipment operator or any worker on a seat of the equipment should stay on the equipment. These workers should not touch anything, especially metal, on the equipment.

- If it is determined that the equipment should be vacated due to a life threatening circumstance, the worker(s) should jump clear as far as possible from the equipment. When jumping keep both feet together and hop away to a safe distance after landing on the ground. Do not use hand holds or touch any part of the equipment when preparing to jump off.

- Workers on the ground should move away from the equipment.

- Keep others away from the equipment and the area.

- If anyone is injured and in contact with the line or equipment, any attempted rescue should be performed with extreme caution. Only use long, dry, clean, unpainted pieces of wood or fiberglass pole or long dry, clean rope to retrieve the victim. Perform first aid/CPR only after the victim is sufficiently clear from the electrical hazard.

- Notify the electric utility or the client as appropriate for the site. Call 911or the client's emergency response phone number, as appropriate, for any serious injury or any situation that may result in fire or other hazard that could produce injury or property damage.

Natural Gas

If a natural gas line of any size is compromised, immediately:

- Shut off the equipment and remove any other ignition sources.
- Evacuate the area as quickly as possible.
- DO NOT attempt to turn off any gas valves.
- Call 911 or the designated client emergency response number as appropriate.
- Call the gas utility, if site response is not controlled by the client.
- Do not return to the area until permitted by the utility or by the approved client emergency response personnel, as appropriate.

Water Lines (all types)

Compromised water lines may rapidly become a significant hazard especially if the line is under considerable pressure. Ruptured pressurized water lines may undermine and wash out unconsolidated materials beneath equipment or structures causing them to become unstable. If a pressurized water line is ruptured, the following guidelines should be followed:

- Promptly shut off all equipment.
- Lower masts or other high extension components of the equipment.
- Evacuate area and call the water utility or client emergency response number, as appropriate.
- Turn off the water if the valve location is known and on the site property.
- If potable water lines have been ruptured, attempt to divert any flow away from structures prone to being flooded. Use caution and keep a safe distance from the line break since the ground surface may be compromised.
- For raw process water or other water of unknown quality, do not attempt to divert or contain. Avoid skin contact or accidental ingestion of any water.

- When returning to the area of the break, survey the area for signs of compromised land surface (cracks in asphalt or concrete, depressions in ground, observations of undercutting, etc.) and avoid moving any equipment until these conditions are repaired or resolved.

Sewers (all types)

Use the same general guidelines for water lines when responding to compromised sewers. If a sanitary sewer is compromised additional guidelines should be followed to avoid contracting any bacterial illnesses. These include:

- Promptly evacuate the area.
- Avoid contact with any sewage material.
- If contaminated, promptly was with soap (antimicrobial) and water and promptly change impacted clothing.
- If sewage is accidentally ingested or infiltrates any breach of the skin or enters the eyes, seek medical attention as a precautionary measure.
- Decontaminate equipment with commercially available disinfectant solutions or a 10% chlorine bleach solution.

Communication Lines

Contact and compromise of communication lines are generally considered more of a financial concern than a concern associated with injury. However, eye damage may occur if looking into the ends of a cut fiber optic line. Do not look into the ends of fiber optic lines or other communication lines of unknown type. Promptly contact the communication company owning the line.

Product Lines and Underground Storage Tanks (all types)

Compromise of a product line or underground storage tank (UST) requires immediate action to mitigate impact to the environment. For gasoline stations and similar facilities the following guidelines should be followed during a line or UST breach:

- Immediately shut down equipment and turn off the emergency shutoff switch for the facility dispensers.

- If there are no injuries, attempt to contain any flowing product using absorbent materials and/or by physically pumping or bailing product out of the breached area.

- If product is flowing on the surface away from the break area, attempt to protect downgradient storm drains, sewer drains, and surface water features form impact of the petroleum product using any readily available materials.

- If the bottom of a UST has been breached, immediately contact a pump truck to remove product from the affected UST.

- For releases involving diesel fuel, care will be taken to avoid any situation where diesel may be injected into the body from impalement by coated nails, wood splinters, etc. If diesel is injected into the body, seek prompt medical attention, even if no apparent symptoms of a problem exist.

- Clear area and arrange for prompt repair.

For industrial sites with lines or USTs containing multiple products with varying hazards, similar guidelines may be followed as above if the material encountered is known and workers have a fundamental understanding of the hazards associated with the material. Upon discovery of a line or UST breach due to work activities at these sites:

- Immediately stop work and notify the client representative or call the client designated emergency number. For abandoned sites call 911.

- If the material is not known, promptly evacuate the area and let HAZMAT teams deal with the release.

ARCADIS

Attachment C

Blood Borne Pathogen Standard Operating Procedure

Approval Signatures

Prepared by: Greg Ertel, CSP, CIH Date: July 2004

Reviewed by: Charles P. Webster, CSP Date: 30 November 2005
(Technical Expert)

Reviewed by: Date: 11/30/05
(Legal Division Reviewer)

Reviewed by: Date: 11/30/05
(Health and Safety Officer)

Standard Operating Procedure: Bloodborne Pathogens

I. Scope and Application

BBL is committed to operate in a manner that will protect the health and safety of its employees and abide by applicable state and federal agency regulations. In order to protect employees of the Firm from the hazards posed by bloodborne pathogens (BBP), this procedure presents health and safety requirements for personnel who may be exposed to these hazards, particularly voluntary first-aid and cardiopulmonary resuscitation (CPR) care providers. In order to meet the requirements of Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulation (CFR) 1910.1030, at least one person on a project site will be adequately trained in first-aid and CPR and in the requirements of the Bloodborne Pathogens Standard as listed in 29 CFR 1910.1030, and in the contents of this procedure. This procedure serves as BBL's Exposure Control Plan.

II. Personnel Qualifications

The following outlines the **responsibilities** of various personnel:

Officers/Division Heads/Project Managers

1. Verify that affected staff have received the appropriate training and equipment and are properly identified and addressed within a project work plan, site health and safety plan (HASP), and/or other project documents.

2. Verify that employees designated as first-aiders have experience, training, and authority to fulfill the requirements of the position.

3. Verify that first-aid and personal protective equipment (PPE) are available for use by affected employees.

Corporate Health and Safety (CHS)

1. Review and revise this procedure as required to meet regulatory requirements.

2. Provide technical assistance regarding BBP and universal precautions.

3. Audit project-specific excavation activities for compliance with this procedure.

4. Review and revise, as appropriate, site-specific HASPs to include requirements for first-aid, emergency response, and activities that could result in exposure to BBP.

Corporate Training Division

1. Provide certified Red Cross (or equivalent) approved First-aid, CPR, and BBP training.

2. Maintain training records and distribute training certification documents.

Affected Employees: Employees Trained in First-Aid and CPR or with Potential Exposure to BBP (working in a sanitary sewer or other setting with potential exposure)

1. Must be capable of recognizing existing or predictable hazards and working conditions associated with BBP exposure.

2. Understand universal precautions and all safety requirements outlined in this SOP and 29 CFR 1910.1030 to be utilized during activities with potential exposure to BBP.

3. Attend annual CPR and BBP refresher training.

4. Notify CHS of any potential BBP exposure incidents and receive appropriate vaccinations or document refusal.

III. Equipment List

The following are specific PPE items that shall be utilized when administering first-aid, rescue breathing, CPR, or other activities which may present a potential exposure to BBP (inspect all PPE prior to use to ensure it is intact and in good working order):

- Hand protection (i.e., latex or nitrile surgical gloves). Do not reuse gloves once removed; use different gloves for each patient/activity. After use, remove gloves from top to bottom inside-out, not allowing unprotected skin to contact the exterior of the gloves;

- Eye protection (i.e., safety glasses, goggles); and

- Appropriate mouthpiece or ventilation barrier device.

IV. Cautions

All employees have the potential for exposure to BBP. BBL policy requires employees that work on HAZWOPER sites or are involved in Confined Space Entry will receive First-Aid and CPR (FA/CPR) training. All employees that are FA/CPR trained must also receive BBP training.

Any employees that believe they may be at risk of exposure to BBP must follow the requirement of this procedure.

V. Health and Safety Considerations

Means of Transmission

The primary activity that may expose site employees to BBP is the response and care of on-site personal injuries or decontamination of equipment/surfaces contaminated by blood or other potentially infectious materials during an incident. Employees could be subject to BBP during rendering of first-aid or CPR by accidental exposure due to:

1. Punctures through the skin with a contaminated sharp object;

2. Contact with blood or blood-contaminated objects which may permit absorption through open or broken skin (i.e., cuts, scratches, rashes); or

3. Blood splashes to the eyes, nose, or mouth.

Workers can reduce their risk of exposure by implementing the work practices outlined in this plan before, during, and after responding to emergency medical incidents involving personal injuries.

VI. Procedure

This procedure is designed to limit occupational exposure of site workers to blood materials and body fluids which may contain infectious pathogenic agents. The contents of this procedure are intended to protect employees trained in first-aid and CPR who may administer medical assistance to site workers. The following definitions apply to this procedure:

Bloodborne Pathogens

BBP are agents (i.e., bacteria, virus, fungi) found in blood, blood components, and certain body fluids. Exposure may result from direct contact with blood and body fluids, or contact with materials, objects, or surfaces that have had contact with blood or body fluids. BBP are capable of causing human disease or death to unprotected people who come into contact with blood or blood-affected items. Diseases caused by BBP include, but are not limited to, hepatitis B virus (HBV), human immunodeficiency virus (HIV), hepatitis C, malaria, and syphilis.

Exposure

Any contact with blood or body fluids, or contact with equipment/surfaces contaminated by blood or other potentially infectious materials, is considered exposure. Significant exposure involves contact or absorption of blood or blood-contaminated objects through open or broken skin (i.e., cuts, scratches, rashes); punctures through the skin with a contaminated sharp object; or blood splashes to the eyes, nose, or mouth.

Hepatitis B Virus (HBV)

HBV is the major bloodborne pathogenic hazard that first-aid/CPR care providers are likely to encounter. HBV can remain infectious for up to 10 days, even in dried blood. The virus adversely affects 8,000 to 10,000 workers annually, resulting in approximately 200 deaths each year.

HBV Exposure Symptoms

Hepatitis means "inflammation of the liver" and can cause severe liver damage or cirrhosis. Exposure symptoms include fever, fatigue, nausea, vomiting, muscle aches, loss of appetite, and jaundice (yellowing of the eyes or skin). Hepatitis diagnosis is difficult because some symptoms are similar to the flu and may remain mild for an extended period of time. Presently, no cure exists for hepatitis. It can be prevented with a vaccination.

Human Immunodeficiency Virus (HIV)

HIV attacks and deteriorates the body's immune system and eventually weakens it to the point that infection sets in, causing the disease Acquired Immune Deficiency Syndrome (AIDS). HIV is transmitted through contact with blood and body fluids. HIV is not transmitted by touching or working with people who are HIV-positive.

HIV Exposure Symptoms

HIV can lead to suppression of the immune system to a degree sufficient to permit the onset of neurological problems, cancer, pneumonia, and death. People may carry the virus for many years without experiencing any symptoms. Upon development, symptoms may include weight loss, skin lesions, dry cough, fever, fatigue, diarrhea, or swelling of the lymph glands. Presently, no cure exists for HIV or AIDS, and no vaccination is currently available.

Voluntary First-aid Provider

An individual trained in first-aid/CPR who may be called on to render first-aid/CPR.

Procedure Implementation

All BBL employees will implement the following controls during work activities that may result in exposure to BBP or infectious materials.

Protective Measures

The establishment of work practice controls is an integral part of an effective exposure control plan. These work practices are designed to protect employees from reasonably foreseeable occupational exposures to BBP from blood and other potentially infectious material. The work practice controls outlined in this section are applicable to the administration of first-aid in emergency situations and subsequent cleanup.

Universal Precautions

Universal precautions is an approach to infection control which operates on the assumption that all human blood, bodily fluids, and sharps or other medical waste are to be treated as if they are known to be contaminated with HIV, HBV, or other infectious diseases. Universal precautions shall be implemented whenever there exists a foreseeable potential for contact with blood or bodily fluids.

Work Practice Controls

Work practice controls shall be instituted whenever foreseeable potential contact with, or exposure to, blood and bodily fluid exists. Examples of situations in which these controls are to be implemented include, but are not limited to, accidents or injuries in which administration of first-aid is required; application of bandages to minor cuts and abrasions of another person; and contact with sores, wounds, or broken skin. Working in a sanitary sewer or other project sites may also present potential exposure to BBP.

Since many work sites are in remote locations, providing hand-washing facilities is difficult. For instances where hand-washing facilities cannot be provided, BBL will provide employees with antiseptic towelettes or an antiseptic hand cleaner and clean cloth or paper towels.

The following are specific work practice controls that shall be implemented to control exposure to BBP:

- Open wounds or cuts will be promptly bandaged.
- Wash hands and face as soon as possible after administering first-aid or CPR. If wash facilities are not readily available, disposable one-time use towelettes are acceptable.
- PPE must be removed immediately upon leaving the work area and placed in an appropriate container for storage, washing, decontamination, or disposal.
- No eating, drinking, or smoking is allowed in any work area where a potential exists for occupational exposure to BBP.
- Non-disposable equipment or materials that have or may have blood or infectious fluid contact must be washed immediately after their use. A fresh solution of bleach and water (1 to 10%) is recommended for proper decontamination.
- Any clothing that comes in contact with blood or infectious fluids shall be removed as soon as possible after administering first-aid or CPR. Clothing must be placed in an appropriate container for storage until it can be laundered.
- No personal clothing that comes in contact with blood or infectious fluids shall be laundered off-site.
- Equipment first-aid kits shall contain two pairs of surgical gloves and CPR mouth pieces.

If a BBL employee believes they have been exposed to BBP through administration of first-aid/CPR or contact with infectious materials, they will be offered a Hepatitis B vaccine at no cost. All incidents of potential exposure should be reported on the BBL Near-Miss/Incident Investigation Form.

Minimization of Contact

Direct contact with blood and bodily fluids should be kept to an absolute minimum, as required in a particular situation. In situations where direct contact is likely, PPE shall be worn to help prevent infection.

Based on professional judgment, an employee may choose to temporarily forego the use of PPE if he determines that the use of PPE will further jeopardize his well-being or that of the injured worker. This limited application must be carefully evaluated by the employee.

VII. Waste Management

Disposable items that have or may have blood contact must be bagged separately from other trash. These wastes must be placed in leak-proof containers or bags and labeled as a "BIOHAZARD."

Wastes used in medical emergency treatment (i.e., gloves, towels, gauze) must be disposed in an infectious waste container(s). The container will be replaced as needed; if the outside of the container becomes contaminated, an additional outside container will be used.

The waste will remain onsite in an approved container(s) until an approved disposal facility capable of receiving medical wastes is identified. Disposal of the infectious waste container(s) shall be in accordance with applicable local, state, and federal regulations.

VIII. Data Recording and Management

Documentation of the exposure incident shall be recorded as soon as possible and include the route(s) of exposure, circumstances surrounding the incident, identification of the source individuals, and identification of potentially exposed persons. Additionally, each incident involving voluntary first-aid providers shall be placed on the "first-aid incident list" attached to the location OSHA Log of Occupational Injuries and Illnesses.

Medical records for employees must include documentation of HBV vaccination status, medical follow-up, post-exposure testing, and a medical professional's written evaluation.

IX. Quality Assurance

Incident Reporting

An incident that occurs as a result of rendering emergency medical care will be reported to the Health and Safety staff and recorded on the OSHA 300 Log as OSHA if applicable.

X. References

Code of Federal Regulations 29 CFR 1910.1030 – Bloodborne Pathogens.

ARCADIS

Attachment D

Defensive Driving Procedure

1. POLICY

ARCADIS considers motor vehicle operation a risk that demands strict management to lead to accident prevention and the resultant decrease in employee injuries, lost productivity and insurance costs to be a vital key in accomplishing our company's vision. Motor vehicle accident prevention involves the safety and well-being of our employees as well as the general public.

To that end, it is the policy of ARCADIS that defensive driving skills and techniques be implemented by all of its employees at all times during the operation of ARCADIS vehicles, rental vehicles or personal vehicles used for company business.

2. PURPOSE AND SCOPEL

2.1 Purpose

2.1.1 ***Purpose Statement*** **-** ARCADIS is committed to providing a healthy and safe work environment for our employees, subcontractors, clients and visitors. To this end, ARCADIS embraces this Health and Safety (H&S) Defensive Driving Policy and Procedure.

2.1.2 ***Providing Standard Practices*** - This policy and the accompanying procedures provide standard practices with regards to defensive driving as required by employees as it relates to motor vehicle operation during the conduct of ARCADIS business.

2.2 Scope

2.2.1 ***Business Driving*** - This Defensive Driving policy and associated procedures apply to the operation of any motor vehicle during the conduct of ARCADIS business. It applies to every employee, temporary agency employee and contract employee operating an ARCADIS, rental or personal vehicle used for company business.

2.2.2 ***Area Involved*** - This policy applies to the operation of motor vehicles for company business in any country in which ARCADIS employees or temporary agency employees are working.

3. DEFINITIONS

ARCADIS Vehicle: Any vehicle owned or leased by ARCADIS.

ARCADIS Driver: Any employee, temporary agency employee, or contract employee who drives an ARCADIS vehicle, rental vehicle, or personal vehicle for business reasons whether the use of the vehicle includes operation from the local office or for travel while away from the local office.

ARCADIS Employee: Any full-time, part-time, temporary or as needed employee, and interns.

Business Use of ARCADIS, Rental, or Personal Vehicle: For the purposes of this policy, examples of business use of an ARCADIS, rental, or personal vehicle includes but is not limited to: attending meetings; driving to and from a client location; driving to dinner while out of town on

business; and driving to an office supply store to pick up office supplies. Use of the vehicle for business would not include personal use as described below.

HSP: Health & Safety Procedure

MVR: Motor Vehicle Report.

Personal Use of ARCADIS Vehicle or Rental Vehicle: For the purposes of this policy, examples of personal use of an ARCADIS Vehicle or Rental Vehicle include but are not limited to: driving to dinner with a non-business-related person(s) in the vehicle; driving for the purposes of personal entertainment; using an ARCADIS Vehicle or Rental Vehicle for staying over period of time not required for business (e.g., staying over a weekend to visit friends, etc.).

Rental Vehicle: For the purposes of this policy, any motor vehicle rented from an established rental car company for ARCADIS business whether the use of the vehicle is operated from the local office or for travel while away from the local office.

Temporary Agency Employee: A temporary agency employee utilized by ARCADIS for temporary work. A temporary agency employee may become an ARCADIS employee after completing the ARCADIS employment process.

4. RESPONSIBILITIES

4.1 *Corporate H&S Department* – Have the responsibility for: Communicating the policy and procedure requirements in this HSP with all offices within ARCADIS – US. They are also responsible for ensuring that offices are aware of this HSP. They also ensure this HSP is being implemented effectively.

4.2 *Health and Safety Managers and Specialists* – Are responsible for facilitating the policy and procedure requirements in this HSP for providing "hands-on" assistance to ARCADIS staff to ensure this procedure is implemented appropriately.

4.3 *ARCADIS Managers and Supervisors (including project and task managers)* – Provide oversight management for the H&S of employees in their respective operations, and ensure that the HSP is being implemented. In addition, they assure that appropriate time is provided to facilitate the implementation of this HSP

4.4 *ARCADIS Employees* – Have the responsibilities to adhere to this HSP and to communicate H&S concerns, issues and questions to their supervisor or to Health and Safety staff. In addition, all employees have the responsibly to use the TRACK process prior to any activity and follow all ARCADIS; federal, state, provincial, and local jurisdiction regulatory; and client requirements

5. PROCEDURE

5.1 General Procedure and Requirements

ARCADIS employees, temporary agency employees, and contract employees who drive an ARCADIS vehicle, rental vehicle or personal vehicle for business will maintain a valid

driver's license that is free from any driving restrictions or suspension. An ARCADIS employee, contract employee, or temporary agency employee who is asked to drive for business purposes in any type of vehicle, shall notify their supervisor or ARCADIS contact by the next business day if:

- Their license is suspended, revoked, or restricted ; and
- They receive a moving violation while driving for ARCADIS-related business.

In the case that one of these two issues occurs, the employee's supervisor or ARCADIS contacts ARCADIS Human Resources. Human Resources, in cooperation with Corporate H&S and legal, as deemed necessary, evaluates the employee's driving status (especially in instances of license suspension, revocation or restriction) and, as appropriate, corrective action recommendations are made.

All ARCADIS employees, temporary agency employees and contract employees driving on ARCADIS business will:

- Wear seat belts at all times;
- Operate and license the vehicle in accordance with applicable laws;
- Drive defensively as learned through training, education, and experience;
- Exercise caution when taking any prescription or over-the-counter medication that may cause drowsiness or an altered mental state;
- Have headlights on at all times, even during daylight hours;
- Do not use controlled substances, illegal drugs, or alcohol while driving on ARCADIS business;
- Do not drive in a manner that could be deemed reckless or aggressive by other drivers; and
- Do not use radar/laser-type detectors.

5.2 Comments on My Driving? Program

Along with continuing to reinforce the Smith System defensive driving techniques and the use of the LPO process, ARCADIS will be soliciting comments on our driving so that we can provide both positive feedback and develop solutions to help eliminate at-risk driving behaviors before an incident occurs using a "Comments on My Driving?" program.

The program entails the placement of a "Comments on My Driving?" bumper sticker to ARCADIS-owned and leased vehicles. The sticker contains an 866 toll-free number that the public can call to comment on our driving. The number will be checked on a daily

basis by H&S. Callers will be asked to provide the ARCADIS license plate number and a description of the positive or at-risk driving behavior observed.

When a call is received, the driver's supervisor will be notified and required to discuss the call with the employee, regardless of the nature of the comment. An investigation will be initiated as follows:

- If the employee denies the actions described in the call and the investigation is inconclusive or if it is determined that the call is not legitimate, the matter will be closed. The call will be logged showing the outcome and any action taken.

- If the employee agrees or confirms the actions described, the call will be logged and:

  - The employee will be recognized commensurate with the event if it is a positive comment.

  - If the issue reported is related to at-risk behaviors, the event will be investigated per the Incident Investigation HSP (ARC HSMS010) as any other near miss would be investigated with the identification of a root cause(s) and appropriate solutions.

- The situation will also be investigated per the Incident Investigation HSP (ARC HSMS010) if an employee is the subject of multiple calls related to at-risk behaviors, even if denied.

- In addition, similar to other H&S or company policy violations, the supervisor will consult with Human Resources about other actions that may be appropriate including possible disciplinary action.

5.3 General Defensive Driving Training and Education Requirements for All Employees

All employees with an active driver's license shall complete the on-line defensive driving training course as designated by Corporate H&S or an equivalent course as approved by Corporate H&S every two years.

If a client requires classroom or hands-on drivers' training, Corporate H&S will arrange for this to be provided. The on-line training will not be required for those employees, who attend the classroom session.

Additional training may be provided or required per the request of an employee's supervisor or Corporate H&S, and as required by a client

5.4 Defensive Driving Training and Education Requirements For New Hires

Human Resources reviews the motor vehicle records (MVRs) of all new hires. If the MVR is acceptable, the new hire process proceeds as indicated below. If it is determined that the MVR is poor or borderline, the hiring manager works with Corporate H&S,

Human Resources and legal, as necessary, to determine their employment and driving status with the company.

New hires with an active driver's license shall complete the on-line defensive driving training course as designated by Corporate H&S or an equivalent course as approved by Corporate H&S within 10 days of hire. If the new hire is approved to drive for the company based on the MVR and the new hire will drive 10 days or more per year for the company business, the following process is implemented to determine additional driving requirements.

If the new hire will only drive sedan-type vehicles including sport utility vehicles (SUV) under normal on-road driving conditions, the new hire is required to:

- Complete the online training described in Section 5.3 and before they are permitted to drive on company business unless approved for limited driving by their supervisor;
- Within one month of employment complete:
  - An on-road Supervisor's Check Ride with their supervisor or designated "expert", using the Supervisor Check Ride form in Exhibit 1; or
  - A Loss Prevention Observation (LPO) with their supervisor or designated "expert" once the Loss Prevention System [LPS] is implemented at the office location; (see the LPS database for a driving LPO form)
- If the person does not successfully complete the Check Ride or LPO per the observer's and supervisor's observations and feedback, it is the hiring manager's discretion to require the successful completion of a one-day, hands-on defensive driving training course within one month of the Check Ride or LPO. It is also the manager's decision to allow the driver to continue to drive on company business until completion of the hands-on course. If approved, the person may drive on company business until the hands-on course can be scheduled and completed. If not approved, the person is not permitted to drive on company business before the hands-on course is scheduled and completed;
- Subsequent Check Rides or LPOs may be completed following the hands-on training at the discretion of the manager; and
- If the person does not successfully complete the subsequent Check Rides or LPOs, the manager reviews the situation and determines the next steps working with Human Resources as appropriate.

If the new hire will be driving vehicles that include, but not limited to, SUVs that are used in off-road field conditions, pick-up trucks, delivery trucks, utility trucks, or non-family type vans, the new hire will be required to:

- Complete the online training described in Section 5.3 and before they are permitted to drive on company business unless approved for limited driving by their supervisor;

- Within the first ten days of employment complete:
  - An on-road Supervisor's Check Ride with their supervisor or designated "expert", using the Supervisor Check Ride form in Exhibit 1; or
  - An LPO with their supervisor or designated "expert" once the LPS is implemented at the office location; (see the LPS database for a driving LPO form.)
- If person successfully completes the Check Ride or LPO per the observer's and supervisor's observations and feedback, the operations manager will make the decision as to whether the person is permitted to drive a pick-up, van, or other large vehicle prior to the completion of the hands-on training. If approved by the manager, the person may drive on company business until the hands-on course can be scheduled and completed. If not approved, the person will be permitted to drive only sedan-type vehicles and SUVs used under normal driving conditions on company business before the hands-on course is scheduled and completed. If the person does not successfully complete the Check Ride or LPO, it is the hiring manager's decision to allow the driver to continue to drive on company business until completion of the hands-on course;
- Successfully complete a one-day, hands-on training course within the first six weeks of employment with additional steps as noted below;
  - If the employee has had their license for less than one year, the supervisor plans and schedules a Check Ride or LPO within one week after the hands-on course. Supervisor may require additional Check Rides or LPOs;
  - Additional Check Rides or LPOs on all drivers may be completed following the hands-on training at the discretion of the manager; and
  - If the person does not successfully complete subsequent Check Rides or LPO, the manager will review the situation and determine the next steps working with Human Resources as appropriate.

If the new hire has a foreign license or has had their foreign license converted to a U.S. license, the new hire will be required to:

- Complete the online training described in Section 5.3 and before they are permitted to drive on company business unless approved for limited driving by their supervisor;
- Successfully complete a one-day, hands-on training course within the first six weeks of employment with additional steps as noted below;
  - If the employee has had their license for less than one year, the supervisor plans and schedules a Check Ride or LPO within one week after the hands-on course. Supervisor may require additional Check Rides or LPOs;

- Additional Check Rides or LPOs on all drivers may be completed following the hands-on training at the discretion of the manager; and

- If the person does not successfully complete subsequent Check Rides or LPO, the manager will review the situation and determine the next steps working with Human Resources as appropriate.

Refer to the flowchart in Exhibit A for the decision-making process for new hires.

5.5 Additional Defensive Driving Training and Education Requirements for Existing Employees

In addition to the training as required in Section 5.3, existing employees complete hands-on defensive driving training at the discretion of their supervisor or manager based on one of two conditions.

- If a manager or supervisor determines that the driving hazards faced by the employee require hands-on training to assist in the prevention of motor vehicle accidents.

- If the results of an LPO or Check Ride conducted by a supervisor or manager indicate that the employee requires additional training.

5.6 Additional Defensive Driving Training and Education Requirements for Employees Involved in a Motor Vehicle Accident

Any ARCADIS employee involved in a motor vehicle accident while driving on company business, may be required to complete hands-on defensive training. This training may be repeated as often as necessary based on the manager's discretion in cooperation with Corporate H&S and Human Resources.

Additional training may not be provided if it is determined by the supervisor in cooperation, as necessary from HR, legal, and/or Corporate H&S, that the employee will no longer be permitted to drive on company business.

5.7 Sources for On-Line and Hands-On Defensive Driving Training

The on-line defensive driving training or equivalent training is provided by, or based on, a nationally recognized defensive driving training company such as the Smith System, National Safety Council, or other recognized provider as approved by Corporate H&S.

Hands-on defensive driving training is provided by, or based on, a nationally recognized defensive driving training provided such as the Smith System, National Safety Council or provider approved by Corporate H&S. The trainer must be certified in the program upon which they are instructing and can be either internal or external to ARCADIS.

5.8 Additional Training and Education for Other Driving Conditions

Supervisors, managers, or H&S staff determines additional training for employees driving under special conditions such as towing trailers, riding and operating all-terrain vehicles (ATVs) or other non-routine driving conditions. Training is coordinated and approved by Corporate H&S and the ARCADIS training department.

5.9 Driving Distractions and Cell Phone Use While Operating a Motor Vehicle

ARCADIS drivers avoid distractions while they operate motor vehicles and the vehicle is moving. These distractions include such things as eating, drinking, reading maps or other information, operating the radio, and using cell phones. Specific requirements regarding cell phones are as follows:

- The safest driving occurs when drivers can focus their full attention on operating the vehicle and the surrounding conditions. To minimize driving distractions, any use of cell phones by ARCADIS employees while operating a motor vehicle is not recommended and highly discouraged. It is expected that all ARCADIS drivers will use the TRACK process to assist in assessing the safety of using a cell phone while driving.

- Using a cell phone or Blackberry for sending/reading text messages, or reading, preparing or sending emails is strictly prohibited while driving.

- The ARCADIS Vehicle Use Policy provides the ARCADIS policy on the use of cell phones while operating a motor vehicle. The policy should be reviewed for employees' guidance and the minimum precautions to use to advance the safe use of cell phones while driving. In summary, this policy allows cell phone use only where it is not banned by a client or regulatory requirement, and only if it is hands free. This policy can be reviewed in the Employee Handbook on the Human Resources intranet page.

- Supervisors and managers are permitted to apply more stringent requirements regarding cell phone use (i.e., no cell phone use at all while driving) based on client, business, or regulatory requirements.

5.10 Additional Required Defensive Driving Procedures

ARCADIS requires additional defensive driving techniques to assist in the elimination or minimization of motor vehicle accidents. These required techniques include:

- When a second ARCADIS employee is available, and where it is safe to do so, all vehicle backing operations will require the use of a spotter to assist with the backing operation.
- To assist drivers in their potential lack of familiarity with the location in which they are driving, one of the following will be utilized by drivers traveling to unfamiliar locations:
  - The use of GPS systems in rental cars such as Hertz Never Lost
  - Pre-Trip Route Planning through the use of Google Maps or MapQuest

- Development and use of a Journey Management Plan (this is required by some clients).

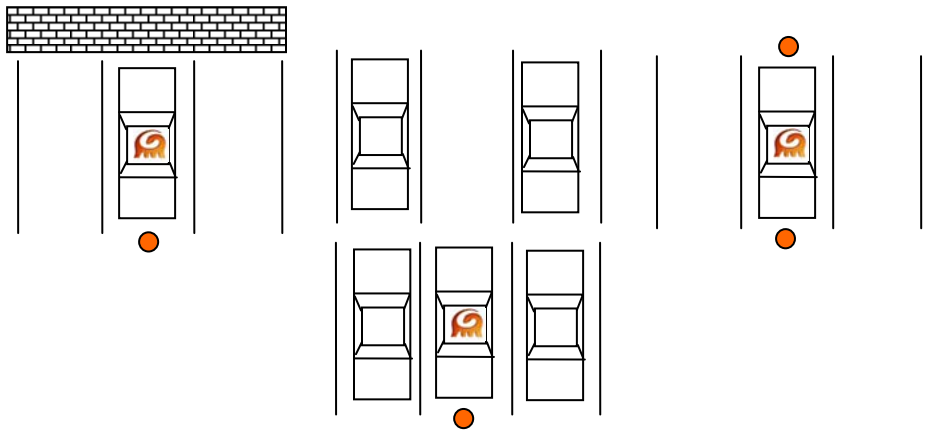
5.11 Cone Placement and Retrieval to Encourage Visual Inspection Around Vehicle

To ensure that the area around a parked vehicle is clear of obstacles, all company owned or leased trucks will be equipped with two to four traffic cones that will be placed around the vehicle whenever the driver leaves the vehicle unattended (when the vehicle is parked and the occupants are outside of the vehicle regardless of distance or visual site); the cones will be placed in the configurations shown on the following page. Upon departing in the vehicle, the driver will pick up the cones and look around the vehicle before moving.

Employees will use TRACK and place cones around vehicles in a manner that promotes driver awareness of vehicle surroundings and is appropriate to conditions encountered. The following general guidelines will help facilitate adherence to this program.

Parking Lots:

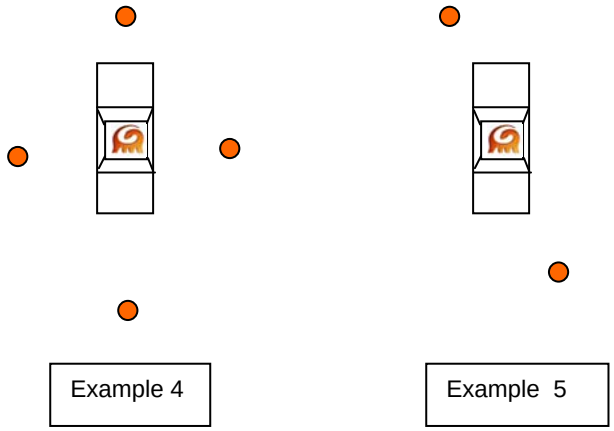
- At a minimum, one cone will be placed at the end of the vehicle in the direction of movement from the parking place when only one direction can be driven (Example 1).
- Parking lots with facing parking spaces, only deploy cone on the roadway end of vehicle (Example 2).
- Two cones will be required (one at each end of the vehicle) if potential movement can be from a forward or backing direction (Example 3)



Example 1 Example 2 Example 3

Project Sites:

- It is recommended that one cone be placed on all four sides of the parked vehicle at a distance sufficient to prevent trip hazards during the course of normal work around the vehicle (Example 4). If only two cones are available, the placement of the cones should be as shown in Example 5.



Example 4

Example 5

- Cone placement is not required for cars used for non- field work purposes.
- Use TRACK for all cone placement activities:
  - DO NOT place cones in parking lots in a manner that could cause a trip hazard to employees or the public.
  - DO NOT place cones in a manner that would affect or impede the flow of traffic, unless part of a traffic control program.

Offices and/or Projects should consider the purchase of exterior cone stands (mount on the vehicle bumper) for easy cone access when complying with this program. Cones should be orange color and have a minimum height of 18 inches. These cones may be procured from existing office stock or are available for purchase on the ARCADIS Section of the Wise Safety and Environmental website.

6. REFERENCES

- ARCADIS HSP - ARC HSMS011 – Incident Reporting and Investigation
- ARCADIS HSP - ARC HSMS015 – Root Cause Analysis and Solutions Development

- ARCADIS HSP - ARC HSMS006 – Health and Safety Training and Competence
- ARCADIS Vehicle Safety Policy, Employee Handbook

7. RECORDS

- Training Records for completion of training
- Completed LPOs or Check Ride forms
- Completed Incident investigations and root cause analyses

8. APPROVALS AND HISTORY OF CHANGE

Approved By: Mija A. Coppola, Director, H&S Compliance Assurance and LPS

History of Change

Revision Date	Revision Number	Reason for change
26 March 2007	01	Original document
18 August 2007	02	Change in required on-line defensive drivers training
22 October 2007	03	Changing over to new template format and addition of the “Comments on My Driving?” program
21 January 2008	04	Change to new template; change to 2008 organization job titles; change to prohibit texting/emailing while driving
13 June 2008	05	Addition of Sections 5.10 and 5.11 on other defensive driving techniques and cone placement.
6 October 2008	06	Clarified who is required to complete online training in Section 5.3 and modified section on when hands-on defensive driving is required after an accident.

Exhibit 1 – Defensive Driving Training and Education for New Hires

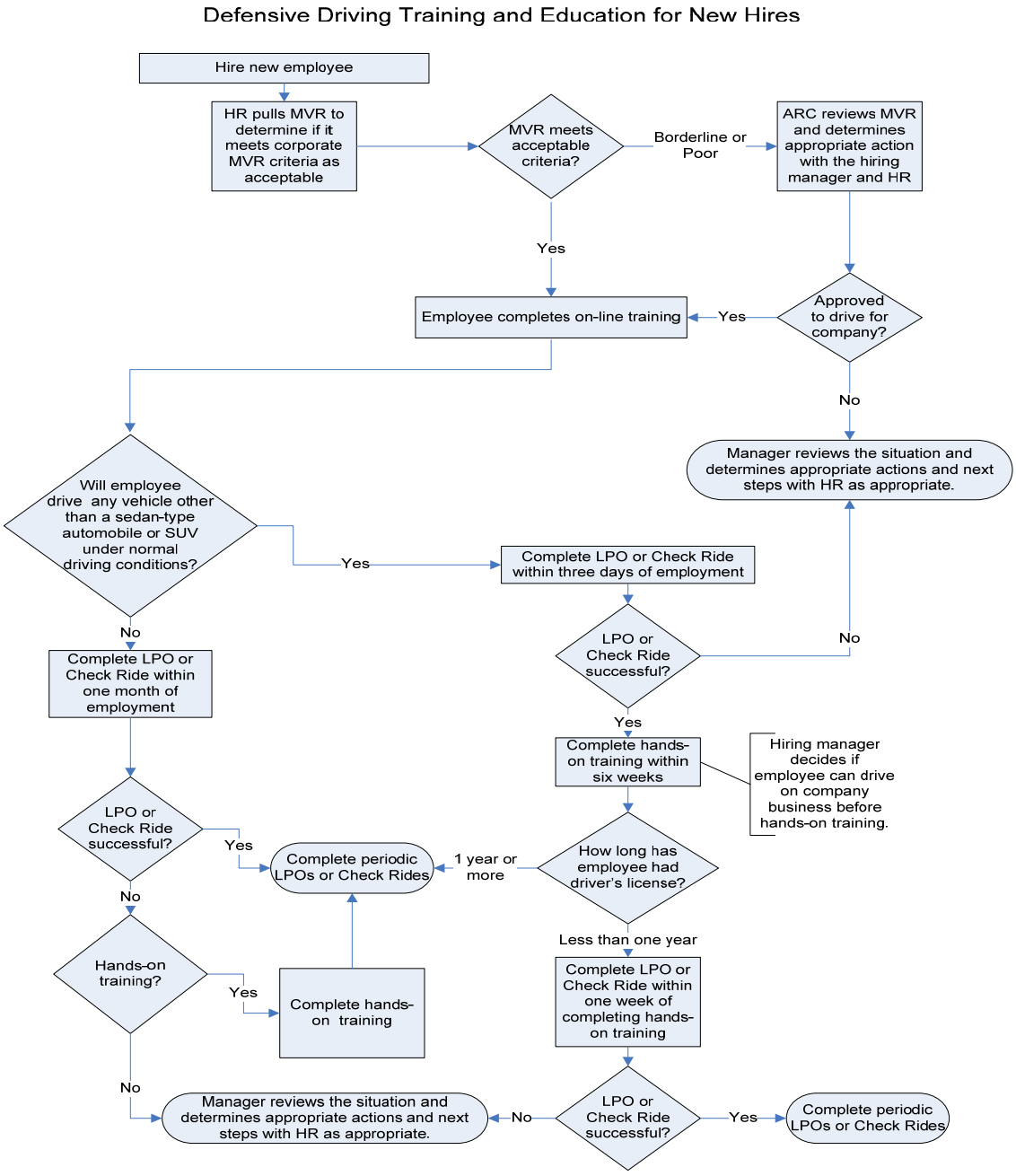


Exhibit 2 – Supervisor's Check-Ride Checklist

Driver's Name _____ Supervisor's Name _____

Date & Time _____ Type of Vehicle _____ Check-ride Number _____ In a Series of _____

	Yes	No	N/A
1. Uses Seatbelt?	☐	☐	☐
2. Drives within speed limit?	☐	☐	☐
3. Maintains proper speed for conditions?	☐	☐	☐
4. Uses "farsighted" seeing skills to prevent last minute surprises?	☐	☐	☐
5. Drives in lane offering least hazards?	☐	☐	☐
6. Maintains adequate space cushion while driving?	☐	☐	☐
7. Keeps eyes moving continuously?	☐	☐	☐
8. Takes in whole picture by utilizing mirrors frequently?	☐	☐	☐
9. Approaches intersections defensively with foot over brake pedal?	☐	☐	☐
10. Slows down gradually when approaching red lights and stop signs?	☐	☐	☐
11. Looks both ways prior to entering an intersection?	☐	☐	☐
12. Recognizes and reacts appropriately to blind intersections?	☐	☐	☐
13. Stops for amber lights whenever possible?	☐	☐	☐
14. Looks both ways before starting up on a green light?	☐	☐	☐
15. Make full stop at all stop signs?	☐	☐	☐
16. Uses turn signals for all turns and lane changes?	☐	☐	☐
17. Turns into proper lane when making a turn?	☐	☐	☐
18. Communicates effectively and properly with horn and/or signal lights?	☐	☐	☐
19. If nighttime, uses bright lights appropriately?	☐	☐	☐
20. Blends smoothly with merging traffic?	☐	☐	☐
21. Keeps both hands on steering wheel?	☐	☐	☐
22. Allows adequate space cushion when stopped behind other vehicles?	☐	☐	☐
23. Walks around vehicle prior to backing to check for obstacles?	☐	☐	☐
24. Checks all clearances?	☐	☐	☐
25. Backs slowly?	☐	☐	☐
26. Responds appropriately to make way for emergency vehicles?	☐	☐	☐

Note any corrective action taken or other comments: _____

_____

_____

Supervisor's Signature _____ **Job Title** _____

ARCADIS

Attachment E

PPE Procedure

1. POLICY

It is the policy of ARCADIS to assess the workplace to identify and assess hazards in order to appropriately implement controls for those hazards. In addition, it is ARCADIS policy to supply personal protective equipment (PPE) for employees in a working environment where engineering and administrative controls are not feasible or effective in the control of hazards. ARCADIS will train and supply this PPE at no cost to the employee.

2. PURPOSE AND SCOPE

2.1 Purpose

The purpose of PPE is to shield or isolate individuals from the chemical, physical, and biologic hazards that may be encountered in their work environment. A hazard analysis or assessment will be performed before a job task is begun to evaluate the if PPE is necessary to protect an employee from identified hazards and determine the type of PPE required. This analysis will include the identification of hazards/suspected hazards and their routes of exposure.

Combinations of protection may be needed to provide the appropriate level of protection for any given work environment. The level of PPE may change during a job, so periodic evaluation will be done to ensure that the most appropriate PPE is being used. Over-protection, as well as under-protection, can be hazardous and should be avoided where possible.

Subcontractors and other non-ARCADIS employees must supply their own PPE. ARCADIS will not supply PPE to any non-ARCADIS employees unless specific arrangements and agreements are made with the other party.

This Health and Safety Procedure (HSP) provides guidance on the proper selection, use, care and maintenance of PPE.

2.2 Scope

Whenever possible, engineering, substitution, and administrative controls will be used to reduce or eliminate hazards, but when they are not feasible, practical or adequate, PPE will be used to protect employees from exposure to hazards during ARCADIS-related work tasks.

3. DEFINITIONS

Eye/Face Protection - Equipment designed to provide eye or face protection when exposed to hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation.

Foot Protection - Footwear designed to provide foot and toe protection when working in areas where there is a danger of foot injuries due to falling or rolling objects, or objects piercing the sole, and/or where an employee's feet are exposed to electrical hazards. These include such measures as steel toe, metatarcal, and boot warmers

Hand and Body Protection - Equipment designed to provide protection to the hands and body during exposures to potential hazards such as potential for skin absorption of harmful substances, sharp objects, abrasive surfaces, punctures, temperature extremes and chemical contact.

Hazard Assessment - The process utilized to identify hazards in the workplace and to select the appropriate PPE to guard people against potential hazards (see attachment Hazard Assessment for Personal Protective Equipment (PPE)).

Head Protection - Equipment designed to provide protection to the head during exposure to potential hazards such as falling objects, striking against objects, or electrical hazards.

Hearing Protection - Equipment designed to provide protection to an individual's hearing during exposure to excessive noise levels and any 8hr work day with noise levels consistently 85dB or above.

Personal Protective Equipment (PPE) - Equipment designed to provide protection to the wearer from potential hazards to the eyes, face, hands, head, feet, ears, extremities, and respiratory system.

Respiratory Protection - Equipment designed to provide protection to the wearer from potential inhalation hazards such as vapors, mists, particulates, and gases.

4. RESPONSIBILITIES

4.1 ARCADIS Management

Is responsible for providing resources for the acquisition of PPE and for the conduct of hazard assessments.

4.2 Project Managers

Project Managers are responsible, as part of the project hazard assessment, for determining PPE necessary to complete the project. In addition, the project manager is responsible for determining client requirements with respect to PPE. Project Managers notify health and safety staff of biological, chemical, and physical hazards present or potentially present on the site.. Project Managers are also responsible for ensuring that project staff has the appropriate and applicable training for PPE use prior to those staff beginning work.

4.2 Corporate Health and Safety

Corporate Health and Safety is responsible for keeping this policy and procedure up-to-datewith current regulatory requirements and best practices and for assisting in determining the appropriate PPE for a particular task and work environment and for assisting in the identification of appropriate vendors of such PPE.

4.3 Health and Safety Staff

Project Health and Safety Staff including designated Writers and Reviewers of Project Health and Safety Plans (HASPs) are responsible for developing control processes andtechniques on specific projects based on the physical, chemical, and biological hazards expected to be encountered on project facilities.

4.4 ARCADIS Staff

ARCADIS staff are responsible for completing PPE training as required by this policy and procedure, and for following all hazard control processes designated by the Project Manager, Project Health and Safety Staff, and the project HASP. If project personnel believe that a hazard is present that was not previously identified or is at levels that are higher than expected, they should stop work and notify project health and safety staff or the project manager immediately and not proceed until authorized.

5. PROCEDURE

5.1 Minimum PPE Requirements

All staff who regularly conduct field work or visit project sites outside of office environments will be issued a field bag that contains, at a minimum, the following PPE:

- An ARCADIS logo'd hardhat
- Two pair of safety glasses, one clear pair and one tinted pair, or one pair of prescription safety glasses with transitional lenses
- Hearing protection
- A minimum, Type 2 reflective vest in either orange, lime green or yellow
- Steel toe safety boots

Office locations will stock extra bags with the equipment listed above for use by other staff who do not regularly go to field locations. Additional PPE and H&S equipment will be issued to staff based on the hazards they face on specific projects (i.e. respirators, goggles, chaps, etc.).

No ARCADIS staff should arrive at a field or project site without this minimum PPE.

5.2 The PPE Program

The basic objectives of a PPE program are to protect the wearer from safety and health hazards; and to prevent injury to the wearer from incorrect use and/or malfunction of the PPE. This document serves as the overall ARCADIS PPE program and is used as guidance for the development of a project-specific PPE program which becomes part of a project-specific health and safety plan. A project-specific PPE program in combination with this HSP will address the following:

- PPE selection based upon site hazards (Hazard Identification/Assessment).

- Identify the hazards/suspected hazards and their potential routes of exposure (e.g., skin, inhalation, ingestion or eye contact).

- The use and limitations of the equipment including limitations during temperature extremes and under certain medical conditions;

- The work mission duration;

- Maintenance, storage, decontamination and disposal of PPE;

- Training including proper fit and how to properly put on and take off PPE;

- PPE inspection procedures prior to, during, and after use; and

- Periodic evaluation of the effectiveness of the PPE program.

5.3 PPE Selection

The use of PPE can itself create significant worker hazards, such as heat stress, physical and psychological stress and impaired vision, mobility and communication. Over-protection, as well as under-protection, can be hazardous and should be avoided where possible. Site or project-specific health and safety plans take into consideration engineering, substitution, and administrative controls first as a means to eliminate/reduce the need for PPE. When it is not feasible or practical to eliminate the use of PPE, PPE selection will be based on an evaluation of the performance characteristics of the PPE relative to the following:

- The requirements and limitations of the tasks or work environment;

- The task-specific conditions and duration; and

- The hazards and potential hazards identified at the site.

The level of protection will be increased whenever it is shown that increased protection is necessary to reduce employee exposures to the hazards. It may be decreased when it is shown that this will not result in hazardous exposure to employees.

5.4 Levels of PPE Protection

For work on hazardous sites, a combination of PPE may be categorized into levels A, B, C, or D with level A offering the highest level of protection and D the lowest. Monitoring the effectiveness of PPE will be done throughout a project to ensure that the appropriate level of protection is being worn. These levels of protection are described below.

Level A Protection

Level A PPE offers the highest level of respiratory and skin protection and should be worn when:

- The hazardous substance has been identified and requires the highest level of protection of the skin, eyes, and respiratory system based on either:
  - The measured (or potential) high concentrations of atmospheric gases, vapors, or particulates; or
  - If site operations and work functions involve a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates which are harmful to skin eyes, or the respiratory system.
- There is a known or suspected high degree of hazard to the skin and skin contact is possible.
- Conducting work in a confined, poorly ventilated area and the other criteria requiring Level A PPE have not been determined.

Level A equipment includes:

- NIOSH approved positive pressure, full-face piece self contained breathing apparatus (SCBA), or positive pressure supplied airline respirator with escape SCBA;
- Totally encapsulating chemical-protective suit (material based on the hazard);
- Chemical resistant outer **and** inner gloves (type and material based on the hazard);
- Chemical resistant boots with steel toe and shank;
- Disposable protective suit, gloves and boots (depending on suit construction, may be worn over the totally encapsulating suit);
- Coveralls (optional, as applicable);
- Long underwear (optional, as applicable); and
- Hard-hat - under suit (optional, as applicable).

Level B Protection

Level B PPE offers a high degree of respiratory protection with lesser levels of skin protection. Level B PPE should be worn when:

- The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection but less skin protection;
- The atmosphere contains less than 19.5 percent oxygen; or
- The presence of incompletely identified vapors or gases is indicated by direct reading organic vapor detection instruments, but the vapors and gases are not suspected of

containing high levels of chemical harmful to the skin or capable of being absorbed through the skin. Level B is the minimum level of protection that should be worn when there is insufficient information to determine the hazards or potential hazards of the substance.

Level B PPE equipment includes:

- NIOSH approved positive pressure, full face piece self contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA;
- Hooded chemical resistant clothing (overalls and long sleeve jacket; coveralls; one or two piece chemical splash suit; disposable chemical resistant overalls) (materials based on the hazards);
- Chemical resistant outer **and** inner gloves (material based on the hazards);
- Chemical resistant boots with steel toe and shank;
- Coveralls (optional, as applicable);
- Outer chemical resistant boot covers (optional, as applicable);
- Hard hat (optional, as applicable); and
- Face shield (optional as applicable).

Level C Protection

Level C PPE is used when the concentration and type of airborne substance is known, and the criteria for using an air purifying respirator are met. It should be worn when:

- Atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect or be absorbed through any exposed skin;
- The types of air contaminants have been identified, concentrations measured, and an air purifying respirator is available that can remove the contaminants; and
- All criteria for the use of an air purifying respirator are met.

Level C PPE equipment includes:

- NIOSH approved full face or half mask air purifying respirator (with appropriate cartridges based on the hazards);
- Hooded chemical resistant clothing (overalls and long sleeve jacket; coveralls; one or two piece chemical splash suit; disposable chemical resistant overalls) (materials based on the hazards);

- Chemical resistant outer **and** inner gloves (materials based on the hazards);
- Chemical resistant boots with steel toe and shank;
- Coveralls (optional, as applicable);
- Outer chemical resistant boot covers (optional, as applicable);
- Hard hat (optional, as applicable);
- Escape mask (optional, as applicable); and
- Face shield (optional, as applicable).

Level D Protection

Level D PPE offers the least skin and respiratory protection and should be worn when the atmosphere contains no known hazards, and work functions preclude splashes, immersions or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

Level D PPE equipment may include any or all of the following depending on the hazards of the site:

- Chemical resistant boots with steel toe and shank (optional, as applicable);
- Coveralls (optional, as applicable);
- Gloves (optional, as applicable);
- Outer chemical resistant boots (disposable) (optional, as applicable);
- Safety glasses or chemical splash goggles (optional, as applicable);
- Hard hat (optional, as applicable);
- Escape mask (optional as applicable); and
- Face shield (optional as applicable).

5.5 Combinations of Protection

Combinations of protection are acceptable if the task hazard analysis and the site conditions warrant modification of PPE levels.

5.6 Equipment List

Eye/Face Protection

All employees engaged in or working in or adjacent to areas with eye-hazardous activities or operations, such as but not limited to flying objects and hazardous chemicals shall wear appropriate eye protection.

- Safety glasses with side shields are required for impact protection and shall meet ANSI Standard Z87.1 requirements.
- Chemical goggles (for protection against chemical splash).
- Face shields (for face protection from chemical splash and are not a substitute for primary eye protection).
- Full-face respirators can provide eye and face protection in lieu of safety glasses, goggles, or face shields.
- Shaded eye protection meeting the minimum shade requirements established in 29 CFR 1910.133 (for employees exposed to sources of injurious light radiation [e.g., welding, cutting, lasers]).
- For prescription eye protection contact your supervisor to fill out an AOSafety order form available on APEX.

Respiratory Protection

Respirators will be provided and used in accordance with the ARCADIS Respiratory Protection Policy/Procedure ARC HSGE017 and 29CFR 1910.134.

Hearing Protection

Hearing protection will be provided and used in accordance with the ARCADIS Hearing Conservation Policy/Procedure ARC HSIH008 and 29CFR 1910.95.

Foot Protection

- Basic foot protection is required for all ARCADIS job sites and industrial locations. Specialized footwear will be provided as required by the nature of the work. Special foot protection may include, but is not limited to, chemically resistant, thermally shielded, metatarsal guards, etc.
- Leather Safety Boots will be provided for employees employees; one pair of leather safety boots will be provided as necessary by ARCADIS. The employee purchasing the footwear is required to ensure that it meets ANSI Standard Z41.
- For most work done by ARCADIS, safety boots will be equipped with steel toes and shanks. It is also required that puncture resistant soles or in-soles are equipped in the safety boots. Some clients require puncture resistant soles or in-soles.

- The maximum expenditure or reimbursement for approved safety shoe purchases will be $150. Reimbursement requests must be approved by the employee's supervisor.

- Athletic-style safety shoes ("safety sneakers") are prohibited (due to the difficulties created by these styles in supervising proper use of protective footwear).

Head Protection

Hard hats meeting ANSI Z89.1 will be provided to protect employees from impact, penetration, falling objects, and/or limited electrical shock and burn, as appropriate for work site hazards. A hard hat must be replaced when it becomes damaged, contaminated (and contamination cannot be removed) or it has been struck by an object of sufficient size to potentially compromise its integrity.

Hardhats must resist penetration by objects, be water resistant and slow burning, and have a chin strap if it is worn while working at elevation. It must be worn square on the head and not be pushed back, to the side or forward.

There are two types and three classes of head protection described in ANSI standard

Z89.1-1997. The types and classes are divided by the protection they provide from impact and electricity. It is important that the level of protection necessary be evaluated when during preparation of the site specifc HASP.

Other hazard situations to consider are:

- In areas of heavy vegetation or in any area where hunters may be present, it is recommended that some type of brightly colored head protection be worn. For example, a bright orange or yellow baseball cap or stocking cap.

- If cold exposure is an issue, hardhat liners are available (made specifically for the particular hardhat) or if a hardhat is not required, some type of insulated head protection such as a stocking cap should be worn.

Hand Protection

Appropriate hand protection will be provided if employee's hands are exposed to hazards while on the job.

such as:

- pinch points
- sharp/pointed tools or objects
- incorrect or inadequate tool use
- improper use
- rotating/energized/automated parts
- abrasive materials

- inadequate job planning
- lack of/inadequate protection
- changing weather conditions and extreme temperatures
- hazardous material
- jewelry and loose clothing.

Once these hazards are identified, the appropriate glove or hand protection must be selected. When choosing gloves, keep in mind:

- Hazardous Chemicals/Substances to be Contacted
- Nature of Contact (total immersion, splash, etc.)
- Duration of Contact
- Area of Protection (hand only, forearm, arm)
- Equipment (rotating, sharp edges, etc.)
- Grip (dry, wet, oily)
- Thermal Protection
- Abrasion/Cut/Puncture Resistance
- Tear/Tensile Strength
- Ergonomics (size, heat stress, dexterity)
- Decontamination/Disposal

In selecting chemically protective gloves, the toxic properties of the chemical(s) will be determined. Information provided on the manufacturer's label or by chemical compatibility charts regarding breakthrough time, permeation rate, and degradation should be considered during selection.

Body Protection

Protective clothing, gloves, boots, and other protective equipment will be provided as appropriate for the hazards associated with the tasks being performed.

Long pants are required for all field work unless approval is granted by corporate H&S. . Additional protection such as cooling vests may be required. In environments with potential biological hazards such as ticks, plantsor snakes, gloves and long sleeves should be worn along with head protection of somekind to protect the scalp. In areas of roadway work or other vehicle traffic high visibility Class II safety vests will be worn.

Chemically Protective Clothing (CPC) will be selected by evaluating the performance characteristics of the CPC against the requirements and limitations of the site and task-

specific conditions. This selection should be performed by an employee with training and experience taking into consideration:

- Permeation, degradation, penetration of the CPC by the chemical and;
- Durability, flexibility, fit, temperature effects, ease of decontamination, compatibility with other necessary equipment (e.g., hardhats, SCBA, etc.); and duration of use that could effect the employees ability perform the task.

Specialized Equipment

All other specialized safety equipment required for an assignment (e.g., work gloves, specialized protective clothing, hip boots, field rain gear, personal floatation devices) will be provided by the Firm as specified in the HASP.

Extreme Cold Environments

Supervisors will provide as necessary any of the following to protect from extreme cold environments:

- Hats/hat liners and gloves
- Thermal clothing
- Hi-Visibility clothing
- Winter footwear

Use of specialized equipment will be charged to projects in accordance with established policy and rental rates.

5.7 Maintenance/Storage/Disposal

PPE Maintenance and Disposal

PPE must be inspected by the user before and after each use for defects, rips, tears, and/or damaged parts. Damaged or compromised PPE will not be used and must be repaired before re-use or disposed. PPE must be disposed of according to the HASP and other project plans for the site. If non-disposable, PPE must be decontaminated and sanitized before being reused according to the HASP Contaminated PPE which cannot be properly decontaminated by normal procedures must be disposed of accordingly.

PPE Storage

All PPE must be stored to protect against dust, sunlight, extreme heat and cold, excessive moisture, and damaging chemicals. Storage must be in accordance with the manufacturer's specifications.

Contaminated Boots

Boots contaminated or damaged on the job will be replaced. Contaminated boots will be disposed of with the site waste.

6. TRAINING

Training in the proper use of PPE will generally be provided in conjunction with HAZWOPER training or via coursework selected and approved by Corporate H&S. Training will be completed prior to the employee's use of PPE, when changes in the work place alter the use or type of PPE, and when inadequacies in the employee's knowledge or use of PPE are noted.

The training will include at a minimum:

- When and what PPE is necessary;
- How to put on, adjust, wear and take off the PPE;
- Limitations of the PPE; and
- Proper care, maintenance, useful life, and proper disposal of PPE.

7. REFERENCES

- 29 CFR 1910.120 "Hazardous Waste Operations and Emergency Response"
- 29 CFR 1910 Subpart I "Personal Protective Equipment"

8. RECORDS

Records of the PPE training are retained by the Employee and in the ARCADIS training database. Medical certification/recertification are retained by Corporate H&S.

9. APPROVALS AND HISTORY OF CHANGE

Approved by: Michael A. Thomas, CIH, Director H&S Environmental Division

History of Change

Revision Date	Revision Number	Reason for change
20 February 2009	01	Original document

ARCADIS

Attachment F

Hearing Conservation Procedure

1. POLICY

It is the policy of ARCADIS to assess noise hazards resulting from or encountered by our staff during job activities and to control such noise hazards to minimize and eliminate hearing loss among our staff, subcontractors, clients, and the public. Any employee who will be exposed to noise at or over 85 decibels (excluding brief intermittent ambient noise) for any amount of time will be required to wear appropriate hearing protection. When in doubt, ARCADIS will provide hearing protection.

2. PURPOSE AND SCOPE

2.1 Purpose

ARCADIS is committed to providing a healthy and safe work environment for our employees, subcontractors, clients and visitors. To this end, ARCADIS embraces this Hearing Conservation Health & Safety (HS) Policy. The purpose of the ARCADIS Hearing Conservation HS Policy is to provide a standard policy on the health and safety requirements and processes for all employees with potential exposure to excessive noise (levels in excess of 85dBA for any amount of time) and to comply with 29CFR1910.95. ARCADIS defines excessive noise as any noise environment that requires speech levels above those used for normal conversation.

2.2 Scope

This policy and associated procedures apply to every project and all operations conducted by ARCADIS. Hearing Protection is supplied and/or approved by ARCADIS for use by employees in carrying out their assignments. All employees conducting work where the potential for excessive noise is present, are required to have their assigned hearing protection available and used as required by the project Health and Safety Plan (HASP), Job Safety Analysis (JSA), or client requirements.

3. DEFINITIONS

NRR – Noise Reduction Rating is the measure, in decibels, of how well a hearing protector reduces noise, as specified by the Environmental Protection Agency. The higher the number, the greater the noise reduction. When dual protectors are used, the combined NRR provides approximately 5 decibels more than the higher rated of the two products. For example, using ear plugs (NRR of 29 decibels) with ear muffs (NRR 27) would provide a Noise Reduction Rating of 34 decibels. For practical purposes, users should assume they will actually receive protection that is 5 decibels less than the published value.

HSP – Health and Safety Procedure

TWA – Time Weighted Average; The average exposure to a contaminant or condition (such as noise) to which workers may be exposed without adverse effect over a period of 8 hours a day or a 40 hour work week.

Decibels – A Weighted – the unit of measure to be used when measuring noise levels on ARCADIS work sites and when comparing to occupational exposure standards and limits.

4. RESPONSIBILITIES

Employees – are required to wear prescribed hearing protection during activities with identified excessive noise levels. In addition, employees are required to have their provided hearing protection available where the potential for excessive noise exists and to use as required by HASPs, JSAs, or client requirements.

In addition, employees have the responsibilities to adhere to this HSP and to communicate HS concerns, issues and questions to their supervisor or their respective Health and Safety resource. In addition, all employees have the responsibility to:

- Use the TRACK process prior to any activity;
- Follow all ARCADIS and client requirements;
- Participate in the medical monitoring program, including annual audiogram and hearing conservation training as applicable based on their job duties;
- Notify the Corporate Health and Safety if they were exposed to high noise levels and required to wear hearing protection during the previous year and are not already in the medical monitoring program;
- To understand and appropriately utilize the “Stop Work Authority” concept.

Managers – Have the responsibility to steward the HS program to ensure that staff in their practice are appropriately equipped with the necessary hearing protection and have been provided the appropriate training. To accomplish this, Business Practice Managers (BPMs) have the responsibility to know and understand our HS program, policy, vision, and this HSP in detail enough so as to be prepared to explain it to a client when required. In addition, Managers have the responsibility to provide oversight management for the HS of employees in their respective operations. Each will assure that appropriate time and resources are provided to facilitate the implementation of this HSP. In addition, the Managers will involve themselves in any “Stop Work” issued by an employee as requested by an ARCADIS employee, project manager, or Principal-in-Charge (PIC). Managers will assist in resolving the issue associated with the “Stop Work Authority” issued by an employee.

Project Managers and Principals in Charge (PICs) – Have the responsibility to know and follow all applicable ARCADIS and client HS requirements, for ensuring work is conducted under the policy stated in this HSP, and for implementing the procedure requirements provided for in this HSP on any project and/or in offices that pose hazards to ARCADIS employees or employees of its subcontractors, clients, and other organizations present in the vicinity of work controlled by ARCADIS

For project related work, Project Managers and PICs responsibilities also include determining and communicating any specific client requirements that are applicable, including:

- Communicating with and appropriately managing subcontractors, ensuring that employees have appropriate training and qualifications, and for ensuring all client HS requirements are met;

- Involving the appropriate ARCADIS HS Staff and project client staff, as necessary;
- Ensuring that all subcontractors have been communicated with concerning the minimum HS requirements for the project
- Providing adequate resources and budget for personal protective equipment (PPE), including hearing protection; PPE will be provided at not cost to the employee

In addition, as project and client agents and on behalf of ARCADIS, the Project Managers and Client Managers for client-related work shall be responsible for:

- Understanding and compliance by employees with HS rules and the requirements;
- Guaranteeing each employee the absolute right to exercise “Stop Work Authority” in good faith without fear of retribution or disciplinary action
- Using the ARCADIS Incident Investigation process for formally resolving a “Stop Work” condition.

Using this “Stop Work Authority” process, the manager and the employee will:

- Discuss and document the condition;
- Identify and document the root cause for the condition;
- Determine and document the solutions;
- Implement the solutions;
- Sign and acknowledge the solutions are in place to the satisfaction of the employee.

Corporate HS Staff – Have the responsibility for:

- Communicating the policy and procedure requirements in this HSP with all offices within ARCADIS – US;
- Ensuring that offices are aware of this HSP;
- Ensuring this HSP is being implemented effectively;
- Provide required training or guidance on approved training options;
- Providing the necessary suppliers and criteria for selection of H&S equipment.

Health and Safety Managers and Specialists – Are responsible for facilitating the policy and procedure requirements in this HSP in their area of responsibility and for providing “hands-on” assistance to ARCADIS staff to ensure this procedure is appropriately implemented.

5. PROCEDURE

5.1 Noise Monitoring and Exposure Assessments

Noise monitoring should be conducted on any or all activities where excessive noise may be present. The monitoring will be prescribed by H&S professionals during the development of HASP and/or JSA. Noise monitoring may also be conducted at the discretion of the health and safety supervisor (HSS) or any staff members that have questions or concerns about potential noise exposure. ARCADIS defines excessive noise as any noise environment that requires speech levels above those used for normal conversation. If noise monitoring is not feasible, the staff will assume that exposures that require elevated speech are above 85 db and will use appropriate hearing protection. Monitoring results will be collected in accordance with guidance provided in 29CFR1910.95 Appendix G - Monitoring noise levels non-mandatory informational appendix. Monitoring results will be communicated to staff and used to determine adequate types and effectiveness (NRR) of hearing protection.

Community based noise monitoring may also be required based on the scope of the project. Community based noise monitoring will be conducted in accordance with the Project specifications and applicable Environmental Protection Agency (EPA), State or Local ordinances.

5.2 Audiometric Testing

Audiometric tests will be scheduled in conjunction with pre-placement, periodic, and termination medical examinations as required by the Medical Surveillance Program. All employees that are not already part of the medical monitoring program must inform their supervisor and Corporate Health and Safety if they were exposed to high noise levels as part of their job duties. Employees that were exposed to high noise levels must receive an audiogram as specified by the Medical Surveillance Program. Employees will be informed of the requirement that they avoid both non-occupational and occupational noise exposure for 14 hours prior to audiometric testing.

Audiograms will be compared to baseline and prior tests to determine if a standard threshold shift has occurred. If a shift is detected, retesting may be done within 30 days. If a shift is confirmed, the employee will be informed in writing and may need to be refitted and retrained in hearing protection use. If subsequent testing shows that a standard threshold shift is not present, the employee will be informed. Additional audiometric testing may be conducted at the discretion of Health and Safety.

The Physician or audiologist will determine if further evaluation is needed and, if so, will provide to the specialist all the information that is required by 29 CFR 1910.95 (g)(7)(iii). If the physician determines that the medical pathology is unrelated to work exposure or wearing hearing protectors, the employee will be informed by the physician.

5.3 Hearing Protection Devices

Employees must use hearing protection selected, supplies, and/or approved by the firm. Requests for hearing protective devices must be directed to the Regional Health and Safety Managers and Specialists. Hearing protective devices are required to be selected by the Project Manager, or their designee, based on consultation with Corporate HS staff.

6. TRAINING

Employees required to wear hearing protection will receive training as provided by Corporate H&S. The training will be provided at least annually with refresher training as necessary and will include information regarding: effects of noise on hearing, the purpose of hearing protectors, their advantages/disadvantages and attenuation of various types, the proper selection, fit, use and care of protectors, and the purpose of audiometric testing. Employees will be trained concerning site specific noises hazards and hearing protection by H&S or project H&S staff as applicable.

7. REFERENCES

- OSHA Standard 29 CFR 1910.95

8. RECORDS

Record Maintenance – All records regarding noise exposure measurements will be maintained by the offices for two years. All audiometric test records will be maintained for the duration of the affected employee's employment. Original copies of shipping declarations and related shipping documents for hazardous materials will be kept in central file in each office location with copies kept in project files, as appropriate. These documents will be kept for a minimum of 2 years (3 years for manifests) or with the project files as long as the project files are kept.

9. APPROVALS AND HISTORY OF CHANGE

Approved By:

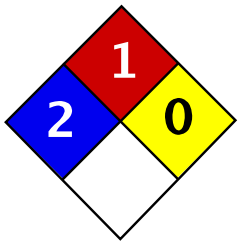
Mija A. Coppola, Director, H&S Compliance Assurance, LPS, Communications

Revision Date	Revision Number	Reason for change
1 December 2007	01	Original document
30 January 2008	02	Change to new template

ARCADIS

Attachment G

Material Safety Data Sheets



Health	2
Fire	1
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Trichloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Trichloroethylene

Catalog Codes: SLT3310, SLT2590

CAS#: 79-01-6

RTECS: KX4560000

TSCA: TSCA 8(b) inventory: Trichloroethylene

CI#: Not available.

Synonym:

Chemical Formula: C2HCl3

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Trichloroethylene	79-01-6	100

Toxicological Data on Ingredients: Trichloroethylene: ORAL (LD50): Acute: 5650 mg/kg [Rat]. 2402 mg/kg [Mouse]. DERMAL (LD50): Acute: 20001 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract.
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 420°C (788°F)

Flash Points: Not available.

Flammable Limits: LOWER: 8% UPPER: 10.5%

Products of Combustion: These products are carbon oxides (CO, CO2), halogenated compounds.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the

product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Carcinogenic, teratogenic or mutagenic materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 50 STEL: 200 (ppm) from ACGIH (TLV)
TWA: 269 STEL: 1070 (mg/m3) from ACGIH
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 131.39 g/mole

Color: Clear Colorless.

pH (1% soln/water): Not available.

Boiling Point: 86.7°C (188.1°F)

Melting Point: -87.1°C (-124.8°F)

Critical Temperature: Not available.

Specific Gravity: 1.4649 (Water = 1)

Vapor Pressure: 58 mm of Hg (@ 20°C)

Vapor Density: 4.53 (Air = 1)

Volatility: Not available.

Odor Threshold: 20 ppm

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; log(oil/water) = 0

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, acetone.

Solubility:
Easily soluble in methanol, diethyl ether, acetone.
Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity:
Extremely corrosive in presence of aluminum.
Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
Acute oral toxicity (LD50): 2402 mg/kg [Mouse].
Acute dermal toxicity (LD50): 20001 mg/kg [Rabbit].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH.
The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract.

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Passes through the placental barrier in human. Detected in maternal milk in human.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Trichloroethylene : UN1710 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Trichloroethylene
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Trichloroethylene
Pennsylvania RTK: Trichloroethylene
Florida: Trichloroethylene
Minnesota: Trichloroethylene
Massachusetts RTK: Trichloroethylene
New Jersey: Trichloroethylene
TSCA 8(b) inventory: Trichloroethylene
CERCLA: Hazardous substances.: Trichloroethylene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC).
CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R36/38- Irritating to eyes and skin.
R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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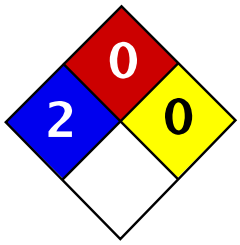

Health	2
Fire	0
Reactivity	0
Personal Protection	G

Material Safety Data Sheet
Tetrachloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Tetrachloroethylene

Catalog Codes: SLT3220

CAS#: 127-18-4

RTECS: KX3850000

TSCA: TSCA 8(b) inventory: Tetrachloroethylene

CI#: Not available.

Synonym: Perchloroethylene; 1,1,2,2-Tetrachloroethylene; Carbon bichloride; Carbon dichloride; Ankilostin; Didakene; Dilatin PT; Ethene, tetrachloro-; Ethylene tetrachloride; Perawin; Perchlor; Perclene; Perclene D; Percosolvel; Tetrachloroethene; Tetraleno; Tetralex; Tetravec; Tetroguer; Tetropil

Chemical Name: Ethylene, tetrachloro-

Chemical Formula: C2-Cl4

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Tetrachloroethylene	127-18-4	100

Toxicological Data on Ingredients: Tetrachloroethylene: ORAL (LD50): Acute: 2629 mg/kg [Rat]. DERMAL (LD): Acute: >3228 mg/kg [Rabbit]. MIST(LC50): Acute: 34200 mg/m 8 hours [Rat]. VAPOR (LC50): Acute: 5200 ppm 4 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (anticipated carcinogen) by NTP.
MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast.
TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to kidneys, liver, peripheral nervous system, respiratory tract, skin, central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with skin. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, metals, acids, alkalis.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Personal Protection:
Safety glasses. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 25 (ppm) from OSHA (PEL) [United States]
TWA: 25 STEL: 100 (ppm) from ACGIH (TLV) [United States]
TWA: 170 (mg/m3) from OSHA (PEL) [United States]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Ethereal.

Taste: Not available.

Molecular Weight: 165.83 g/mole

Color: Clear Colorless.

pH (1% soln/water): Not available.

Boiling Point: 121.3°C (250.3°F)

Melting Point: -22.3°C (-8.1°F)

Critical Temperature: 347.1°C (656.8°F)

Specific Gravity: 1.6227 (Water = 1)

Vapor Pressure: 1.7 kPa (@ 20°C)

Vapor Density: 5.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 5 - 50 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.4

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Miscible with alcohol, ether, chloroform, benzene, hexane.
It dissolves in most of the fixed and volatile oils.
Solubility in water: 0.015 g/100 ml @ 25 deg. C
It slowly decomposes in water to yield Trichloroacetic and Hydrochloric acids.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, metals, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Oxidized by strong oxidizing agents.
Incompatible with sodium hydroxide, finely divided or powdered metals such as zinc, aluminum, magnesium, potassium, chemically active metals such as lithium, beryllium , barium.
Protect from light.

Special Remarks on Corrosivity: Slowly corrodes aluminum, iron, and zinc.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 2629 mg/kg [Rat].
Acute dermal toxicity (LD50): >3228 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 5200 4 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (Some evidence.) by NTP.
MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast.
May cause damage to the following organs: kidneys, liver, peripheral nervous system, upper respiratory tract,

skin, central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of inhalation.
Slightly hazardous in case of skin contact (permeator), of ingestion.

Special Remarks on Toxicity to Animals:
Lowest Publishe Lethal Dose/Conc:
LDL [Rabbit] - Route: Oral; Dose: 5000 mg/kg
LDL [Dog] - Route: Oral; Dose: 4000 mg/kg
LDL [Cat] - Route: Oral; Dose: 4000 mg/kg

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects and birth defects(teratogenic).
May affect genetic material (mutagenic).
May cause cancer.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Causes skin irritation with possible dermal blistering or burns. Symtoms may include redness, itching, pain, and possible dermal blistering or burns. It may be absorbed through the skin with possible systemic effects. A single prolonged skin exposure is not likely to result in the material being absorbed in harmful amounts.
Eyes: Contact causes transient eye irritation, lacrimation. Vapors cause eye/conjunctival irritation. Symptoms may include redness and pain.
Inhalation: The main route to occupational exposure is by inhalation since it is readily absorbed through the lungs. It causes respiratory tract irritation, . It can affect behavior/central nervous system (CNS depressant and anesthesia ranging from slight inebriation to death, vertigo, somnolence, anxiety, headache, excitement, hallucinations, muscle incoordination, dizziness, lightheadness, disorentiation, seizures, enotional instability, stupor, coma). It may cause pulmonary edema
Ingestion: It can cause nausea, vomiting, anorexia, diarrhea, bloody stool. It may affect the liver, urinary system (proteinuria, hematuria, renal failure, renal tubular disorder), heart (arrhythmias). It may affect behavior/central nervous system with symptoms similar to that of inhalation.
Chronic Potential Health Effects:
Skin: Prolonged or repeated skin contact may result in excessive drying of the skin, and irritation.
Ingestion/Inhalation: Chronic exposure can affect the liver(hepatitis,fatty liver degeneration), kidneys, spleen, and heart (irregular heartbeat/arrhythmias, cardiomyopathy, abnormal EEG), brain, behavior/central nervous system/peripheral nervous system (impaired memory, numbness of extremeties, peripheral neuropathy and other

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 18.4 mg/l 96 hours [Fish (Fatthead Minnow)]. 18 mg/l 48 hours [Daphnia (daphnia)]. 5 mg/l 96 hours [Fish (Rainbow Trout)]. 13 mg/l 96 hours [Fish (Bluegill sunfish)].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Tetrachloroethylene UNNA: 1897 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Tetrachloroethylene
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Tetrachloroethylene
Connecticut hazardous material survey.: Tetrachloroethylene
Illinois toxic substances disclosure to employee act: Tetrachloroethylene
Illinois chemical safety act: Tetrachloroethylene
New York release reporting list: Tetrachloroethylene
Rhode Island RTK hazardous substances: Tetrachloroethylene
Pennsylvania RTK: Tetrachloroethylene
Minnesota: Tetrachloroethylene
Michigan critical material: Tetrachloroethylene
Massachusetts RTK: Tetrachloroethylene
Massachusetts spill list: Tetrachloroethylene
New Jersey: Tetrachloroethylene
New Jersey spill list: Tetrachloroethylene
Louisiana spill reporting: Tetrachloroethylene
California Director's List of Hazardous Substances: Tetrachloroethylene
TSCA 8(b) inventory: Tetrachloroethylene
TSCA 8(d) H and S data reporting: Tetrachloroethylene: Effective date: 6/1/87; Sunset date: 6/1/97
SARA 313 toxic chemical notification and release reporting: Tetrachloroethylene
CERCLA: Hazardous substances.: Tetrachloroethylene: 100 lbs. (45.36 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R40- Possible risks of irreversible effects.
R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
S23- Do not breathe gas/fumes/vapour/spray
S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S37- Wear suitable gloves.
S61- Avoid release to the environment. Refer to special instructions/Safety data sheets.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: g

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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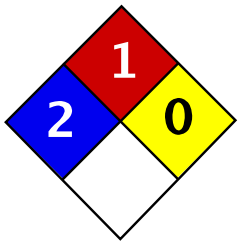

Health	2
Fire	1
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
1,1,1-Trichloroethane MSDS

Section 1: Chemical Product and Company Identification

Product Name: 1,1,1-Trichloroethane

Catalog Codes: SLT4180, SLT2167, SLT3460

CAS#: 71-55-6

RTECS: KJ2975000

TSCA: TSCA 8(b) inventory: 1,1,1-Trichloroethane

CI#: Not available.

Synonym:

Chemical Formula: CH3CCl3

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
{1,1,1-}Trichloroethane	71-55-6	100

Toxicological Data on Ingredients: 1,1,1-Trichloroethane: ORAL (LD50): Acute: 9600 mg/kg [Rat]. 6000 mg/kg [Mouse]. DERMAL (LD50): Acute: 15800 mg/kg [Rabbit]. VAPOR (LC50): Acute: 18000 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of eye contact (irritant), of ingestion. Hazardous in case of skin contact (irritant, permeator), of inhalation. Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to lungs, the nervous system, liver, mucous membranes.
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 537°C (998.6°F)

Flash Points: Not available.

Flammable Limits: LOWER: 7.5% UPPER: 12.5%

Products of Combustion: These products are carbon oxides (CO, CO2), halogenated compounds.

Fire Hazards in Presence of Various Substances: Slightly flammable to flammable in presence of oxidizing materials, of acids, of alkalis.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.
Slightly explosive to explosive in presence of oxidizing materials, of acids, of alkalis.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Combustible materials should be stored away from extreme heat and away from strong oxidizing agents.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 350 STEL: 440 CEIL: 440 (ppm) from ACGIH (TLV) [1995]
TWA: 1900 STEL: 2460 CEIL: 2380 (mg/m3) from ACGIH [1995]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 133.41 g/mole

Color: Not available.

pH (1% soln/water): Not available.

Boiling Point: 74.1°C (165.4°F)

Melting Point: -32.5°C (-26.5°F)

Critical Temperature: Not available.

Specific Gravity: 1.3376 (Water = 1)

Vapor Pressure: 100 mm of Hg (@ 20°C)

Vapor Density: 4.6 (Air = 1)

Volatility: Not available.

Odor Threshold: 400 ppm

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; log(oil/water) = 0

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 6000 mg/kg [Mouse].
Acute dermal toxicity (LD50): 15800 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 18000 ppm 4 hour(s) [Rat].

Chronic Effects on Humans: The substance is toxic to lungs, the nervous system, liver, mucous membranes.

Other Toxic Effects on Humans:
Very hazardous in case of ingestion.
Hazardous in case of skin contact (irritant, permeator), of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Detected in maternal milk in human.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : 1,1,1-Trichloroethane : UN2831 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: 1,1,1-Trichloroethane
Massachusetts RTK: 1,1,1-Trichloroethane
TSCA 8(b) inventory: 1,1,1-Trichloroethane
SARA 313 toxic chemical notification and release reporting: 1,1,1-Trichloroethane
CERCLA: Hazardous substances.: 1,1,1-Trichloroethane

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC).

DSCL (EEC):
R38- Irritating to skin.
R41- Risk of serious damage to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Last Updated: 10/10/2005 08:31 PM

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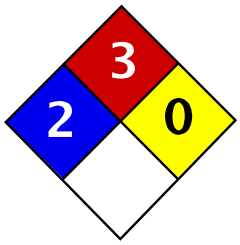

Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
1,1-Dichloroethane MSDS

Section 1: Chemical Product and Company Identification

Product Name: 1,1-Dichloroethane

Catalog Codes: SLD3280

CAS#: 75-34-3

RTECS: KI0175000

TSCA: TSCA 8(b) inventory: 1,1-Dichloroethane

CI#: Not available.

Synonym:

Chemical Name: 1,1-Dichloroethane

Chemical Formula: C2-H4-Cl2

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
{1,1-}Dichloroethane	75-34-3	100

Toxicological Data on Ingredients: 1,1-Dichloroethane: ORAL (LD50): Acute: 725 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified 2 (Reasonably anticipated.) by NTP. A4 (Not classifiable for human or animal.) by ACGIH.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Classified Development toxin [POSSIBLE].
The substance is toxic to kidneys, lungs, liver, central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 458°C (856.4°F)

Flash Points: CLOSED CUP: -17°C (1.4°F). OPEN CUP: -6°C (21.2°F).

Flammable Limits: LOWER: 5.6% UPPER: 11.4%

Products of Combustion: These products are carbon oxides (CO, CO2), halogenated compounds.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable liquid.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth,

sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes Keep away from incompatibles such as oxidizing agents, alkalis.

Storage:
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 100 STEL: 250 (ppm) from ACGIH (TLV) [1999]
TWA: 100 (ppm) from OSHA (PEL)
Australia: TWA: 200 (ppm)
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Oily liquid.)

Odor: Chloroform like odor (Slight.)

Taste: Not available.

Molecular Weight: 98.96 g/mole

Color: Colorless.

pH (1% soln/water): Not available.

Boiling Point: 57.3°C (135.1°F)

Melting Point: -96.9°C (-142.4°F)

Critical Temperature: 261.5°C (502.7°F)

Specific Gravity: 1.175 (Water = 1)

Vapor Pressure: 180 mm of Hg (@ 20°C)

Vapor Density: 3.44 (Air = 1)

Volatility: Not available.

Odor Threshold: 120 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties:
Partially dispersed in diethyl ether.
See solubility in water, diethyl ether.

Solubility: Partially soluble in diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents, alkalis.

Corrosivity: Corrosive in presence of aluminum.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Will attack some forms of plastic and rubber

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 725 mg/kg [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 2 (Reasonably anticipated.) by NTP. A4 (Not classifiable for human or animal.) by ACGIH.
DEVELOPMENTAL TOXICITY: Classified Development toxin [POSSIBLE].
The substance is toxic to kidneys, lungs, liver, central nervous system (CNS).

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification:
CLASS 3: Combustible liquid with a flash point greater than 37.8C (100F).
Marine pollutant

Identification: : 1,1-Dichloroethane : UN2362 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65 (no significant risk level): 1,1-Dichloroethane
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: 1,1-Dichloroethane
Rhode Island RTK hazardous substances: 1,1-Dichloroethane
Pennsylvania RTK: 1,1-Dichloroethane
Florida: 1,1-Dichloroethane
Minnesota: 1,1-Dichloroethane
Massachusetts RTK: 1,1-Dichloroethane
New Jersey: 1,1-Dichloroethane
New Jersey spill list: 1,1-Dichloroethane
TSCA 8(b) inventory: 1,1-Dichloroethane
TSCA 8(a) PAIR: 1,1-Dichloroethane
TSCA 8(d) H and S data reporting: 1,1-Dichloroethane: June 1999
TSCA 12(b) one time export: 1,1-Dichloroethane
SARA 313 toxic chemical notification and release reporting: 1,1-Dichloroethane: 1%
CERCLA: Hazardous substances.: 1,1-Dichloroethane: 1000 lbs. (453.6 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):

R11- Highly flammable.
R22- Harmful if swallowed.
R37/38- Irritating to respiratory system and skin.
R41- Risk of serious damage to eyes.
R52- Harmful to aquatic organisms.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Last Updated: 10/09/2005 05:07 PM

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VINYL CHLORIDE

0082
April 2000

CAS No: 75-01-4
RTECS No: KU9625000
UN No: 1086 (stabilized)
EC No: 602-023-00-7

Chloroethene
Chloroethylene
VCM
(cylinder)
C_2H_3Cl / $H_2C=CHCl$
Molecular mass: 62.5

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Extremely flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking.	Shut off supply; if not possible and no risk to surroundings, let the fire burn itself out; in other cases extinguish with powder, carbon dioxide.
EXPLOSION	Gas/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Use non-sparking handtools.	In case of fire: keep cylinder cool by spraying with water. Combat fire from a sheltered position.

EXPOSURE		AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
Inhalation	Dizziness. Drowsiness. Headache. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	ON CONTACT WITH LIQUID: FROSTBITE.	Protective gloves. Cold-insulating gloves. Protective clothing.	ON FROSTBITE: rinse with plenty of water, do NOT remove clothes.
Eyes	Redness. Pain.	Safety goggles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion		Do not eat, drink, or smoke during work.	

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Evacuate danger area! Consult an expert! Ventilation. Remove all ignition sources. Personal protection: complete protective clothing including self-contained breathing apparatus.	F+ Symbol T Symbol R: 45-12 S: 53-45 Note: D UN Hazard Class: 2.1

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-20S1086 NFPA Code: H 2; F 4; R 2	Fireproof. Separated from incompatible materials. (See Chemical Dangers.) Cool. Store only if stabilized.

IPCS
International Programme on Chemical Safety

Prepared in the context of cooperation between the International Programme on Chemical Safety and the European Commission © IPCS 2005

SEE IMPORTANT INFORMATION ON THE BACK.

IMPORTANT DATA

Physical State; Appearance
COLOURLESS COMPRESSED LIQUEFIED GAS, WITH CHARACTERISTIC ODOUR.

Physical dangers
The gas is heavier than air, and may travel along the ground; distant ignition possible. Vinyl chloride monomer vapours are uninhibited and may form polymers in vents or flame arresters of storage tanks, resulting in blockage of vents.

Chemical dangers
The substance can under specific circumstances form peroxides, initiating explosive polymerization. The substance will polymerize readily due to heating and under the influence of air, light and on contact with a catalyst, strong oxidizing agents and metals such as copper and aluminium, with fire or explosion hazard. The substance decomposes on burning producing toxic and corrosive fumes (hydrogen chloride, phosgene). Attacks iron and steel in the presence of moisture.

Occupational exposure limits
TLV: 1 ppm as TWA; A1 (confirmed human carcinogen); (ACGIH 2004).
MAK: Carcinogen category: 1; (DFG 2004).

Routes of exposure
The substance can be absorbed into the body by inhalation.

Inhalation risk
A harmful concentration of this gas in the air will be reached very quickly on loss of containment.

Effects of short-term exposure
The substance is irritating to the eyes. The liquid may cause frostbite. The substance may cause effects on the central nervous system. Exposure could cause lowering of consciousness. Medical observation is indicated.

Effects of long-term or repeated exposure
The substance may have effects on the liver, spleen, blood and peripheral blood vessels, and tissue and bones of the fingers. This substance is carcinogenic to humans.

PHYSICAL PROPERTIES

Boiling point: -13/C
Melting point: -154/C
Relative density (water = 1): 0.9 (liquid)
Density: 8 (vapour) at 15/C g/l
Solubility in water: none
Relative vapour density (air = 1): 2.2
Flash point: -78/C c.c.
Auto-ignition temperature: 472/C
Explosive limits, vol% in air: 3.6-33
Octanol/water partition coefficient as log Pow: 0.6

ENVIRONMENTAL DATA

This substance may be hazardous to the environment; special attention should be given to ground water contamination.

NOTES

Depending on the degree of exposure, periodic medical examination is suggested.
The odour warning when the exposure limit value is exceeded is insufficient.
Do NOT use in the vicinity of a fire or a hot surface, or during welding.
An added stabilizer or inhibitor can influence the toxicological properties of this substance, consult an expert.
Card has been partly updated in April 2005. See section Occupational Exposure Limits.

ADDITIONAL INFORMATION

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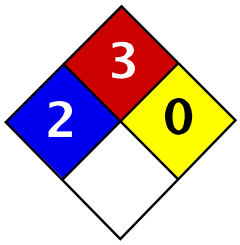

Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Toluene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Toluene

Catalog Codes: SLT2857, SLT3277

CAS#: 108-88-3

RTECS: XS5250000

TSCA: TSCA 8(b) inventory: Toluene

CI#: Not available.

Synonym: Toluol, Tolu-Sol; Methylbenzene; Methacide; Phenylmethane; Methylbenzol

Chemical Name: Toluene

Chemical Formula: C6-H5-CH3 or C7-H8

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Toluene	108-88-3	100

Toxicological Data on Ingredients: Toluene: ORAL (LD50): Acute: 636 mg/kg [Rat]. DERMAL (LD50): Acute: 14100 mg/kg [Rabbit]. VAPOR (LC50): Acute: 49000 mg/m 4 hours [Rat]. 440 ppm 24 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to blood, kidneys, the nervous system, liver, brain, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 480°C (896°F)

Flash Points: CLOSED CUP: 4.4444°C (40°F). (Setaflash) OPEN CUP: 16°C (60.8°F).

Flammable Limits: LOWER: 1.1% UPPER: 7.1%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Flammable in presence of open flames and sparks, of heat.
Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable liquid, insoluble in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards:
Toluene forms explosive reaction with 1,3-dichloro-5,5-dimethyl-2,4-imidazolididione; dinitrogen tetraoxide;

concentrated nitric acid, sulfuric acid + nitric acid; N_2O_4; $AgClO_4$; BrF_3; Uranium hexafluoride; sulfur dichloride. Also forms an explosive mixture with tetranitromethane.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Toxic flammable liquid, insoluble or very slightly soluble in water.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 200 STEL: 500 CEIL: 300 (ppm) from OSHA (PEL) [United States]
TWA: 50 (ppm) from ACGIH (TLV) [United States] SKIN
TWA: 100 STEL: 150 from NIOSH [United States]
TWA: 375 STEL: 560 (mg/m^3) from NIOSH [United States]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweet, pungent, Benzene-like.

Taste: Not available.

Molecular Weight: 92.14 g/mole

Color: Colorless.

pH (1% soln/water): Not applicable.

Boiling Point: 110.6°C (231.1°F)

Melting Point: -95°C (-139°F)

Critical Temperature: 318.6°C (605.5°F)

Specific Gravity: 0.8636 (Water = 1)

Vapor Pressure: 3.8 kPa (@ 25°C)

Vapor Density: 3.1 (Air = 1)

Volatility: Not available.

Odor Threshold: 1.6 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 2.7

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:
Soluble in diethyl ether, acetone.
Practically insoluble in cold water.
Soluble in ethanol, benzene, chloroform, glacial acetic acid, carbon disulfide.
Solubility in water: 0.561 g/l @ 25 deg. C.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources (flames, sparks, static), incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Incompatible with strong oxidizers, silver perchlorate, sodium difluoride, Tetranitromethane, Uranium Hexafluoride.
Frozen Bromine Trifluoride reacts violently with Toluene at -80 deg. C.
Reacts chemically with nitrogen oxides, or halogens to form nitrotoluene, nitrobenzene, and nitrophenol and halogenated products, respectively.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 636 mg/kg [Rat].
Acute dermal toxicity (LD50): 14100 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 440 24 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC.
May cause damage to the following organs: blood, kidneys, the nervous system, liver, brain, central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of ingestion, of inhalation.
Slightly hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose:
LDL [Human] - Route: Oral; Dose: 50 mg/kg
LCL [Rabbit] - Route: Inhalation; Dose: 55000 ppm/40min

Special Remarks on Chronic Effects on Humans:
Detected in maternal milk in human. Passes through the placental barrier in human. Embryotoxic and/or foetotoxic in animal. May cause adverse reproductive effects and birth defects (teratogenic). May affect genetic material (mutagenic)

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Causes mild to moderate skin irritation. It can be absorbed to some extent through the skin.
Eyes: Cauess mild to moderate eye irritation with a burning sensation. Splash contact with eyes also causes conjunctivitis, blepharospasm, corneal edema, corneal abraisons. This usually resolves in 2 days.
Inhalation: Inhalation of vapor may cause respiratory tract irritation causing coughing and wheezing, and nasal discharge. Inhalation of high concentrations may affect behavior and cause central nervous system effects characterized by nausea, headache, dizziness, tremors, restlessness, lightheadedness, exhilaration, memory loss, insomnia, impaired reaction time, drowsiness, ataxia, hallucinations, somnolence, muscle contraction or spasticity, unconsciousness and coma. Inhalation of high concentration of vapor may also affect the cardiovascular system (rapid heart beat, heart palpitations, increased or decreased blood pressure, dysrhythmia,), respiration (acute pulmonary edema, respiratory depression, apnea, asphyxia), cause vision disturbances and dilated pupils, and cause loss of appetite.
Ingestion: Aspiration hazard. Aspiration of Toluene into the lungs may cause chemical pneumonitis. May cause irritation of the digestive tract with nausea, vomiting, pain. May have effects similar to that of acute inhalation.
Chronic Potential Health Effects:
Inhalation and Ingestion: Prolonged or repeated exposure via inhalation may cause central nervous system and cardiovascular symptoms similar to that of acute inhalation and ingestion as well liver damage/failure, kidney damage/failure (with hematuria, proteinuria, oliguria, renal tubular acidosis), brain damage, weight loss, blood (pigmented or nucleated red blood cells, changes in white blood cell count), bone marrow changes, electrolyte imbalances (Hypokalemia, Hypophostatemia), severe, muscle weakness and Rhabdomyolysis.
Skin: Repeated or prolonged skin contact may cause defatting dermatitis.

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 313 mg/l 48 hours [Daphnia (daphnia)]. 17 mg/l 24 hours [Fish (Blue Gill)]. 13 mg/l 96 hours [Fish (Blue Gill)]. 56 mg/l 24 hours [Fish (Fathead minnow)]. 34 mg/l 96 hours [Fish (Fathead minnow)]. 56.8 ppm any hours [Fish (Goldfish)].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may

arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Toluene UNNA: 1294 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Toluene
California prop. 65 (no significant risk level): Toluene: 7 mg/day (value)
California prop. 65 (acceptable daily intake level): Toluene: 7 mg/day (value)
California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Toluene
Connecticut hazardous material survey.: Toluene
Illinois toxic substances disclosure to employee act: Toluene
Illinois chemical safety act: Toluene
New York release reporting list: Toluene
Rhode Island RTK hazardous substances: Toluene
Pennsylvania RTK: Toluene
Florida: Toluene
Minnesota: Toluene
Michigan critical material: Toluene
Massachusetts RTK: Toluene
Massachusetts spill list: Toluene
New Jersey: Toluene
New Jersey spill list: Toluene
Louisiana spill reporting: Toluene
California Director's List of Hazardous Substances.: Toluene
TSCA 8(b) inventory: Toluene
TSCA 8(d) H and S data reporting: Toluene: Effective date: 10/04/82; Sunset Date: 10/0/92
SARA 313 toxic chemical notification and release reporting: Toluene
CERCLA: Hazardous substances.: Toluene: 1000 lbs. (453.6 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R11- Highly flammable.
R20- Harmful by inhalation.
S16- Keep away from sources of ignition - No smoking.
S25- Avoid contact with eyes.
S29- Do not empty into drains.
S33- Take precautionary measures against static discharges.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:30 PM

Last Updated: 10/10/2005 08:30 PM

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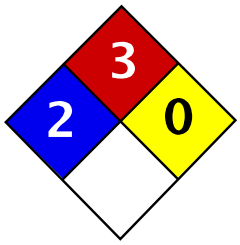

Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Ethylbenzene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Ethylbenzene

Catalog Codes: SLE2044

CAS#: 100-41-4

RTECS: DA0700000

TSCA: TSCA 8(b) inventory: Ethylbenzene

CI#: Not available.

Synonym: Ethyl Benzene; Ethylbenzol; Phenylethane

Chemical Name: Ethylbenzene

Chemical Formula: C8H10

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Ethylbenzene	100-41-4	100

Toxicological Data on Ingredients: Ethylbenzene: ORAL (LD50): Acute: 3500 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, permeator).

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (irritant, sensitizer).
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC.
MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 432°C (809.6°F)

Flash Points:
CLOSED CUP: 15°C (59°F). (Tagliabue.) OPEN CUP: 26.667°C (80°F) (Cleveland) (CHRIS, 2001)
CLOSED CUP: 12.8 C (55 F) (Bingham et al, 2001; NIOSH, 2001)
CLOSED CUP: 21 C (70 F) (NFPA)

Flammable Limits: LOWER: 0.8% - 1.6%UPPER: 6.7% - 7%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.
Slightly explosive in presence of heat.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards:
Vapor may travel considerable distance to source of ignition and flash back. Vapors may form explosive mixtures with air. When heated to decomposition it emits acrid smoke and irritating fumes.

Special Remarks on Explosion Hazards: Vapors may form explosive mixtures in air.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with eyes. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Sensitive to light. Store in light-resistant containers.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 100 STEL: 125 (ppm) from OSHA (PEL) [United States]
TWA: 435 STEL: 545 from OSHA (PEL) [United States]
TWA: 435 STEL: 545 (mg/m3) from NIOSH [United States]
TWA: 100 STEL: 125 (ppm) from NIOSH [United States]
TWA: 100 STEL: 125 (ppm) from ACGIH (TLV) [United States]
TWA: 100 STEL: 125 (ppm) [United Kingdom (UK)]
TWA: 100 STEL: 125 (ppm) [Belgium]
TWA: 100 STEL: 125 (ppm) [Finland]
TWA: 50 (ppm) [Norway]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweetish. Gasoline-like. Aromatic.

Taste: Not available.

Molecular Weight: 106.16 g/mole

Color: Colorless.

pH (1% soln/water): Not available.

Boiling Point: 136°C (276.8°F)

Melting Point: -94.9 (-138.8°F)

Critical Temperature: 617.15°C (1142.9°F)

Specific Gravity: 0.867 (Water = 1)

Vapor Pressure: 0.9 kPa (@ 20°C)

Vapor Density: 3.66 (Air = 1)

Volatility: 100% (v/v).

Odor Threshold: 140 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.1

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility:
Easily soluble in diethyl ether.
Very slightly soluble in cold water or practically insoluble in water.
Soluble in all proportions in Ethyl alcohol.
Soluble in Carbon tetrachloride, Benzene.
Insoluble in Ammonia.
Slightly soluble in Chloroform.
Solubility in Water: 169 mg/l @ 25 deg. C.; 0.014 g/100 ml @ 15 deg. C.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ingnition sources (flames, sparks, static), incompatible materials, light

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Not considered to be corrosive for metals and glass.

Special Remarks on Reactivity:
Can react vigorously with oxidizing materials.
Sensitive to light.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation.

Toxicity to Animals: Acute oral toxicity (LD50): 3500 mg/kg [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC.
MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast.
May cause damage to the following organs: central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of ingestion, of inhalation.
Slightly hazardous in case of skin contact (irritant, permeator).

Special Remarks on Toxicity to Animals:
Lethal Dose/Conc 50% Kill:
LD50 [Rabbit] - Route: Skin; Dose: 17800 ul/kg
Lowest Published Lethal Dose/Conc:
LDL[Rat] - Route: Inhalation (vapor); Dose: 4000 ppm/4 H

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects and birth defects (teratogenic) based on animal test data.
May cause cancer based on animals data. IARC evidence for carcinogenicity in animals is sufficient. IARC evidence of carcinogenicity in humans inadequate.
May affect genetic material (mutagenic).

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Can cause mild skin irritation. It can be absorbed through intact skin.
Eyes: Contact with vapor or liquid can cause severe eye irritation depending on concentration. It may also cause conjunctivitis. At a vapor exposure level of 85 - 200 ppm , it is mildly and transiently irritating to the eyes; 1000 ppm causes further irritation and tearing; 2000 ppm results in immediate and severe irritation and tearing; 5,000 ppm is intolerable (ACGIH, 1991; Clayton and Clayton, 1994). Standard draize test for eye irritation using 500 mg resulted in severe irritation (RTECS)
Inhalation: Exposure to high concentrations can cause nasal, mucous membrane and respiratory tract irritation and can also result in chest constriction and, trouble breathing, respiratory failure, and even death. It can also affect behavior/Central Nervous System. The effective dose for CNS depression in experimental animals was 10,000 ppm (ACGIH, 1991). Symptoms of CNS depression include headache, nausea, weakness, dizziness, vertigo, irritability, fatigue, lightheadedness, sleepiness, tremor, loss of coordination, judgement and conciousness, coma, and death. It can also cause pulmonary edema. Inhalation of 85 ppm can produce fatigue, insomnia, headache, and mild irritation of the respiratory tract (Haley & Berndt, 1987).
Ingestion: Do not drink, pipet or siphon by mouth. May cause gastroinestinal/digestive tract irritation with Abdominal pain, nausea, vomiting. Ethylbenzene is a pulmonary aspiration hazard. Pulmonary aspiration of even small amounts of the liquid may cause fatal pneumonitis. It may also affect behavior/central nervous system with

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 14 mg/l 96 hours [Fish (Trout)] (static). 12.1 mg/l 96 hours [Fish (Fathead Minnow)] (flow-through)]. 150 mg/l 96 hours [Fish (Blue Gill/Sunfish)] (static). 275 mg/l 96 hours [Fish (Sheepshead Minnow)]. 42.3 mg/l 96 hours [Fish (Fathead Minnow)](soft water). 87.6mg/l 96 hours [Shrimp].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Ethylbenzene UNNA: 1175 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Ethylbenzene
Illinois toxic substances disclosure to employee act: Ethylbenzene
Illinois chemical safety act: Ethylbenzene
New York release reporting list: Ethylbenzene
Rhode Island RTK hazardous substances: Ethylbenzene
Pennsylvania RTK: Ethylbenzene
Minnesota: Ethylbenzene
Massachusetts RTK: Ethylbenzene
Massachusetts spill list: Ethylbenzene
New Jersey: Ethylbenzene
New Jersey spill list: Ethylbenzene
Louisiana spill reporting: Ethylbenzene
California Director's List of Hazardous Substances: Ethylbenzene
TSCA 8(b) inventory: Ethylbenzene
TSCA 4(a) proposed test rules: Ethylbenzene
TSCA 8(d) H and S data reporting: Ethylbenzene: Effective Date: 6/19/87; Sunset Date: 6/19/97
SARA 313 toxic chemical notification and release reporting: Ethylbenzene

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).
CLASSE D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R11- Highly flammable.
R20- Harmful by inhalation.
S16- Keep away from sources of ignition - No smoking.
S24/25- Avoid contact with skin and eyes.
S29- Do not empty into drains.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References:
-Manufacturer's Material Safety Data Sheet.
-Fire Protection Guide to Hazardous Materials, 13th ed., National Fire Protection Association (NFPA)
-Registry of Toxic Effects of Chemical Substances (RTECS)
-Chemical Hazard Response Information System (CHRIS)
-Hazardous Substance Data Bank (HSDB)
-New Jersey Hazardous Substance Fact Sheet
-Ariel Global View
-Reprotext System

Other Special Considerations: Not available.

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Last Updated: 10/09/2005 05:28 PM

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DOD Hazardous Materials Information System
DoD 6050.5-L
AS OF July 1998

FSC: 6550
NIIN: 00F037480
Manufacturer's CAGE: 8Y898
Part No. Indicator: A
Part Number/Trade Name: 0-659 CIS 1,2-DICHLOROETHENE

General Information

Item Name: LABORATORY STANDARD
Company's Name: CHEM SERVICE INC
Company's Street: 660 TOWER LN
Company's P. O. Box: 3108
Company's City: WEST CHESTER
Company's State: PA
Company's Country: US
Company's Zip Code: 19381-3108
Company's Emerg Ph #: 215-692-3026/800-452-9994
Company's Info Ph #: 215-692-3026/800-452-9994
Distributor/Vendor # 1:
Distributor/Vendor # 1 Cage:
Distributor/Vendor # 2:
Distributor/Vendor # 2 Cage:
Distributor/Vendor # 3:
Distributor/Vendor # 3 Cage:
Distributor/Vendor # 4:
Distributor/Vendor # 4 Cage:
Safety Data Action Code:
Safety Focal Point: F
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SE
Date MSDS Prepared: 02JUN92
Safety Data Review Date: 06DEC94
Supply Item Manager:
MSDS Preparer's Name:
Preparer's Company: CHEM SERVICE INC
Preparer's St Or P. O. Box: 660 TOWER LN
Preparer's City: WEST CHESTER
Preparer's State: PA
Preparer's Zip Code: 19381-3108
Other MSDS Number:
MSDS Serial Number: BWJDT
Specification Number:
Spec Type, Grade, Class:
Hazard Characteristic Code:
Unit Of Issue:
Unit Of Issue Container Qty:
Type Of Container:
Net Unit Weight:

Report for NIIN: 00F037480

NRC/State License Number:
Net Explosive Weight:
Net Propellant Weight-Ammo:
Coast Guard Ammunition Code:

Ingredients/Identity Information

Proprietary: NO
Ingredient: DICHLOROETHENE
Ingredient Sequence Number: 01
Percent: N/K
Ingredient Action Code:
Ingredient Focal Point: F
NIOSH (RTECS) Number: KV9420000
CAS Number: 156-59-2
OSHA PEL: N/K
ACGIH TLV: N/K
Other Recommended Limit: N/K

Physical/Chemical Characteristics

Appearance And Odor: COLORLESS LIQUID
Boiling Point: 140F
Melting Point: -112F
Vapor Pressure (MM Hg/70 F): N/K
Vapor Density (Air=1): N/K
Specific Gravity: N/K
Decomposition Temperature: N/K
Evaporation Rate And Ref: N/K
Solubility In Water: INSOLUBLE
Percent Volatiles By Volume: N/K
Viscosity:
pH: N/K
Radioactivity:
Form (Radioactive Matl):
Magnetism (Milligauss):
Corrosion Rate (IPY): N/K
Autoignition Temperature:

Fire and Explosion Hazard Data

Flash Point: 42.8F
Flash Point Method: N/P
Lower Explosive Limit: N/K
Upper Explosive Limit: N/K
Extinguishing Media: CO2, DRY CHEMICAL POWDER/SPRAY.
Special Fire Fighting Proc: N/K
Unusual Fire And Expl Hazrds: FLAMMABLE CHEMICAL. VAPORS MAY TRAVEL CONSIDERABLE DISTANCE TO IGNITION SOURCE & FLASH BACK. DECOMPOSITION PRODUCTS ARE CORROSIVE.

Report for NIIN: 00F037480

Reactivity Data

Stability: YES
Cond To Avoid (Stability): MOISTURE, AIR, LIGHT, HEAT & OTHER IGNITION SOURCES.
Materials To Avoid: STRONG OXIDIZING AGENTS, MAGNESIUM, ALUMINUM.
Hazardous Decomp Products: TOXIC FUMES
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): N/K

Health Hazard Data

LD50-LC50 Mixture:

Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: SKIN: MAY BE HARMFUL IF ABSORBED. CAN CAUSE IRRITATION. INHALATION: MAY BE HARMFUL. DUST &/VAPORS CAN CAUSE RESPIRATORY TRACT IRRITATION. CAN BE IRRITATING TO MUCOUS MEMBRANCES. INGESTION: MAY BE HARMFUL. EYES: IRRITATION. EXPOSURE CAN CAUSE LIVER DAMAGE. NARCOTIC AT HIGH CONCENTRATIONS.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NONE
Signs/Symptoms Of Overexp: IRRITATION, NARCOTIC.
Med Cond Aggravated By Exp: N/K
Emergency/First Aid Proc: EYES: FLUSH CONTINUOUSLY W/WATER FOR 15-20 MINS. SKIN: FLUSH W/WATER FOR 15-20 MINS. IF NOT BURNED, WASH W/SOAP & WATER TO CLEANSE. INHALATION: REMOVE TO FRESH AIR. GIVE CPR/OXYGEN IF NEEDED & CONTINUE LIFE SUPPORT UNTIL MEDICAL ASSISTANCE ARRIVES. INGESTION: RINSE MOUTH OUT W/WATER, IF CONSCIOUS. OBTAIN MEDICAL ATTENTION IN ALL CASES.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: EVACUATE AREA. WEAR APPRORPRIATE OSHA REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE/SIMILAR MATERIAL. SWEEP UP & PLACE IN APPROPRIATE CONTAINER/HOLD FOR DISPOSAL. WASH CONTAMINATED SURFACES TO REMOVE ANY RESIDUES.
Neutralizing Agent: N/K
Waste Disposal Method: BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AN AFTERBURNER & SCRUBBER IAW/FEDERAL, STATE & LOCAL REGULATIONS.
Precautions-Handling/Storing: STORE IN A COOL DRY PLACE ONLY W/COMPATIBLE CHEMICALS. KEEP TIGHTLY CLOSED. STORE UNDER REFRIGERATION.
Other Precautions: AVOID CONTACT W/SKIN, EYES & CLOTHING. DON'T BREATH VAPORS. CONTACT LENSES SHOULDN'T BE WORN IN THE LABORATORY. ALL CHEMICALS SHOULD BE CONSIDERED HAZARDOUS. AVOID DIRECT PHYSICAL CONTACT.

Control Measures

Respiratory Protection: WEAR APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.

Report for NIIN: 00F037480

Ventilation: CHEMICAL SHOULD BE HANDLED ONLY IN A HOOD.
Protective Gloves: N/K
Eye Protection: EYE SHIELDS
Other Protective Equipment: N/K
Work Hygienic Practices: N/K
Suppl. Safety & Health Data: N/K

Transportation Data

Transportation Action Code:
Transportation Focal Point:
Trans Data Review Date:
DOT PSN Code:
DOT Symbol:
DOT Proper Shipping Name:
DOT Class:
DOT ID Number:
DOT Pack Group:
DOT Label:

DOT/DoD Exemption Number:
IMO PSN Code:
IMO Proper Shipping Name:
IMO Regulations Page Number:
IMO UN Number:
IMO UN Class:
IMO Subsidiary Risk Label:
IATA PSN Code:
IATA UN ID Number:
IATA Proper Shipping Name:
IATA UN Class:
IATA Subsidiary Risk Class:
IATA Label:
AFI PSN Code:
AFI Symbols:
AFI Prop. Shipping Name:
AFI Class:
AFI ID Number:
AFI Pack Group:
AFI Label:
AFI Special Prov:
AFI Basic Pac Ref:
MMAC Code:
N.O.S. Shipping Name:
Additional Trans Data:

Disposal Data

Disposal Data Action Code:
Disposal Data Focal Point:
Disposal Data Review Date:
Rec # For This Disp Entry:
Tot Disp Entries Per NSN:
Landfill Ban Item:

Report for NIIN: 00F037480

Disposal Supplemental Data:
1st EPA Haz Wst Code New:
1st EPA Haz Wst Name New:
1st EPA Haz Wst Char New:
1st EPA Acute Hazard New:
2nd EPA Haz Wst Code New:
2nd EPA Haz Wst Name New:
2nd EPA Haz Wst Char New:
2nd EPA Acute Hazard New:
3rd EPA Haz Wst Code New:
3rd EPA Haz Wst Name New:
3rd EPA Haz Wst Char New:
3rd EPA Acute Hazard New:

Label Data

Label Required: YES
Technical Review Date:
Label Date:
MFR Label Number:
Label Status: G
Common Name: 0-659 CIS 1,2-DICHLOROETHENE
Chronic Hazard: N/P
Signal Word:

Acute Health Hazard-None:
Acute Health Hazard-Slight:
Acute Health Hazard-Moderate:
Acute Health Hazard-Severe:
Contact Hazard-None:
Contact Hazard-Slight:
Contact Hazard-Moderate:
Contact Hazard-Severe:
Fire Hazard-None:
Fire Hazard-Slight:
Fire Hazard-Moderate:
Fire Hazard-Severe:
Reactivity Hazard-None:
Reactivity Hazard-Slight:
Reactivity Hazard-Moderate:
Reactivity Hazard-Severe:
Special Hazard Precautions: SKIN: MAY BE HARMFUL IF ABSORBED. CAN CAUSE IRRITATION. INHALATION: MAY BE HARMFUL. DUST &/VAPORS CAN CAUSE RESPIRATORY TRACT IRRITATION. CAN BE IRRITATING TO MUCOUS MEMBRANCES. INGESTION: MAY BE HARMFUL. EYES: IRRITATION. EXPOSURE CAN CAUSE LIVER DAMAGE. NARCOTIC AT HIGH CONCENTRATIONS. IRRITATION, NARCOTIC.
Protect Eye:
Protect Skin:
Protect Respiratory:
Label Name: CHEM SERVICE INC
Label Street: 660 TOWER LN
Label P.O. Box: 3108
Label City: WEST CHESTER
Label State: PA

Report for NIIN: 00F037480

Label Zip Code: 19381-3108
Label Country: US
Label Emergency Number: 215-692-3026/800-452-9994
Year Procured:

Material Safety Data Sheet

12601 Twinbrook Parkway
Rockville, MD 20852 USA

Telephone calls: (301) 881-0666
8:00am - 5:00pm EST Mon. - Fri.

Responsible Party: Reference Standards Technical Services

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RESIDUAL SOLVENT CLASS 2 - 1,2-DICHLOROETHENE

Catalog Number: 1601420 **Package Size:** See label **Revision Date:** September 29, 2003

This reference standard contains 1,2-dichloroethene (cis/trans) in dimethyl sulfoxide (DMSO). The mixture has not been tested to determine specific physical hazards, but it is considered potentially combustible.
DMSO is an irritant and is rapidly absorbed through the skin. It may carry dissolved chemicals into the body through this route.
1,2-Dichloroethene (cis/trans) is an irritant.

SECTION 1 - IDENTIFICATION

Common Name: 1,2-Dichloroethene **Formula:** C2H2Cl2 (1,2-Dichloroethene); C2H6OS (DMSO)

Synonym: Acetylene dichloride; sym-dichloroethylene

Chemical Name: sym-1,2-dichloroethylene in dimethyl sulfoxide

CAS Number: 540-59-0 (1,2-Dichloroethene); 67-68-5 (DMSO) **RTECS Number:** KV9360000 (1,2-Dichloroethene); PV6210000 (DMSO)

Chemical Family: Halogenated hydrocarbon (1,2-Dichloroethene)

Therapeutic Category: Residual solvent

SECTION 2 - INGREDIENT INFORMATION

Principle Components	Percent	Exposure Limits
1,2-Dichloroethene	0.9350%	OSHA: TWA 200 ppm NIOSH: TWA 200 ppm; IDLH 1000 ppm ACGIH: TWA 200 ppm
Dimethyl sulfoxide	99.065%	

SECTION 3 - HEALTH HAZARD INFORMATION

Usual Adult Dose: n/f

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n/f = not found

Adverse Effects: Adverse effects of DMSO may include redness, itching, or rash on skin; garlic-like taste or odor on breath and skin; swelling of face; troubled breathing; shortness of breath; and nasal congestion. Effects of exposure to 1,2-dichloroethene may include nausea, vomiting, weakness, tremor, stomach cramps, corneal clouding, and central nervous system depression. Possible allergic reaction to material if inhaled, ingested or in contact with skin.

Overdose Effects: n/f

Acute: Eye, skin, gastrointestinal and/or respiratory tract irritation; central nervous system depression.

Chronic: Possible hypersensitization.

Inhalation: Causes irritation and toxicity. Avoid inhalation. Remove to fresh air.

Eye: Causes irritation. Avoid contact. Flush with copious quantities of water for at least 15 minutes.

Skin: Causes irritation. Avoid contact. Flush with copious quantities of soap and water. DMSO readily penetrates the skin and can enhance absorption of other chemicals.

Ingestion: Causes irritation. Avoid ingestion. Flush out mouth with water.

Medical Conditions Aggravated by Exposure: Hypersensitivity to material, liver conditions, and chronic respiratory disease.

Cross Sensitivity: n/f

Pregnancy Comments: In chick embryos, dichloroethylene congeners selectively increased the incidence of cardiac defects. Rat embryos exposed to dichloroethylene by continuous intrauterine perfusion also had an increased incidence of heart defects.

Pregnancy Category: n/f

SECTION 4 - FIRST AID MEASURES

General: Remove from exposure. Remove contaminated clothing. Persons developing serious hypersensitivity (anaphylactic) reactions must receive immediate medical attention. If person is not breathing give artificial respiration. If breathing is difficult give oxygen. Obtain medical attention.

Overdose Treatment: Treatment of overdose should be symptomatic and supportive.

SECTION 5 - TOXICOLOGICAL INFORMATION

Oral Rat: LD50: 770 mg/kg (1,2-Dichloroethene); 14500 mg/k

Oral Mouse: LD50: 7920 mg/kg (DMSO)

Irritancy Data: RTECS - Rabbit/skin: moderate (1,2-Dichloroethene); Rabbit/skin,eye: mild (DMSO)

Target Organ(s): Central nervous system; eyes (1,2-Dichloroethene)

Listed as a Carcinogen? **NTP:** No **IARC:** No **OSHA:** No

Other: No

SECTION 6 - FIREFIGHTING MEASURES

Flash Point: n/f **Upper Flammable Limit:** n/f

Auto-Ignition Temperature: n/f **Lower Flammable Limit:** n/f

Extinguisher Media: Water spray, dry chemical, carbon dioxide or foam as appropriate for surrounding fire and materials.

Fire and Explosion Hazards: This material is expected to be combustible. Vapors may form explosive mixtures with air. Vapors may travel to sources of ignition and flash back.

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n/f = not found

Firefighting Procedures: As with all fires, evacuate personnel to a safe area. Firefighters should use self-contained breathing equipment and protective clothing.

SECTION 7 - PHYSICAL HAZARDS

Conditions to Avoid: Avoid exposure to light.

Incompatibilities: Heat and sunlight may cause polymerization of 1,2-dichloroethene if material is not inhibited.

Decomposition Products: When heated to decomposition material emits toxic fumes. Emits toxic fumes under fire conditions.

Stable? Yes **Hazardous Polymerization?** No

SECTION 8 - HANDLING / SPILL / DISPOSAL MEASURES

Handling: As a general rule, when handling USP Reference Standards avoid all contact and inhalation of dust, mists, and/or vapors associated with the material. Wash thoroughly after handling.

Storage: Store in tight container as defined in the USP-NF. This material should be handled and stored per label instructions to ensure product integrity.

Spill Response: Wear approved respiratory protection, chemically compatible gloves and protective clothing. Wipe up spillage. Avoid breathing vapors. Place spillage in appropriately labelled container for disposal. Wash spill site.

Disposal: Dispose of waste in accordance with all applicable Federal, State and local laws.

SECTION 9 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Respiratory Protection: Use a NIOSH approved respirator, if it is determined to be necessary by an industrial hygiene survey involving air monitoring.

Ventilation: Recommended

Gloves: Chemically compatible

Eye Protection: Safety Goggles

Protective Clothing: Protect exposed skin.

SECTION 10 - PHYSICAL AND CHEMICAL PROPERTIES

NOTE: The data reported below is general information, and is not specific to the USP Reference Standard Lot provided!

Appearance and Odor: Colorless liquid.

Melting Point: n/f

Solubility in Water: n/f

Boiling Point: n/f

Specific Gravity: n/f

Vapor Pressure: n/f

Vapor Density: n/f

Evaporation Rate: n/f

Reactivity in Water: n/f

% Volatile by Volume: n/f

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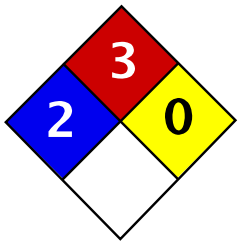
n/f = not found



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Xylenes MSDS

Section 1: Chemical Product and Company Identification

Product Name: Xylenes

Catalog Codes: SLX1075, SLX1129, SLX1042, SLX1096

CAS#: 1330-20-7

RTECS: ZE2100000

TSCA: TSCA 8(b) inventory: Xylenes

CI#: Not available.

Synonym: Xylenes; Dimethylbenzene; xylol; methyltoluene

Chemical Name: Xylenes (o-, m-, p- isomers)

Chemical Formula: C6H4(CH3)2

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Xylenes	1330-20-7	100

Toxicological Data on Ingredients: Xylenes: ORAL (LD50): Acute: 4300 mg/kg [Rat]. 2119 mg/kg [Mouse]. DERMAL (LD50): Acute: >1700 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: 3 (Not classifiable for human.) by IARC.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to blood, kidneys, liver, mucous membranes, bone marrow, central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 464°C (867.2°F)

Flash Points: CLOSED CUP: 24°C (75.2°F). (Tagliabue.) OPEN CUP: 37.8°C (100°F).

Flammable Limits: LOWER: 1% UPPER: 7%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat.
Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Slightly explosive in presence of open flames and sparks, of heat.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use alcohol foam, water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Vapors may travel to source of ignition and flash back.

Special Remarks on Explosion Hazards:
Vapors may form explosive mixtures with air.
Containers may explode when heated.

May polymerize explosively when heated.
An attempt to chlorinate xylene with 1,3-Dichloro-5,5-dimethyl-2,4-imidazolidindione (dichlorohydrantoin) caused a violent explosion

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 100 (ppm) [Canada]
TWA: 435 (mg/m3) [Canada]
TWA: 434 STEL: 651 (mg/m3) from ACGIH (TLV) [United States]
TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) [United States]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweetish.

Taste: Not available.

Molecular Weight: 106.17 g/mole

Color: Colorless. Clear

pH (1% soln/water): Not available.

Boiling Point: 138.5°C (281.3°F)

Melting Point: -47.4°C (-53.3°F)

Critical Temperature: Not available.

Specific Gravity: 0.864 (Water = 1)

Vapor Pressure: 0.9 kPa (@ 20°C)

Vapor Density: 3.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 1 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.1

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Insoluble in cold water, hot water.
Miscible with absolute alcohol, ether, and many other organic liquids.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources, incompatibles

Incompatibility with various substances: Reactive with oxidizing agents, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Store away from acetic acid, nitric acid, chlorine, bromine, and fluorine.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 2119 mg/kg [Mouse].

Acute dermal toxicity (LD50): >1700 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 5000 4 hours [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: 3 (Not classifiable for human.) by IARC.
May cause damage to the following organs: blood, kidneys, liver, mucous membranes, bone marrow, central nervous system (CNS).

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals:
Lowest Lethal Dose:
LDL [Human] - Route: Oral; Dose: 50 mg/kg
LCL [Man] - Route: Oral; Dose: 10000 ppm/6H

Special Remarks on Chronic Effects on Humans:
Detected in maternal milk in human. Passes through the placental barrier in animal. Embryotoxic and/or foetotoxic in animal.
May cause adverse reproductive effects (male and femael fertility (spontaneous abortion and fetotoxicity)) and birth defects based animal data.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Causes skin irritation. Can be absorbed through skin.
Eyes: Causes eye irritation.
Inhalation: Vapor causes respiratory tract and mucous membrane irritation. May affect central nervous system and behavior (General anesthetic/CNS depressant with effects including headache, weakness, memory loss, irritability, dizziness, giddiness, loss of coordination and judgement, respiratory depression/arrest or difficulty breathing, loss of appetite, nausea, vomiting, shivering, and possible coma and death). May also affects blood, sense organs, liver, and peripheral nerves.
Ingestion: May cause gastrointestinal irritation including abdominal pain, vomiting, and nausea. May also affect liver and urinary system/kidneys. May cause effects similar to those of acute inhalation.
Chronic Potential Health Effects:
Chronic inhalation may affect the urinary system (kidneys) blood (anemia), bone marrow (hyperplasia of bone marrow) brain/behavior/Central Nervous system. Chronic inhalation may alsocause mucosal bleeding.
Chronic ingestion may affect the liver and metabolism (loss of appetite) and may affect urinary system (kidney damage)

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Xylenes UNNA: 1307 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Xylenes
Illinois chemical safety act: Xylenes
New York acutely hazardous substances: Xylenes
Rhode Island RTK hazardous substances: Xylenes
Pennsylvania RTK: Xylenes
Minnesota: Xylenes
Michigan critical material: Xylenes
Massachusetts RTK: Xylenes
Massachusetts spill list: Xylenes
New Jersey: Xylenes
New Jersey spill list: Xylenes
Louisiana spill reporting: Xylenes
California Director's List of Hazardous Substances: Xylenes
TSCA 8(b) inventory: Xylenes
SARA 302/304/311/312 hazardous chemicals: Xylenes
SARA 313 toxic chemical notification and release reporting: Xylenes
CERCLA: Hazardous substances.: Xylenes: 100 lbs. (45.36 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R10- Flammable.
R21- Harmful in contact with skin.
R36/38- Irritating to eyes and skin.
S2- Keep out of the reach of children.
S36/37- Wear suitable protective clothing and gloves.
S46- If swallowed, seek medical advice immediately and show this container or label.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/11/2005 12:54 PM

Last Updated: 10/11/2005 12:54 PM

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ARCADIS

Attachment H

Incident/Near Miss Investigation Form

ARCADIS
Infrastructure, environment, buildings

Incident / Near-Miss Investigation Report

☐ OSHA Recordable	☐ First Aid Injury	☐ Fire	Date of Incident:
☐ Lost Workday Injury	☐ Vehicle Accident	☐ Spill / Leak	
☐ Restricted Duty Injury	☐ Equipment Damage	☐ Near Miss	Incident Number:

Every employee injury, accident, and near miss must be reported within 24 hours of the injury. If the incident results in hospitalization, an immediate report must be made by telephone to the Project Manager and the Health and Safety Officer.

Project Information

Project Name: | Project #

Location of Incident:

Employee

Name: | Employee Number:

Employment Status: ☐ Regular ☐ Part Time | How long in present job?

Injury or Illness Information

Where did the incident / near miss occur? (number, street, city, state, zip):

Employee's specific activity at the time of the incident / near miss:

Equipment, materials, or chemicals the employee was using when the incident / near miss occurred (e.g., the equipment employee struck against or that struck the employee; the vapor inhaled or material swallowed; what the employee was lifting, pulling, etc.):

Describe the specific injury or illness (e.g., cut, strain, fracture, etc.):

Body part(s) affected (e.g., back, left wrist, right eye, etc.):

Name and address of treatment provider (e.g., physician or clinic): | Phone No.:

If hospitalized, name and address of hospital: | Phone No.:

Date of injury or onset of illness: / / | Time of event or exposure: ☐ AM ☐ PM

Did employee miss at least one full shift's work? ☐ No ☐ Yes, 1st date absent (MM/DD/YYYY) / /

Has employee returned to work? ☐ Regular work ☐ Restricted work ☐ No
☐ Yes, date returned (MM/DD/YYYY) / /

To whom reported: | Other workers injured / made ill in this event? ☐ Yes ☐ No

Description of Incident / Near Miss: (Describe what happened and how it happened.)

ARCADIS
Infrastructure, environment, buildings

Incident / Near-Miss Investigation Report

Motor Vehicle Accident (MVA)									
				Company Vehicle?	☐ Yes ☐ No				
Accident Location (street, city, state)									
Vehicle Towed?	☐ Yes ☐ No	Other Vehicle?	☐ Yes ☐ No	# Vehicles Towed:		# of Injuries:			

Spill		
Material Spilled:	Quantity:	Source:
Agency Notifications:		
Cost of Incident $		

Third Party Incidents			
Name of Owner:		Address:	Telephone:
Description of Damage:			
Witness Name:		Address:	Telephone:
Witness Name:		Address:	Telephone:

#	Root Cause and Contributing Factors: Conclusion (Describe in Detail Why Incident / Near Miss Occurred)
1	
2	
3	
4	
5	

Root Cause(s) Analysis (RCA):

1. Lack of skill or knowledge.
2. Lack of or inadequate operational procedures or work standards.
3. Inadequate communication of expectations regarding procedures or work standards.
4. Inadequate tools or equipment.
5. Correct way takes more time and / or requires more effort.
6. Short-cutting standard procedures is positively reinforced or tolerated.
7. Person thinks there is no personal benefit to always doing the job according to standards.
8. Uncontrollable.

#	RCA #	Solution(s): How to Prevent Incident / Near Miss From Reoccurring	Person Responsible	Due Date	Closure Date

Investigation Team Members		
Name	Job Title	Date

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Incident / Near-Miss Investigation Report

Results of Solution Verification and Validation

Reviewed By

Name	Job Title	Date
	Project Manager	
	Health and Safety Reviewer	

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Attachment I

Loss Prevention Observation Form

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Loss Prevention Observation

Observer Name	Observer Title	Project/Project Number

Date _____ Time ____ ☐ AM ☐ PM	Project Type / Task Observed

Background Information

List Critical Work Procedures

List Issue/Items Requiring Corrective Action

Root Cause Analysis

1. Employee lacks the skill or knowledge to carry out duties
2. Procedures, work standards, or expectations were not communicated
3. Procedures or work standards were not developed or were inadequate
4. Equipment, systems, or tools were inadequate
5. Employee chose not to take the time or put forth the effort to do the job properly
6. Supervisor did not require the employee to follow the standard procedure
7. Employee doesn't see any advantage to doing the job to standard.
8. Uncontrollable.

Criterion #	RCA #	Corrective Action Identified	Responsible Individual	Due Date	Closure Date

Results of Corrective Action

Reviewed by	Date	Reviewed by	Date

Environmental Operations

	PRE-TASK PREPARATION	Correct	Questionable	Comments
1.	Health and Safety Plan / MSDSs on site			
2.	Employee familiar / trained on task			
3.	OSHA-required training/medical surveillance			
4.	Utility mark out / check performed			
5.	Traffic hazard addressed / work area marked			
6.	Walking / working surfaces free of hazards			
7.	Tailgate safety meeting performed			
8.	Impact on nearby residence/business evaluated			
9.	Communicates intentions to other personnel			
10.	Knowledge of emergency procedures			
11.	Distance between equipment and power lines			
12.	Personal protective equipment			
13.	Air monitoring equipment on site, calibrated			
14.	First aid kit / fire extinguisher on site			
15.	One person trained in first aid / CPR			
16.	Work zones established and marked			
	PERFORMING TASK			
17.	Employee trained in task to be performed			
18.	Correct body positioning			
19.	Proper lifting / pushing / pulling techniques			
20.	Keep hands / body away from pinch points			
21.	Walking / working surfaces kept clear of debris			
22.	Faces traffic as appropriate			
23.	Vehicles/ barricades to protect against traffic			
24.	Drill rig located properly, blocked / chocked			
25.	Drill rig moved only with derrick lowered			
26.	Excavator located on stable ground			
27.	Eye contact made with equipment operator			
28.	Spoil at least 2 feet back from edge of excavation			
29.	Excavation shored/sloped/benched			
30.	Excavation entry controlled			
31.	Equipment/tools used properly			
32.	Electrical equipment connected through GFCI			
33.	Power tools handled properly			
34.	Electrical cords inspected / in good condition			
35.	Follows lockout / tagout procedures			
36.	Air monitoring conducted/action levels understood			
37.	Equipment decontaminated properly			
38.	Personnel decon prior to eating/drinking/smoking			
39.	Decontamination effective			
	POST – TASK			
40.	Procedures / JSA adequate			
41.	Equipment / tools stored properly			
42.	Proper storage of soil / water / waste material			
43.	Work area secured			
44.	Other			

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Attachment J

Air Monitoring Log

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Air Monitoring Log

Project: **Date:**

Monitoring Instruments:

Air Monitor: **Activity:**

Level of Protection:

Time	Location	Instrument Reading	Comments

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Attachment K

Health and Safety Inspection Form

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Health and Safety Inspection Form

Project Name:	**Date:**
Project Number:	**Location:**
Prepared By:	**Project Manager:**
Auditor:	**HSS On Site:**

	YES	NO	N/A	COMMENTS
GENERAL				
Is the HASP on site?				
Is the HASP finalized and approved?				
Is the OSHA poster displayed?				
Are emergency telephone numbers posted?				
Is emergency eyewash immediately available?				
Is an emergency shower immediately available?				
Are emergency notification means available (radio, telephone)?				
Is a first-aid kit immediately available?				
Is the first-aid kit adequately stocked?				
Is there a proper sanitation facility on site?				
DOCUMENTATION AND RECORDKEEPING				
Are only personnel listed and approved in the HASP on site?				
Are all personnel properly trained? (Check company-issued wallet cards.)				
Is the daily field log kept by the Site Manager?				
Are levels of PPE recorded?				
Are contaminant levels recorded?				
Are site surveillance records kept by HSS?				
Is a copy of current fit test records on site?				
Are calibration records maintained for air monitoring equipment?				
Are accident / incident forms on site?				
Are field team review sheets signed?				
Are additional hospital route directions available?				
Is the visitors' logbook being accurately maintained?				
Are MSDSs available for all chemicals on site?				
Are HASP revisions recorded?				
Is the first-aid kit inspected weekly?				
Are daily safety meetings held?				
Are emergency procedures discussed during safety meetings?				

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Health and Safety Inspection Form

	YES	NO	N/A	COMMENTS
EMERGENCY RESPONSES				
Is a vehicle available on site for transportation to the hospital?				
Are fire extinguishers on site and immediately available at designated work areas?				
Is at least one person trained in CPR and first aid on site at all times during work activities?				
Do all personnel know who is trained in CPR / first aid?				
PERSONAL PROTECTIVE EQUIPMENT (PPE)				
Is proper PPE being worn as specified in HASP?				
Level of PPE being worn.				
Is PPE adequate for work conditions?				
If not, give reason.				
Upgrade/downgrade to PPE level.				
Does any employee have facial hair that would interfere with respirator fit?				
If yes, willing to shave, as necessary?				
Fit-tested within the last year? (Documentation present)				
If Level B, is a back-up / emergency person suited up (except for air)?				
Does the HSS periodically inspect PPE and equipment?				
Is the PPE not in use properly stored?				
Is all equipment required in the HASP on site?				
Properly calibrated?				
In good condition?				
Used properly?				
Other equipment needed?				
List.				
Is monitoring equipment covered with plastic to minimize contamination?				
PERSONNEL AND EQUIPMENT DECONTAMINATION				
Is the decontamination area properly designated?				
Is appropriate cleaning fluid used for known or suspected contaminants?				
Are appropriate decontamination procedures used?				
Are decontamination personnel wearing proper PPE?				
Is the equipment decontaminated?				

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Health and Safety Inspection Form

	YES	NO	N/A	COMMENTS
PERSONNEL AND EQUIPMENT DECONTAMINATION (continued)				
Are sample containers decontaminated?				
Are disposable items replaced as required?				
WORK PRACTICES				
Was proper collection and disposal of potentially contaminated PPE performed?				
Was proper collection and disposal of decontamination fluid performed?				
Is water available for decontamination?				
Is the buddy system used?				
Is equipment kept off drums and the ground?				
Is kneeling or sitting on drums or the ground prohibited?				
Do personnel avoid standing or walking through puddles or stained soil?				
Are work zones established?				
If night work is conducted, is there adequate illumination?				
Is smoking, eating, or drinking in the exclusion or CRZ prohibited?				
To the extent feasible, are contaminated materials handled remotely?				
Are contact lenses not allowed on site?				
Is entry into excavations not allowed unless properly shored or sloped?				
Is a competent person on site during excavation?				
Are all unusual situations on site listed in HASP?				
If not, when?				
Action taken?				
HASP revised?				
CONFINED SPACE ENTRY				
Are employees trained according to 1910.146 – Confined Space Entry?				
Are all confined spaces identified? If not, list:				
Is all appropriate equipment available and in good working order?				
Is equipment properly calibrated?				
Are confined space permits used?				
Are confined space permits completely and correctly filled out?				

*N/A = Not Applicable

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Attachment L

Site Activities Tailgate Health & Safety Briefing Form

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SITE ACTIVITIES TAILGATE HEALTH & SAFETY BRIEFING FORM

This briefing form documents the tailgate briefing conducted in accordance with the HASP. Personnel who perform work operations on site are required to attend each briefing and to acknowledge receipt of each briefing, at least daily.

Project Number:		**Project Name:**
Date:	**Time:**	**Briefing Conducted by:**
Company:		**Signature/Title:**

TRACKing the Tailgate Briefing

Think through the Tasks (list the tasks for the day):

1 _____ 3 _____ 5 _____

2 _____ 4 _____ 6 _____

Recognize the hazards (check all those that are discussed) and **A**ssess the Risks (Low, Medium, High-circle risk level)

☐ Confined Space	(L M H)	☐ Buried/Overhead Utilities	(L M H)	☐ Excavation	(L M H)
☐ Walking/Working surfaces	(L M H)	☐ Chemical Exposure	(L M H)	☐ Noise	(L M H)
☐ Thermal Stress (Hot/Cold)	(L M H)	☐ Overhead Hazards	(L M H)	☐ Traffic/Roadway/Railway	(L M H)
☐ Severe Weather	(L M H)	☐ Chemical Usage	(L M H)	☐ Elevated work	(L M H)
☐ Hazardous Energy	(L M H)	☐ Heavy Machinery	(L M H)	☐ Biological/Animals	(L M H)
☐ Ergonomic	(L M H)	☐ Personal Safety/Security	(L M H)	☐ Mining	(L M H)
☐ Client/Other Site Activities	***List***	☐ Chemical Exposure	***List***	☐ Other	***Specify***
_____	(L M H)	_____	(L M H)	_____	(L M H)
_____	(L M H)	_____	(L M H)	_____	(L M H)
_____	(L M H)	_____	(L M H)	_____	(L M H)

Control the hazards (Check all those methods to control the hazards that apply):

☒ **STOP WORK AUTHORITY** (Must be addressed in every Tailgate meeting-*See H&S Handbook for definition*)

☐ General PPE Usage	☐ Hearing Conservation	☐ Respiratory Protection
☐ Personal Hygiene	☐ Exposure Guidelines	☐ Decon Procedures
☐ Emergency Action Plan	☐ Fall Protection	☐ Work Zones/Site Control
☐ JSA to be developed/used ***(specify)***	☐ LPO conducted ***(specify job/JSA)***	☐ Other ***(specify)***
_____	_____	_____
_____	_____	_____
_____	_____	_____

Personnel Sign-in List

Printed Name	Signature

Keep H&S 1st in all things

Use the back to add comments such as recent near misses, injuries or property damage, visitors to the site, etc

SITE ACTIVITIES TAILGATE HEALTH & SAFETY BRIEFING FORM

Additional Comments:

Discussion of recent results of LPOs conducted on the project:

Discussion of recent Near-miss, injuries, and/or property damage on the project:

List Visitors to Site Today:

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Attachment M

Health and Safety Plan
Acknowledgment Forms

Employee Signature Form

I certify that I have read, understand, and will abide by the safety requirements outlined in this HASP.

Printed Name	Signature	Date

Subcontractor Acknowledgement: Receipt of HASP Signature Form

ARCADIS claims no responsibility for the use of this HASP by others although subcontractors working at the site may use this HASP as a guidance document. In any event, ARCADIS does not guarantee the health and/or safety of any person entering this site. Strict adherence to the health and safety guidelines provided herein will reduce, but not eliminate, the potential for injury at this site. To this end, health and safety becomes the inherent responsibility of personnel working at the site.

Printed Name	Company	Signature	Date

Visitor Acknowledgement and Acceptance of HASP Signature Form

By signing below, I waive, release and discharge the owner of the site and ARCADIS and their employees from any future claims for bodily and personal injuries which may result from my presence at, entering, or leaving the site and in any way arising from or related to any and all known and unknown conditions on the site.

Name	Company	Reason for Visit	Date/Time On Site	Date/Time Off Site

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Attachment N

Hazardous Materials Shipment Form

Hazardous Materials Shipment Form

Material Description and Proper Shipping Name (per DOT or IATA)	Shipment Quantity	DOT Hazard Classification	Shipment Method (air/ground)

List Shipper (i.e., who we are offering the shipment to):

_____

_____

List Trained Employee(s):

_____

_____

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Attachment O

Hazardous Materials
Transportation Form

Hazardous Materials Transportation Form

	Vehicle (place X in box)	Type (pick-up, car, box truck, etc.)
Personal		
Rental		
ARCADIS owned/leased		
Government owned		
Trailer		

Materials Transported	Quantity	Storage/Transport Container

List Trained Drivers:

_____

_____

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Attachment P

Real Time Exposure Monitoring
Data Collection Form

Real Time Exposure Monitoring Data Collection Form

Document all air monitoring conducted on the Site below. Keep this form with the project file.

Site Name: _____ Date: _____

Instrument: _____ Model: _____ Serial #: _____

Calibration Method: (Material used settings, etc.)	
Calibration Results:	
Calibrated By:	

Activity Being Monitored	Compounds/Hazards Monitored	Time	Reading	Action Required? Y/N

Describe Any Actions Taken as a Result of this Air Monitoring and Why (does it match Table 5-1):

_____

_____

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Attachment Q

Field Health & Safety Stewardship Checklist

ARCADIS OFFICER
FIELD HEALTH & SAFETY STEWARDSHIP CHECKLIST

Client: **Project Name:**

Project / Task Manager: **Completed By:** **Date:**

A yes answer indicates that in addition to asking the question you have verified, by reviewing documentation, that the activities have been completed:	Yes	No	NA
1. Are the H&S responsibilities/requirements for the project clearly defined and understood by project staff?			
2. Can project staff identify the major hazards of the project and how they are controlled?			
3. Do staff have all required identification, appropriately displayed and up-to-date including photo IDs, training certifications and all other client specific documentation?			
4. Is the project Health and Safety plan (HASP) on-site?			
5. Does field staff know where the HASP is located?			
6. Has the HASP been reviewed within the last year?			
7. Has the field staff signed off on and understand the HASP?			
8. Have designated and approved HASP writers and job experts been identified to develop HASP and appropriate JSAs?			
9. Have HASPs and other H&S procedures for the project been coordinated with subcontractors and the client?			
10. Does the field staff understand client requirements that are applicable?			
11. Have H&S activities been coordinated with the client?			
12. Is there a sign-in log for visitors who may come to the site?			
13. Have visitors been signing in and out on the visitor's log?			
14. Has a site-safety officer (SSO) been designated?			
15. Has any subsurface work been cleared using the ARCADIS Utility Locate procedure?			
16. Has H&S been coordinated with other client contractors who may be on-site?			
17. Have selected subcontractors been reviewed for H&S qualifications and performance?			
18. Have selected subcontractors been notified of H&S responsibilities?			
19. Have selected subcontractors been notified of client H&S requirements?			
20. Have selected subcontractors submitted their H&S plans and documents?			
21. Is there documentation on site for ARCADIS & Subcontractor staff H&S training and Medical Certification, as required by certain clients?			
22. Can employees explain what training is required for their required tasks?			
23. Is all training, including applicable OSHA/MSHA/Canadian regulatory required training, current?			
24. Are JSAs available and being used on site?			
25. Are staff using TRACK (ask them to describe how they used TRACK for the task they are conducting)?			
26. Can employees describe their Stop Work Authority and how they would use it?			
27. Have LPOs been done on site tasks or are any planned for completion?			
28. Have tailgate safety meetings been conducted before work begins and after the mid-day break?			
29. Do tailgate safety meetings cover appropriate topics using the TRACK process as well as appropriate client specific requirements?			
30. Do tailgate safety meetings include subcontractors and/or clients?			
31. Is staff wearing PPE appropriate to the hazards and according to the HASP?			

32. Does staff have appropriate PPE including at a minimum: a. Hard hat b. Class II traffic safety vest c. Safety toe work boots d. Safety glasses e. Hearing protection f. Other PPE as required by HASP and client			
33. If not a federal or other government project, was PPE purchased through Wise Safety?			
34. Does staff know what to do in the event of an emergency?			
35. Does staff have an adequate way to communicate in the event of an emergency?			
36. Is emergency information posted in appropriate spots for staff to know what to do?			
37. Does staff have the WorkCare phone number available and does staff understand what Workfare is and when it should be utilized?			
38. Is emergency equipment available, like first aid kits, fire extinguishers, eye washes, etc.?			
39. If required by the HASP, is someone on-site First Aid/CPR/BBP trained and is training current?			
40. Are Material Safety Data Sheets available for chemicals used on-site?			
41. Does staff understand the purpose of the MSDSs and how they are utilized?			
42. Has any incident (including near miss) occurred on the project?			
43. Were the solutions implemented on site and have they been validated and verified?			
44. Can the project employees indicate how they are combating fatigue?			
45. Is the Buddy System in use on this project and is it part of the HASP requirements?			
46. If you have the opportunity to ride with someone, are Smith System driving techniques being used by project staff?			
47. Is housekeeping on the site being conducted and does staff understand the rationale behind the inspections?			
48. Have inspections been conducted on field equipment including drill rigs and other equipment and does staff understand the rationale behind the inspections?			
49. If the HASP indicates that air monitoring will be conducted, is there documentation of the monitoring and of equipment calibration?			
50. Are work zones/exclusion zones clearly identified as appropriate?			
51. Is a plan in place for the appropriate transportation and/or shipping of hazardous materials per the US DOT? Do employees handling or shipping HAZMAT have the required training?			
52. Is there appropriate storage of hazardous materials on the site, is that area designated, and are materials labeled as such?			
53. Are appropriate personal hygiene, break areas, and fluids available to the project staff?			
54. Are overnight accommodations within a reasonable distance to and from the site?			
55. Have appropriate measures been taken to ensure the personal security of the project staff?			
56. Are there Short Service Employees on site? Are they appropriately identified and who is there field mentor?			
57. Are there other issues that were addressed during this site assessment? Describe in the comments section below.			

Comments: _____

ARCADIS BBL

Dye Injection HASP Addendum

October 2007

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Imagine the result

Ashland Inc.

Dye Injection HASP Addendum

Ashland Distribution Company Site
Rensselaer, New York

October 2007

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Health and Safety Plan Acknowledgment

I have read the Site-Specific Health and Safety Plan, or its contents have been presented to me, and I understand the contents and I agree to abide by its requirements.

Name (Print)	Signature	Representing	Date

ARCADIS BBL

Dye Injection HASP Addendum

Ashland Distribution
Company Site
Rensselaer, New York

Scope of Work

Tracer Dye Injection – Several thousand gallons of dye solution will be injected into injection wells located at two injection test areas. The solution will be mixed on-site by diluting 10% dye solution with potable water. Water samples will be collected from nearby monitoring wells to observe for the appearance of dye.

Task Hazard Analysis

Tracer Dye Injection

HAZARD	Well Caps Under Pressure	Level of Risk	High
Source of Hazard	Gas build-up in injection area wells may cause well caps to launch into the air at high speed when they are being opened.		
Admin. & Eng. Controls	When opening wells, employees should not stand with their head over the well cap. The employees should stand back (keep their body back) from the well as much as possible, to avoid being hit in the head by a cap. When possible. It would be ideal to retrofit the well with a valve, which could be opened to vent the well prior to removing the cap, which would greatly reduce the threat of this hazard.	PPE:	Hard hat, safety glasses
HAZARD	**Injection Line Under Pressure**	**Level of Risk**	**Low**
Source of Hazard	Build-up of excessive pressure in the injection lines and injection wells causes dislodgement of injection line components (e.g. well-head fittings).		
Admin. & Eng. Controls	The injection lines will not be pressurized under normal operating conditions. The configuration of valves and readings of totalizer / flow meter should be check periodically to ensure un-obstructed fluid flow. In an event that excessive pressure is built up, disconnect the pump to the power source and open the pressure relief valve.	PPE:	Hard hat, safety glasses

HAZARD	Generator and Fuel Use	Level of Risk	High
Source of Hazard	Improper operation and grounding of the generator causes electrical shock. Improper storage and handling of fuel, and re-fuelling of the generator are potential fire hazards. Prolonged exposure to fuel liquid or vapor causes adverse health effects. Cords from the generator can be a tripping hazard.		
Admin. & Eng. Controls	Guidelines for use of electric generator • Use the proper power cords. Plug individual appliances into the generator using heavy-duty, outdoor-rated cords with a wire gauge adequate for the appliance load. • Read and adhere to the manufacturer's instructions for safe operation. Carefully read and observe all instructions in the generator's owner manual. • To prevent electrical shock, make sure your generator is properly grounded. Consult your manufacturer's manual for correct grounding procedures.	PPE:	Hard hat, safety glasses
Admin. & Eng. Controls	Guidelines for use of portable containers • Use only an approved portable container for fuel storage (1 to 5 gallons, metal or UL approved plastic, colored red, with vapor-tight cap). The container must be in good condition with vapor-tight cap. Never store gasoline in glass or unapproved containers. • When filling fuel container turn off engine; extinguish smoking materials, leave electronic devices in the vehicle. • Place portable fuel container on the ground during filling, and keep the metal nozzle spout in contact with the container to prevent build up and discharge of static electricity. Never fill a container in the bed of a pickup, in the back of a station wagon, or in the trunk of a car. • Keep container five feet away from cars to prevent ignition of fumes by hot engines or mufflers. • Manually control the nozzle valve throughout the filling process. Fill a portable container slowly to decrease the chance of static electricity buildup and minimize spilling or splattering.	PPE:	Hard hat, safety glasses

HAZARD	Generator and Fuel Use	Level of Risk	High
Admin. & Eng. Controls	• Back off on the trigger to slow fuel flow as the container becomes full. Fill container no more than 95 percent full to allow for expansion. When filling is complete, tightly cap container. Wipe off any gasoline that spilled on the outside of the container. Guidelines for transporting gasoline in portable containers • Make sure the cap is on tightly before you put the container in your vehicle. • Put container in trunk of car or in bed of pickup. Do not put container in the passenger area of your vehicle. • Restrain the container so it cannot tip over or slide around while you are driving. • Never leave a vehicle with a portable gasoline container in direct sunlight. Guidelines for fueling the generator ▪ Transfer fuel in an area with good ventilation to reduce hazard of fire and exposure to vapors. ▪ Ensure that there are no sources of ignition (gas pilot lights or flames, electric motors, stoves, heaters) within 50 feet. ▪ Do not refuel when the generator is running. Avoid getting fuel on your skin or clothes. Use a funnel to avoid spills. Do not breathe fuel vapors.	PPE:	Hard hat, safety glasses

HAZARD	Potential demolition work	Level of Risk	High
Source of Hazard	Heavy demolition equipment near workers.		
Admin. & Eng. Controls	Use traffic cones/barricades in accordance with state, county or local requirements. PPE as noted. Coordinate with demolition workers regarding work areas and safety precautions. Keep distance with heavy equipment. Keep eye contact with equipment operators to ensure proper communications.	PPE:	ANSI Class II traffic vests (Class III vest if traffic in area is moving at speeds greater than 50 mph), hardhats, steel toe boots, eye protection.

HAZARD	Heavy Lifting	Level of Risk:	High
Source of Hazard	Injections may require lifting heavy containers of dye or other injection materials as well as equipment needed for injecting.		
Admin. & Eng. Controls	Do not lift alone. Use a buddy system to avoid any injuries and trip/slip hazards. Do not attempt to lift more than maximum physical strength or 49 pounds. Lift with the knees, not the back. If possible, make multiple trips and carry less.	PPE:	None
HAZARD	**Heat**	**Level of Risk**	**Medium**
Source of Hazard	Summer and fall weather; Heat stress, heat exhaustion or heat stroke.		
Admin. & Eng. Controls	Frequent work breaks. Intake of fluids (5-7 oz. every 15-20 minutes). Rotate personnel.	PPE:	None.
HAZARD	**Power tools**	**Level of Risk**	**Medium**
Source of Hazard	Use of power tools during injection activities.		
Admin. & Eng. Controls	Guards on tools must be maintained; SSO should ensure that only trained personnel use portable hand and power tools	PPE:	Protective eyewear, work gloves
HAZARD	**Cold**	**Level of Risk**	**Medium**
Source of Hazard	Winter weather. Frostbite, hypothermia.		
Admin. & Eng. Controls	Frequent short breaks in warm dry areas; insulated, waterproof, layered clothing; work during warmest hours of the day.	PPE:	Dry, insulated clothing , including protection for hands, face and head.
HAZARD	**Walking/Working Surfaces (protruding objects, debris, spills)**	**Level of Risk:**	**Medium**
Source of Hazard	Slips, trips, falls, puncture wounds; hazard increased by darkness		
Admin. & Eng. Controls	Don't run, use handrails/grips when available, keep paths clear of tools, etc., and use adequate lighting.	PPE:	Steel-toed work boots with good tread.
HAZARD	**Biological Hazards: insects, rodents, snakes, plants**	**Level of Risk:**	**Low to Medium**
Source of Hazard	Poison ivy, snakes, biting/stinging insects		
Admin. & Eng. Controls	Wear long pants/sleeves and gloves if handling vegetation, conduct frequent body/clothing checks for insects/ticks when working in brushy areas; remove ticks as soon as possible.	PPE:	Long pants/sleeves; insect repellant

HAZARD	Ergonomic Hazards	Level of Risk:	Low to Medium
Source of Hazard	Repetitive motion, frequent/heavy lifting, awkward positions.		
Admin. & Eng. Controls	Reduce manual lifting where possible; reduce weight of lifts where possible. Use the buddy system to lift heavy or awkward objects. Do not lift more than you can physical handle (and not more than 49 lbs).	PPE:	None
HAZARD	**Driving early/late**	**Level of Risk**	**Low to Medium**
Source of Hazard	Sleepiness while driving.		
Admin. & Eng. Controls	Take driving breaks as needed. Do not rush.	PPE:	None
HAZARD	**Severe Weather**	**Level of Risk**	**Low**
Source of Hazard	Lightning, high winds, hail, heavy rain		
Admin. & Eng. Controls	Stoppage of work when lightning occurs and when SSO deems necessary; monitor radio weather forecasts;	PPE:	None.

MATERIAL SAFETY DATA SHEET
MOLASSES/MOLASSES BLENDS/BINDERS

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Chemical Name	Chemical Formula	Molecular Weight
N/A	Mixture of liquid Agricultural commodities	No data

Trade Name – Molasses/Molasses Blends

Synonyms: DOT Identification No.

Liquid animal supplement: N/A

Company Identification:
Westway Trading Corporation
365 Canal Street, Suite 2900
New Orleans, Louisiana 70130
(504) 525-9741

2. COMPOSITION, INFORMATION ON INGREDIENTS

Component(s), Chemical Name	CAS Registry No.	%(Approx.)	ACGIH TLV-TWA
Proprietary	NA	No data	No data

See ingredient tag

3. HAZARDS IDENTIFICATION

Emergency Overview

This material should be stored in a vented tank designed to contain a material with a specific gravity of 1.3 or greater. Material can ferment if excessive moisture contamination is allowed. Fermentation can yield carbon dioxide with possible traces of ethanol or volatile fatty acids (e.g. acetic, propionic, lactic, or butyric) and if exposed to a spark or flame may result in an explosion. These conditions should be avoided. If maintenance of tank requires entry by personnel, OSHA's Confined Space standard (29CFR1910.146) shall be complied with. If welding is to be performed, the tank should be gas freed and only certified welders shall perform welding operations.

Potential Health Effects

Eyes - Mild irritant

Skin - None

Inhalation – Insufficient oxygen may be present in vessels containing the product due to the generation of carbon monoxide during fermentation

4. FIRST AID MEASURES

Eyes: Flush eyes for 15 minutes.

Skin: Wash with soap and water.

Ingestion: No data

5. FIRE FIGHTING MEASURES

Flashpoint (Method used)	Flammable Limits in Air
Non-flammable Non-combustible	Non-flammable Non-combustible

Extinguishing Agents - NA

Unusual Fire and Explosion Hazards - Fermentation occurs when diluted with water and is accelerated by heat. During fermentation, carbon monoxide with possible traces of ethanol or volatile fatty acids (e.g., acetic, propionic, lactic, or butyric) is given off, which produces inhalation hazards and possible explosion hazards.

6. ACCIDENTAL RELEASE MEASURES

Steps to be Taken in Case Material is Released or Spilled

Small spills - Stop the source of the spill. Recover as much product as possible for reuse. Absorb remaining spill and dispose solids in waste container.

Large spills - Stop the source of the spill. Create diversionary structures to minimize the extent of the release. Prevent the release from entering a waterway or sewer. Recover useable product. Absorb remaining spill and dispose of at an approved facility such as a municipal landfill or land application site.

7. HANDLING AND STORAGE

This material should be stored in a vented tank designed to contain a material with a specific gravity of 1.3 or greater. Material can ferment if excessive moisture contamination is allowed.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

Respiratory Protection - None

Ventilation - Provide adequate ventilation to prevent accumulation of vapors.

Skin Protection - Rubber gloves

Eye Protection - Safety glasses

Hygiene - Wash any exposed area promptly with soap and water. Launder contaminated clothing.

Other Control Measures - None

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance Dark brown syrupy liquid	Odor Sweet
Physical State Liquid	Specific Gravity 1.45
Boiling Point Very high	Freezing/Melting Point Varies
Vapor Pressure Low	% Volatile, by Volume No data
Evaporation Rate No data	Vapor Density in Air Water vapor only
Solubility in Water Soluble	pH 2.25 to 6.0

10. STABILITY AND REACTIVITY

Chemical Stability - Stable

Conditions to Avoid – Excess moisture or heat. Unventilated containers.

Incompatibility with Other Materials - Reacts with concentrated nitric acid or concentrated Sulphuric acid. Ferments when diluted with water.

Hazard Decomposition Products – Carbon monoxide, alcohol or fatty acid vapors

Hazardous Polymerization - NA

11. ECOLOGICAL INFORMATION

Prevent releases to land or water. Results in high Biological Oxygen Demand (BOD) and potential oxygen depletion of aquatic systems.

12. DISPOSAL CONSIDERATIONS

Dispose of waste material at an approved municipal landfill or land application site.

13. TRANSPORT INFORMATION

Hazardous Materials Description/ Proper Shipping Name - NA

DOT Hazard Class - NA

DOT Identification Number - NA

X This product is not a DOT hazardous material.

14. REGULATORY INFORMATION

Discharges to a water of the U.S. are regulated by the Environmental Protection Agency.

15. OTHER INFORMATION

None.

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