# APPENDIX L

# SAMPLING AND ANALYSIS PLAN

PES Environmental, Inc.
Engineering & Environmental Services

A Report Prepared for:
BMR-Dexter LLC
17190 Bernardo Center Drive
San Diego, CA 92128

# SAMPLING AND ANALYSIS PLAN
# FORMER AMERICAN LINEN SUPPLY
# 700 DEXTER AVENUE NORTH
# SEATTLE, WASHINGTON

**Facility Site Identification Number: 3573**
**Cleanup Site Identification Number: 12004**

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By:

Karsten W. Springstead, LG
Project Geologist

William R. Haldeman

William R. Haldeman, LHG
Associate Hydrogeologist

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## 1.0 INTRODUCTION

This Sampling and Analysis Plan ("SAP") has been prepared to support interim action activities to be conducted at the Former American Linen Supply ("American Linen") property ("Property") located at 700 Dexter Avenue North, Seattle, Washington (Figure 1). This SAP defines applicable field procedures and protocols to be followed during the interim action. This SAP, and the associated Quality Assurance Project Plan ("QAPP") that specifies laboratory procedures and quality control documentation, are included as appendices to the Interim Action Work Plan ("Work Plan") that has been prepared on behalf of BMR-Dexter LLC ("BMRD") for the Property.

### 1.1 Purpose

This SAP defines applicable procedures and protocols to be followed during interim action field activities. The purpose of this SAP is to ensure that procedures are followed that will collect sufficiently high quality data to support the project data quality objectives ("DQOs") in order to accomplish the interim action objectives. Should additional activities be added to the interim action scope of work in the future, this SAP will be modified and amended as necessary to address the activities.

### 1.2 Sampling and Analysis Plan Organization

The SAP is organized into five sections. A brief description of each section is presented below.

- **Section 1 – Introduction.** Section 1 contains an overview of the SAP.
- **Section 2 – Interim Action Approach.** Section 2 describes the interim action overview, well locations, sample locations, types, and frequency of collection.
- **Section 3 – Sample Designation.** Section 3 describes the sample nomenclature for soil, groundwater, and field quality assurance ("QA") samples collected during the interim action.
- **Section 4 – Field Procedures.** Section 4 describes procedures for: soil sampling; injection well and performance monitoring well installation and development; well decommissioning; treatment chemical injection; performance monitoring; surveying; collection of field QA samples; field documentation, including alteration of sampling procedures; sample labeling, shipping, and custody; decontamination; residuals management; and health and safety.
- **Section 5 – References.** Section 5 provides the references cited in the document.

## 2.0 INTERIM ACTION APPROACH

### 2.1 Project Overview

As discussed in the Work Plan, the interim action will consist of source treatment at the Property using *in-situ* chemical oxidation ("ISCO") and enhanced reductive dechlorination ("ERD"). ISCO will be used for aggressive, short-term treatment, and ERD will be used for long-term, post development treatment. Modified Fenton's Reagent ("MFR") will be used as the oxidant, and emulsified vegetable oil ("EVO") will be used as the ERD amendment. Both MFR and EVO will be injected in wells installed in the areas to be treated. The interim action will include the following tasks:

- Injection Well Installation and Development;
- Performance Monitoring Well Installation and Development;
- On-Property Well Decommissioning;
- Installation and Development of the Perimeter Injection Well Network;
- ISCO Injection;
- EVO Injection;
- Interim Action Performance Groundwater Monitoring

### 2.2 On-Property Injection Well Locations

The 132 injection wells will be installed at the locations shown on Figures 2 through 5. The four treatment zones (TZ-A, TZ-B, TZ-C, and TZ-D) shown on Figures 2 through 5 consist of 15-foot thick zones between elevations 5 feet and -55 feet NAVD88 (Figures 6 and 7) that includes areas on the Property with total CVOC concentrations in soil exceeding 0.5 mg/kg.

### 2.3 Interim Action Performance Monitoring Well Locations

Sixteen new performance monitoring wells will be installed at the locations shown on Figure 8. Four of these wells are located on the Property and will be used, along with existing on-Property wells, to monitor the effects of the ISCO and EVO injections described above after each injection event. These wells will be decommissioned following the monitoring event conducted after the final injection round.

Twelve of these new wells are located across 8th Avenue North and Roy Street, and will be used in conjunction with existing monitoring well network to monitor (1) the long-term performance of the ISCO and EVO injections downgradient of the Property and (2) the area downgradient of the perimeter injection well network. The new monitoring wells include two wells to monitor the shallow water-bearing zone, six wells to monitor the Intermediate A water-bearing zone, seven wells to monitor the Intermediate B water-bearing zone, and one well to monitor the deep water-bearing zone (Tables 1 and 2).

## 2.4 Perimeter Injection Well Network and Contingency Injection Well Locations

A total of 88  perimeter injection wells will be installed at 44 locations just downgradient of the Property along 8th Avenue and Roy Street (Figure 9). These wells will be screened at a range of depths such that EVO can be applied at elevations consistent with treatment zones TZ-A through TZ-D (ranging from 5 feet to -55 feet). Given the limited space available to install these wells, the design of the perimeter injection wells will consist of dual-completion wells, with the screen intervals as follows:

- **"Type 1" Completion.** A dual-completion well will be installed at these locations, with a well screened between elevations 5 feet and -10 feet and a well screened between elevations -25 feet and -40 feet installed in the same boring (Figure 7). A bentonite seal will be placed in the boring annulus between the two well screen intervals; and

- **"Type 2" Completion.** A dual-completion well will be installed at these locations, with a well screened between elevations -10 feet and -25 feet and a well screened between elevations -40 feet and -55 feet installed in the same boring (Figure 7). A bentonite seal will be placed in the boring annulus between the two well screen intervals.

The "Type 1" and "Type 2" wells will be located 10 feet apart, meaning that successive "Type 1" well locations (and successive "Type 2" well locations) will be 20 feet apart.

## 2.5 Sample Locations, Types, and Frequency

### 2.5.1 Soil

Soil samples will not be collected while drilling the on-Property or perimeter injection wells. Soil samples will be collected approximately every 5 feet for lithologic identification while drilling the off-Property performance monitoring well borings, with soil samples submitted for laboratory analysis as outlined in Table 1. Where wells monitoring different water-bearing zones are co-located, only soil samples from the deepest well boring will be submitted for laboratory analysis.. Soil samples will be collected from residual soil for waste profiling as discussed in Section 4.16.

### 2.5.2 Groundwater

Performance monitoring samples will be collected before the first on-Property injection event (baseline monitoring), after each on-Property injection event, quarterly during on-Property dewatering, and quarterly after the perimeter injection event (see Table 2). Figure 8 shows the performance monitoring network. Baseline monitoring will include all existing shallow, intermediate, and deep wells, including those recently installed during the pre-interim action investigation, and all new performance monitoring wells. Inter-injection sampling events will be conducted after each injection event, including the EVO injection event (at least one week after completing the previous injection round), and will include the limited number of wells shown in Table 2. After the last of the inter-injection sampling is completed (following the EVO injection round), all of the on-Property monitoring wells and any other remaining on-Property wells (e.g., the ERH/SVE wells) will be decommissioned in preparation for the beginning of construction, and specifically the installation of shoring and mass excavation of soil. Longer-term post-injection monitoring of the effects of the interim action will be conducted using the wells listed in Table 2 located immediately downgradient of the Property. These wells will be monitored for five quarters during on-Property dewatering and quarterly after injection in the perimeter injection well network. After fou quarters of monitoring post injection in the perimeter injection well network, the scope and need for additional monitoring will be assessed based on the monitoring results and the status of the Site-wide remedial investigation/feasibility study.

All groundwater samples will be analyzed for volatile organic compounds ("VOCs"), gasoline-range organics ("GRO"), and/or general chemistry parameters as detailed in Table 2. The QAPP (Work Plan Appendix M) provides the QA/QC procedures used to evaluate the laboratory data.

## 2.6 Sample Analysis

Chemical and physical testing will be conducted by ESC Lab Sciences ("ESC") of Mount Juliet, Tennessee, a laboratory accredited by Ecology and by the National Environmental Laboratories Accreditation Program. All chemical analyses will be performed using U.S. Environmental Protection Agency ("EPA") or Ecology analytical methods following and consistent with the procedures described in the QAPP (Appendix M of the Work Plan). Prior to analysis, all samples will be maintained according to the appropriate holding times and temperatures for each analysis (Table 3). Tables 4 and 5 present the laboratory method detection limits and reported detection limits for the soil and groundwater analyses.

Soil samples collected during drilling will be analyzed as outlined in Tables 1 and 3 using the following methods:

- VOCs by EPA Method 8260;
- GRO by Ecology Method NWTPH-Gx;
- Grain-size analysis with sieve and hydrometer (or laser) by American Society for Testing and Materials ("ASTM") Methods D421/D422/D4464;
- Dry bulk density by ASTM Method D2937;
- Total organic carbon ("TOC") and fraction organic carbon ("foc") by the Walkley-Black method; and
- Vertical hydraulic conductivity analysis using a flexible water parameter by ASTM Method D5084.

Residual soil samples will be analyzed as outlined in Table 3 using the following methods:

- VOCs by EPA Method 8260C; and
- GRO by Ecology Method NWTPH-Gx.

The groundwater samples collected at each location will be analyzed as detailed in Tables 2 and 3 using the following methods:

- VOCs by EPA Method 8260C;
- GRO by Ecology Method NWTPH-Gx;
- Alkalinity by Standard Methods 2320B-2011;
- Chloride, Nitrate, Sulfate by EPA Method 9056A;
- TOC by EPA Method 9060A;
- Total Iron and Manganese by EPA Method 6020A;
- Ferrous Iron (in the field) by Hach Kit IR-18C; and
- Methane, Ethane, Ethene by EPA Method RSK175.

## 3.0 SAMPLE DESIGNATION

Each sample collected during the interim actionwill be assigned a unique alphanumeric identifier. The identifier will either be pre-labeled prior to entering the field or filled out in indelible ink and affixed to appropriate containers using waterproof labels immediately prior to sample collection. In addition to the sample identifier and number, the sample labels will include the following information: client name, project name and number, date and time of sample collection, sampler's initials, analytical method, and analyte preservative(s), if any. Field collection information will be maintained as each sample is collected, which will at a minimum include the sample location and depth, sample number and identifier, and other observations regarding the sample.

### 3.1 Soil

Soil samples collected from drums or waste containers will be assigned a unique alphanumeric identifier, including the three components listed below:

- A prefix of D for drum or B for bin;
- The container identification number; and
- The location within the container, if applicable.

The sample identification will be placed on the sample label, field report form, and chain-of-custody ("COC") form.

### 3.2 Groundwater

Groundwater samples collected from monitoring wells will be assigned a unique alphanumeric identifier, including up to four components:

- A prefix of MW for monitoring wells or IA for interim action performance wells;
- The well identification number; and
- The date in the MMDDYY format.

For example, a groundwater sample collected from monitoring well MW-132 on February 28, 2018, would be numbered MW-132-022818. The sample identification will be placed on the sample label, field report form, and COC.

### 3.3 Field Quality Assurance Samples

The field quality assurance ("QA") samples will be assigned a unique alphanumeric identifier. The field QA samples for soil and groundwater sampling will start at MW-901 for field duplicates, EQ for equipment rinsate blanks, and TB for transport (trip) blanks. For example, a field duplicate sample collected on February 28, 2018, would be labeled MW-901-092817. The corresponding locations where the field duplicates and equipment rinsate blanks are collected will be recorded on the Groundwater Sampling Form (Appendix A) for the applicable location sampled.

## 4.0 FIELD PROCEDURES

This section describes the field procedures for soil and groundwater sample collection; well installation and development; aquifer testing; surveying; field documentation; sample labeling, shipping, and custody; decontamination; and residuals management; and health and safety.

### 4.1 Soil Sampling Procedures

Prior to drilling, applicable permits and access agreements will be procured, utilities will be cleared at each drilling location, sampling equipment will be properly decontaminated (see Section 4.15), and applicable health and safety procedures will be reviewed. The injection well borings and performance monitoring well borings will be advanced using a hollow-stem auger drilling rig ("auger" rig) operated by a subcontracted drilling firm.

Soil samples will be collected with a driven split spoon or split barrel sampler approximately every 5 feet during drilling from the highest point possible to the bottom of the hole; samples will be extracted from the sampler, monitored for odors, screened for VOCs with a photoionization detector ("PID"), and logged for lithologic characterization consistent with ASTM D-2488. All observations and measurements will be recorded on a Field Lithologic Log (Appendix A). The planned soil samples to be submitted for laboratory analysis are presented in Table 1. Samples for VOC and GRO analysis will be collected using EPA Method 5035 after the sample core is screened but before the sample core is logged. Additional sample volume for physical or remediation parameter testing will be collected using either decontaminated stainless steel or plastic sampling tools.

Field QA samples will be collected as described in Section 4.11. Field QA samples will consist of field duplicates, equipment rinsate blanks, and transport (trip) blanks as summarized in Table 6. Laboratory QA/QC protocols are defined in the QAPP (Appendix M of the Work Plan).

### 4.2 Injection Well Installation

The 132 injection wells will be constructed in accordance with Chapter 173-160 of the Washington Administrative Code at the locations shown on Figures 2 through 6. The injection well designs are shown on Figure 7. Each well will be completed in a nominal 8-inch borehole housing 2-inch diameter casing. The injection wells will be constructed of 2-inch diameter Schedule 40 PVC flush-thread casing, with 15-foot long 0.020-inch slotted PVC screen. The annulus of each injection well will be filled with 10 x 20 Colorado silica sand (or equivalent), which will extend from the bottom of the borehole to approximately one foot above the top of the screen, followed by hydrated bentonite (3/8-inch diameter pellets) to a depth of 6 feet below ground surface ("bgs"). The remainder of the borehole will be filled with concrete. The top of each well casing will consist of blank 2-inch PVC pipe, such that the injection wellhead assembly can be connected. The surface completion for each injection well will be constructed in a 12-inch diameter (or larger) steel traffic box set in concrete.

### 4.3 Performance Monitoring Well Installation

The wells will be constructed in accordance with Chapter 173-160 of the Washington Administrative Code. The 11 performance monitoring wells will be installed at the locations shown on Figure 8 to the depths shown in Table 1. Each well will be completed in a nominal 8-inch borehole housing 2-inch diameter casing. The wells will be completed with nominal 2-inch-diameter, flush-threaded Schedule 40 PVC, with 10-foot-long 0.020-inch slot width screens and 10 x 20 silica sand outside of the screen. The filter pack in each well will extend to approximately 2 feet above the top of the well screen, and a bentonite annular or grout seal will extend from the top of the filter pack to within 2 feet of the ground surface. All materials will be placed concurrent with casing withdrawal, and bentonite chips/grout placed above the water table will be hydrated with an equal volume of water. The surface monument protecting each well will be completed flush with grade. As-built construction details, including the volume of materials used, will be recorded on a Field Lithologic Log (Appendix A). A typical monitoring well completion diagram is shown on Figure 10.

### 4.4 Perimeter Injection Well Installation

The 88 perimeter injection wells will be installed at the locations shown on Figure 9 to the depths shown on Figure 7. The wells will be constructed of 2-inch-diameter Schedule 40 PVC flush-thread casing, with 0.020-inch slotted PVC screen. The annulus of each injection well will be filled with 10x20 Colorado Silica Sand (or equivalent) from the bottom of each well screen to approximately one foot above the top of the screen. The well annulus between the two filter packs and above the top filter pack will be filled with hydrated bentonite chips to a depth of 6 feet bgs, with the remainder of the borehole filled with concrete. The top of each well casing will be completed with a flush-with-grade steel monument such that the well can be used for monitoring purposes as necessary or as an injection well. Because two wells will be installed in each dual completion well boring, a variance from the prohibition on nested resource protection wells contained in the Minimum Standards for Construction and Maintenance of Wells (WAC 173-160-420) must be obtained from Ecology prior to installing the wells.

### 4.5 Well Development

Each new injection and performance monitoring well will be developed before it is used for its intended purpose. Development will involve repeated surging (with a surge block or bailer) and pumping until the color of the discharge water does not change with additional development. Turbidity will be measured during development, and if possible, the well will be developed until the measured turbidity is below 100 Nephelometric turbidity units (“NTU”). If the well pumps dry during development, it will be allowed to refill, and up to one additional well casing volume will be removed. Water levels, amount of water removed, and observations of the discharged water will be recorded on a Well Development Form or equivalent (Appendix A). All development water will be handled as described in Section 4.16.

## 4.6 Well Decommissioning

After the last of the inter-injection sampling event is completed (following the EVO injection round), all of the on-Property injection wells, on-Property performance monitoring wells, and any other remaining on-Property wells (e.g., the ERH/SVE wells) will be decommissioned in preparation for the beginning of construction, and specifically the installation of shoring and mass excavation of soil. Wells will be decommissioned consistent with WAC 173-160-460, unless the Washington State Department of Ecology has granted a waiver allowing a different method of decommissioning. All decommissioned well locations will be finished with a soil cap at the ground surface.

## 4.7 MFR Injection Procedures

This section describes the general procedures used to inject the reagents into the subsurface.

### 4.7.1 Mobilization

Mobilization activities include transportation and staging of the required equipment, materials, instruments, personnel and services required for implementing the program, including hoses, tanks, drums, a gas-powered air compressor and generator, electric mixers, and pneumatic pumps. The reagents that will be transported to the Property will include hydrogen peroxide at a concentration of 30 percent, and a dry catalyst required for reagent preparation. The 30 percent hydrogen peroxide will be stored in a secure location on the Property in U.S. Department of Transportation-approved 55-gallon drums.

### 4.7.2 Reagent Preparation

The oxidizer component of the MFR consists of a pre-determined proprietary concentration of hydrogen peroxide, water and stabilizer. During the initial injection round, a standard oxidizer concentration of 3 to 12 percent will be used. The 30 percent hydrogen peroxide will be diluted down to the target concentration (e.g., 3 to 12 percent) in 300-gallon bulk tanks, with water obtained from a fire hydrant located adjacent to the Property. The catalyst component of the MFR consists of a neutral pH-buffered ferrous iron complex. At post-reaction concentrations, the iron complex is similar and comparable to naturally occurring metals within the soil matrix (i.e., ppm range). The catalyst will be shipped to the site in dry form and mixed with water on-Property in 300-gallon bulk tanks. A reagent mixing schematic is included as Figure 11.

All reagents will be either injected during the mobilization or removed from the Property at the completion of injections.

### 4.7.3 Material Handling and Storage

Only injection contactor employees with appropriate training will handle and store hydrogen peroxide and catalyst to complete this interim action. These employees will also have received specific training in the personal protective equipment (PPE) required to handle these chemicals safely. A fire extinguisher and eye-wash station will be on-Property at all times during injection events.

Chemicals will be stored according to the requirements of the U.S. Department of Transportation ("DOT"). In brief, the hydrogen peroxide and the catalyst will be stored at separate locations on the Property in such a way that, if a spill were to occur, the two would not come into contact with each other. The potential for combustion issues associated with the presence of hydrogen peroxide, a strong oxidizer, are minimized since a maximum solution of 30 percent will be delivered to the Property. Flammable materials, i.e., gasoline, will not be stored near the peroxide or in locations where a peroxide spill could occur.

Diluting the peroxide will be performed in a dilution tank. Water will be added to the dilution tank along with dry stabilizer in a predetermined volume to create an approximately 12 percent concentration after the addition of a predetermined volume of hydrogen peroxide. An electric drum pump or an air-operated double diaphragm pump will be used to transfer the peroxide into the dilution tank. Two technicians are required to complete this process: one operates the pump and one holds the transfer wand in the dilution tank. Both technicians will wear splash-resistant aprons, face-shields and chemical resistant gloves while completing the transfer.

To mix the catalyst, iron will be added to the mixing tank, followed by a predetermined quantity of water. An electric mixer is used to mix the solution. The chelating agents will then be added to the solution and mixing will continue. Although the chemicals are non-hazardous and the mixing process is generally dust-free, the technician completing the mixing will wear nitrile gloves and a particulate respirator as a precautionary measure, consistent with the HASP.

As described below, the MFR components are not combined at the surface. The peroxide and catalyst only come into contact with one another in the subsurface. Additional precautions are taken to prevent reactions in the injection equipment by flushing all equipment with water between separate injections of each reagent.

### 4.7.4 Spill Prevention

Site personnel should be aware of potential conditions that could cause a spill and take preventative measures before a spill occurs. Safe storage and handling procedures are discussed above.

The tanks used to dilute the peroxide and to mix and store the catalyst are oversized to prevent spillage from the tanks. If a small spill (less than five gallons) of peroxide occurs to the ground surface, water will be used to dilute it further and actions taken to prevent the fluid from entering any storm drains or drainage ditches while the fluid is soaked up with clay sorbent. If a larger spill of peroxide occurs, the same procedure will be followed and any excess liquid will be pumped into a clean empty storage tank. If a small spill (less than 5 gallons) of catalyst occurs, it will be contained and soaked up with sorbent pads then placed in a steel or poly drum. If a large spill of catalyst occurs, it will be contained and pumped into the storage tank with an air diaphragm pump. If a spill of dry catalyst occurs, it will be swept up and placed in a poly bag.

Work will stop immediately if a spill occurs and will not restart until after the spill is cleaned up and the cause of the spill is determined and corrected. All spilled materials will be disposed of properly.

### 4.7.5 Reagent Injection Procedures

The MFR reagents consist of a patented neutral pH chelated iron catalyst (catalyst) and dilute stabilized hydrogen peroxide (oxidizer). The procedures for reagent preparation and injection, and the basis for establishing the appropriate dose rate and injection well sequencing are described below.

**Injection Dosing.** The objective of each round of injections is to inject enough MFR to fill 3 to 5 percent of the pore volume within the assumed radius of influence ("ROI"). Each injection round will address the contaminants in the dissolved phase at that time, and also the contaminants that get desorbed at the time of injection. Based on the assumed ROI of 12.5 feet, and a porosity of 0.25, and a 15-foot long screen, the total pore volume to be treated around each well screen is approximately 13,800 gallons, which gives a target injection volume of up to approximately 380 to 680 gallons (roughly 3 to 5 percent). If more than 3 to 5 percent pore volume is filled up, or too strong of a peroxide mixture is used, the aggressive nature of the reaction can lead to well over-pressurization, surfacing, and increased injection pressures. Note that this a target volume and conditions encountered in the field may limit the volume of chemicals that can be injected in certain wells (e.g., wells completed in Treatment Zone C completed in the lower portion of the Intermediate B water bearing zone).

**Injection Sequencing.** The injections will be sequenced such that adjacent injection wells will not be used on consecutive days.

**Injection Equipment.** Chemical injection equipment consists of storage containers, pneumatic double-diaphragm pumps, regulators, flow meters, 0.75-inch-diameter reinforced PVC tubing, valves, and cam-lock connectors. Transfer of the reagents from the storage and/or mixing containers to the point of injection will be performed via a double diaphragm pump. Reagents are conveyed through 0.75-inch reinforced PVC tubing and connected to the injection well with a wellhead containing ball valves, fittings, and a pressure gauge.

**Injection Method.** Reagents will be injected into the subsurface using injection wells in a five-step process. The first step is injecting approximately 10 to 25 gallons of water into the subsurface, followed by approximately 190 to 340 gallons of catalyst. An additional 10 to 25 gallons of water will then be injected to flush the catalyst away from the screen. Following the water flush, approximately 190 to 340 gallons of oxidizer will be injected into the subsurface. The last step is a final water injection to flush the oxidizer from the injection equipment. It is important to note that the actual volume injected will depend upon the lithology, surfacing, injection flow rate, pressure and radial effects noted during injection.

This process is repeated for each injection well. An MFR injection method schematic detailing the injection method is included in Work Plan Figure 41. Reagent quantities will be recorded on daily log sheets.

It is important to note that, if surfacing occurs during injections into a particular injection screen, the injection pump will be immediately shut off to limit the amount of liquid escaping to the surface. The surface materials will be immediately cleaned up and containerized for proper disposal.

**Injection Rates and Pressures.** Injection rates and volumes are interrelated to the reaction rates of hydroxyl radicals with the contaminants, the distribution of contaminants in the subsurface, and the rate of hydrogen peroxide decomposition. The rate at which reagents are injected into the subsurface is initially determined by the soil/aquifer characteristics. Based upon review of the provided data, and the results of the recent water injection test, expected injection flow rates are between 1 and 3 gpm and injection pressures are between 15 and 70 psi. In order to prevent compromising the injection well and avoid surfacing of MFR reagents, injection pressures will be maintained at less than 100 psi. Injection rates and pressures will be recorded on daily log sheets.

### 4.8 EVO Injection Procedures

Sodium lactate, a fast-release carbon source, is a commonly used carbon substrate for ERD. Commercially available EVO products used for remediation contain a nominal amount of sodium lactate (generally less than 5 percent). Additional sodium lactate will be added to the EVO solution to accelerate the transition from the aerobic and high ORP conditions that are likely to be present after ISCO injections to the anaerobic and reducing conditions needed to support ERD.

A pH buffer may be included in the carbon substrate solution in efforts to maintain pH in a range favorable for dechlorinating bacteria. As a result of fermentation by soil microbes following carbon addition, groundwater pH can drop if the aquifer is not sufficiently buffered. Bicarbonate buffers are commonly used for ERD in order to keep groundwater pH in the injection zone to a range of 6.0 to 7.5 to maintain remedial performance. An additional benefit of injecting a pH buffer is that reductive dechlorination rates have been observed to be approximately four times higher in the laboratory at pH 7 compared to pH 6 (Young and Gossett, 1997). Site-specific bicarbonate demand is difficult to estimate prior to remediation, as different geochemical conditions and microbial activity will be generated following application of ISCO and injection of carbon substrate. A dosage approximately equivalent to 0.5 to 2 pounds of sodium bicarbonate per gallon of 60 percent EVO shipped is anticipated.

Based on observed dissolved oxygen concentrations in groundwater following the third ISCO injection, the ERD injections may be initiated with injection of only a sodium lactate solution to more rapidly consume residual dissolved oxygen and generate reducing groundwater. Approximately 50 to 150 gallons of a 1 to 5 percent sodium lactate solution may be injected into select injection wells to precondition the aquifer. The anticipated EVO dose rate, based on the Property-specific soil and groundwater characteristics, CVOC concentrations, and standard industry practices for EVO application, is initially set at 5 percent; however, actual solutions to be injected may range from 2 to 10 percent EVO. Based on an expected 15-ft radius of influence, a 15-foot injection well screen length, and the goal of injecting enough EVO solution to displace 7 to 10 percent of the pore volume, the total target injection volume for each well will be approximately 2,500 gallons. Site conditions (e.g., required injection pressures, hydraulic conductivity) may not allow this volume of EVO to be injected in all wells.

As noted above, bioaugmentation (addition of dechlorinating bacteria) will also conducted concurrent with the EVO injections. The bioaugmentation cultures (e.g., KB-1 or SDC-9) are anaerobic bacterium, and exposure to oxygen has been demonstrated to reduce activity and viability. Therefore, the culture solution will be kept in the shipping vessels, under anoxic conditions, until they are injected. To minimize exposure to oxygen, a small volume of anaerobic water will be injected immediately before and immediately after injection of the bacterial culture (approximately 10 to 15 gallons before and after). Specific bioaugmentation dosage are anticipated to be between 0.5 and 1.5 liters per well; however, higher concentrations of bioaugmentation may be applied to targeted areas based on groundwater conditions following ISCO injections. To optimize delivery of the dechlorinating bacteria, the bioaugmentation solution will also be injected in the middle of EVO injection as follows:

- Inject approximately 1/2 to 2/3 of the EVO solution;
- Inject the bioaugmentation culture (i.e., 10 gallons anoxic water, bioaugmentation culture, 10 gallons anoxic water); and
- Inject remaining carbon substrate solution per injection point. This final injection of EVO solution will help distribute the dechlorinating bacteria into the water bearing zones.

It is important to note that the above approach may be changed based on field conditions, observations, and monitoring conducted during the three rounds of ISCO injections. For example, if injection wells in a portion of a treatment zone will not readily take 2,500 gallons of EVO, the concentration of EVO in the solution may be increased and the volume of solution injected reduced so that a similar quantity of carbon substrate can be injected in a smaller volume.

## 4.9 Performance Groundwater Monitoring

### 4.9.1 Groundwater Level Measurements

Groundwater levels will be measured using the following procedures:

1. Open the well monument, remove any standing water and debris (i.e., sediment, vegetation, or refuse) prior to removing the well cap;
2. Open the well by carefully removing the cap. Allow the riser to vent if under pressure or vacuum. Record the time at which the well is initially vented to the atmosphere (i.e., time of well cap removal). Document initial conditions (i.e., well over-pressurized or under-pressurized relative to the atmosphere) on the Water Level Data Form (Appendix A).
3. After opening and venting the well, measure the initial water level to the nearest 0.01 foot from the surveyed location, using an electronic water level probe.

4. Measure the water level at the surveyed measuring point ("MP") on the north side of the top of the PVC casing.
5. Duplicate the water level measurement in each well in the field to ensure that the reading is accurate. Record all results (times, measured values, etc.) on the Water Level Data Form.
6. Rinse the portion of the water level probe that contacted water with distilled water between each well to avoid cross contamination.
7. Replace the well cap upon completing the water level measurement.
8. If needed, check the time needed for water level equilibration after cap removal by measuring the water level in a well, allowing the well to vent for a more extended period (at least 1 hour), and measuring the water level a second time. Record all results on the Water Level Data Form.
9. Upon completion of the water level measurements, replace and tightly seal each of the surface monuments.

### 4.9.2 Groundwater Sampling

Appendix E of the Work Plan provides the well logs for existing monitoring wells for determining the pump intake depth, and Appendix A of this SAP provides sample field forms.

**Sampling Preparation.** Prior to the initiation of any sampling activities, all of the necessary field equipment and documentation materials (e.g. field sampling forms) will be prepared. A summary of the sampling tools and equipment to be used during the sampling activities are listed in Table 7.

Laboratory supplied sample bottles will be inspected for proper preservative (Table 3). The depth to water will be measured prior to sampling using the procedures outlined above.

**Low-Flow Purging.** For monitoring wells with water levels less than 20 feet below the top of casing, a peristaltic sampling pump fitted with disposable polyethylene and silicon (at the pump head only) tubing will be used to collect samples. New (disposable) polyethylene tubing will be slowly lowered into the well until the intake is placed at the mid-point of the well screen (see Table 2). For monitoring wells with water levels greater than 20 feet below the top of casing, a clean stainless steel bladder pump with dedicated polyethylene tubing attached to the pump head will be used to collect samples. The bladder pump and attached tubing will be slowly lowered into the well until the pump intake is at the mid-point of the well screen. The monitoring well will be purged with the bladder pump fitted with dedicated polyethylene tubing which extends from the pump head to the discharge.

The start time will be recorded on a Groundwater Sampling Form (Appendix A), and the pump will be started. Pumping rates will be measured with a stopwatch and graduated cylinder, graduated cup, or volatile organic analysis ("VOA") vial, depending on flow rate. Low flow purging will be conducted at a pumping rate less than 500 milliliters per minute ("mL/min").

During purging, the water level will be measured approximately every 3 to 5 minutes, until a steady water level is determined. If possible, a drawdown of 0.3 feet or less will be maintained in the well. The water level in the well will be maintained above the intake at all times. If the well yield is sufficiently poor that the water level drops to the level of the intake, the pump will be stopped until the water level recovers to near the pre-pumping level. The process will then be repeated until the field parameters have stabilized. All measured water levels and pumping rate changes will be recorded on a Groundwater Sampling Form.

**Field Parameter Measurements.** All meters will be calibrated at the start of each work period, and meters will be recalibrated, as necessary, during or after the work period. Calibration procedures (including time, standards used, and calibration results) will be noted in the field notes. Field indicator parameters will be measured approximately every 3 to 5 minutes during purging. Field parameters will include pH, specific conductance, temperature, dissolved oxygen ("DO"), and oxidation-reduction potential ("ORP"). Measurements will be recorded to the following standards:

- pH to ±0.01 units;
- Specific conductance to ±1 micromho;
- Temperature to ±0.1°C;
- DO to ±0.1 milligrams per liter ("mg/L"); and
- ORP to ±1 millivolts.

Samples will not be collected until these parameters have stabilized for three consecutive readings to the following criteria:

- pH to ±0.1 pH unit;
- Conductivity to ±3 percent;
- Temperature to ±3 percent; and
- DO to ±10 percent.

ORP measurements will not be used to determine stability. If field parameters do not stabilize after 1 hour of pumping, a sample will be collected. Well purging data will be recorded on a Groundwater Sampling Form.

**Sample Collection.** Upon completion of purging, samples will be collected from the discharge end of the pump tubing. The same pump rate used at the end of well purging will be used during sample collection. Groundwater samples will be submitted for the laboratory analyses presented in Table 3 using the methods described in Section 2.6. VOA vials will be filled by allowing the sample water to pour down the inside of the vials and without splashing onto the base. The containers will be filled to eliminate any headspace and the seal/lid will be secured. All sample containers will be prepared and provided by the analytical laboratory (Table 3).

After collection of the sample from each well, the pump will be disconnected from the tubing, the well cap will be replaced, and the well cap or monument locked. Decontamination and purge water will be handled in accordance to the residuals management procedures outlined in Section 4.16.

**Field Quality Assurance.** Field QA samples will be collected as described in Section 4.11. Field QA samples will consist of field duplicates, equipment rinsate blanks, and transport (trip) blanks as summarized in Table 6. Laboratory QA/QC protocols are defined in the QAPP (Appendix M of the Work Plan).

## 4.10 Horizontal Positioning and Vertical Control

The locations of the new performance monitoring wells will be surveyed after the initial well installations. Per current Ecology guidelines, the horizontal coordinates will reference the Washington State Plane System North Zone (“NAD 83”), and the vertical coordinates will reference the North American Vertical Datum of 1988 (“NAVD 88”). The elevations of the monitoring well rim (north side), top of casing (north side), and the adjacent ground surface will be surveyed. Each sampling location will be photographed for documentation of the sample location.

## 4.11 Field Quality Assurance

Field QA samples will be used to evaluate the efficiency of field decontamination and processing procedures. Laboratory QA/QC protocols are defined in the QAPP (Appendix M of the Work Plan). Field QA samples will consist of field duplicates, equipment rinsate blanks, and transport (trip) blanks as summarized in Table 5. All field QA samples will be documented in the field notes and verified by the QA/QC manager or designee. Details of the field duplicate samples will be kept in the field notes only so that the laboratory is blind to the origin of the sample.

### 4.11.1 Field Duplicates

Field duplicates will be collected to evaluate the variability of the sample concentrations due to sample processing. Field duplicate samples will be collected along with the original sample as a split from one homogenized sample and analyzed for the identical chemical analyte list as the media from which they were collected. Field duplicate samples of each matrix sampled will be collected at a frequency of one duplicate per 20 samples.

### 4.11.2 Equipment Blanks

An equipment blank (also known as a rinsate blank or field blank) is a sample of reagent grade or distilled water poured into or over or pumped through the sampling device, collected in a sample container, and transported to the laboratory for analysis. Equipment blanks will be used to assess the effectiveness of equipment decontamination procedures. One equipment blank will be collected for every 20 project samples being collected using non-dedicated equipment. Equipment blanks will be collected immediately after the equipment has been decontaminated. The blank will be analyzed for all laboratory analyses requested for the environmental samples collected at the location that the blank is collected. If an analyte is detected in an equipment blank sample, the affected results will be qualified during the data review per EPA's National Functional Guidelines for Inorganic (EPA, 2017a) or Organic (EPA, 2017b) Data Review.

### 4.11.3 Transport Blanks (Trip Blanks)

A transport blank (also known as a trip blank) consists of a VOC sample vial filled in the laboratory with reagent grade water, transported to the sampling site, handled under the same conditions as an environmental sample, and returned to the laboratory for analysis. Transport blanks are not opened in the field. Transport blanks are prepared only when volatile samples are collected and are analyzed only for volatile analytes. Transport blanks are used to assess the potential introduction of contaminants from sample containers or during the transportation and storage procedures. One transport blank will be submitted for every 20 project samples or one per each shipment of samples to the laboratory, whichever is less. Transport Blank samples will be analyzed for the volatile constituents to be analyzed in the project sample collected at that location (i.e., BTEX, VOCs, and/or GRO). If an analyte is detected in a transport blank, the data will be qualified during the data review per EPA's National Functional Guidelines for Organic Data Review(EPA, 2017b).

## 4.12 Field Documentation

All documents generated during the field effort are controlled documents that become part of the project file. Field team members will keep a daily record of significant events, observations, and measurements on the appropriate field forms. All field activities will be recorded on field notes maintained by the Field Coordinator (“FC”) or his designee for each activity. Field forms will be the main source of field documentation for all field activities. The on-site field representative will record on the field forms information pertinent to the investigation program. The sampling documentation will contain information on each sample collected, and will include at a minimum the following information:

- Project name;
- Field personnel on site;
- Facility visitors;
- Weather conditions;
- Field observations;
- Notes on maps and/or drawings;
- Date and time sample collected;
- Sampling method and description of activities;
- Identification or serial numbers of instruments or equipment used;
- Deviations from the Work Plan, SAP, and QAPP; and
- Conferences associated with field sampling activities.

In general, sufficient information will be recorded during sampling so that reconstruction of the event can occur without relying on the memory of the field personnel. Example field forms are provided in Appendix A.

To assist field sampling activities, sample collection checklists may be prepared prior to a sampling event. The checklist will include location designations, types of samples to be collected, QC samples to be collected, and any specific instructions about the field event.

## 4.13 Sampling Procedure Alterations

Any deviations from the general sampling procedures presented here will be documented and brought to the attention of the PES project manager. The sampling alteration will be document on a Sampling Alteration Checklist (Appendix A).

## 4.14 Sample Labeling, Shipping, and Chain-of-Custody

All environmental samples collected during the project will be labeled, stored, and shipped using standard PES protocols. These protocols are summarized below.

### 4.14.1 Sample Labeling

Sample container labels will be completed immediately before or immediately following sample collection. Container labels will include the following information:

- Project name;
- Sample number;
- Initials of collector;
- Date and time of collection; and
- Analysis requested.

### 4.14.2 Sample Transportation

Soil samples will be transported to the analytical laboratory using the following procedures:

- Sample containers will be transported with ice in a cooler or other suitable shipping container;
- Ice or "blue ice" will be placed into each shipping container with the samples;
- All sample shipments will be accompanied by a COC form. The completed form will be sealed in a plastic bag;
- The name and address of the analytical laboratory will be placed on each shipping container prior to transportation; and
- Coolers sent to out-of-town laboratories will be shipped for overnight delivery.

### 4.14.3 Chain-Of-Custody

Once a sample is collected, it will remain in the custody of the sampler or other environmental contractor personnel until shipment to the laboratory. Upon transfer of sample possession to subsequent custodians, a COC form will be signed by the persons transferring custody of the sample container. Upon receipt of samples at the laboratory, the condition of the samples will be recorded by the receiver. COC records will be included in the analytical report prepared by the laboratory.

### 4.14.4 Sample Log-in

Upon receipt of samples (which will be accompanied by a completed chain-of-custody record detailing requested analyses), the Laboratory Coordinator(s) or his/her delegate will:

- Verify all paperwork, chain-of-custody records, and similar documentation;
- Log-in samples, assign unique laboratory sample numbers, and attach the numbers to the sample container(s);
- Open a project file and enter data into the file;
- Store samples in a refrigerated sample bank; and
- Email a record of the sample receipt and log-in form to the PES Project Manager noting any problems with the samples.

## 4.15 Decontamination

Decontamination procedures will be performed consistent with the procedures described in this section. All non-disposable sampling equipment will be decontaminated prior to initial use, between sampling locations, and at the completion of the site-specific sampling.

The following decontamination procedure will be used for non-dedicated and non-disposable sampling equipment:

- Tap water rinse;
- Non-phosphatic detergent (e.g., Liquinox) and tap water wash;
- Tap water rinse; and
- Distilled water rinse.

Water level probes will be decontaminated by rinsing with distilled or de-ionized water. Decontamination of personnel involved in sampling activities will be accomplished as described in the project-specific health and safety plan (Appendix N of the Work Plan).

### 4.16 Residuals Management

The following procedures will be used for the drilling and sampling residuals, including soil, well development water, groundwater sampling purge water, and decontamination water:

- Soil generated during drilling will be placed in 55-gallon drums and securely stored on the Property. Upon completion of drilling, a representative sample will be collected and analyzed for disposal characterization. Based on the results, the soil will be profiled and disposed of at an appropriate facility;
- Development water, purge water and decontamination water generated during the investigation activities will be placed in 55-gallon drums and securely stored on the Property. A representative sample collected and analyzed for disposal characterization. Based on the results, the water will be profiled and disposed of at an appropriate facility;
- Disposable clothing and equipment will be placed in plastic bags and disposed of as solid waste; and
- Soil and water samples will be collected from the residual containers and analyzed for the parameters specified by the disposal facility.

### 4.17 Health and Safety

A project-specific health and safety plan (“HASP”) is provided in Appendix N of the Work Plan. The HASP was prepared consistent with the requirements of the Washington State Division of Occupational Safety and Health Hazardous Waste Operations Regulation (WAC 296-843). The HASP includes a description of the project team, the scope of work, site control, a site hazard information, site hazard control, air monitoring, and emergency response. Information about the nearest hospital, including a map, is also provided.

# TABLES

# Table 1

## Interim Action Performance Monitoring Locations and Soil Samples
## Former American Linen Supply
## 700 Dexter Avenue North, Seattle, Washington

| Well Number | Site Location | Estimated Screen Depth (ft bgs) | Estimated Screen Elevation (ft) | Soil Samples Collected for Analysis During Drilling | | Soil Sample Analyses | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Number | Rationale | VOCs | GRO | Other |
| MW-142 | 8th Ave N ROW, near MW121 | 40 to 50 | 2 to -8 | 0 | samples will be collected in adjacent deeper boring | – | – | – |
| MW-143 | 8th Ave N ROW, near MW121 | 70 to 80 | -28 to -38 | 8 | 1/10 ft starting at 10 ft bgs | X | – | X |
| MW-144 | East side of 8th Ave N ROW, north of Roy Street | 40 to 50 | 5 to -5 | 0 | samples will be collected in adjacent deeper boring | – | – | – |
| MW-145 | East side of 8th Ave N ROW, north of Roy Street | 70 to 80 | -25 to -35 | 8 | 1/10 ft starting at 10 ft bgs | X | – | X |
| MW-146 | South side of Roy Street ROW, near MW106 | 40 to 50 | 12 to 2 | 0 | samples will be collected in adjacent deeper boring | – | – | – |
| MW-147 | South side of Roy Street ROW, near MW106 | 70 to 80 | -18 to -28 | 8 | 1/10 ft starting at 10 ft bgs | X | – | X |
| MW-148 | South side of the Roy St ROW, near MW105 | 70 to 80 | -26 to -36 | 8 | 1/10 ft starting at 10 ft bgs | X | – | X |
| MW-149 | Northeast quadrant of the Property | 35 to 45 | 0 to -10 | 0 | samples already collected in the vicinity | – | – | – |
| MW-150 | Northeast quadrant of the Property | 50 to 60 | -15 to -25 | 0 | samples already collected in the vicinity | – | – | – |
| MW-151 | Southwest quadrant of the Property | 35 to 45 | 5 to -5 | 0 | samples already collected in the vicinity | – | – | – |
| MW-152 | Southwest quadrant of the Property | 50 to 60 | -10 to -20 | 0 | samples already collected in the vicinity | – | – | – |
| MW-153 | South side of the Roy St ROW, east of Dexter Ave N | 120 to 130 | -69 to -79 | 11 | 1/10 ft to 90 ft starting at 10 ft bgs; also at 110, 130 ft bgs | X | – | X |
| MW-154 | South side of the Roy St ROW, near MW106 | 25 to 35 | 27 to 17 | 0 | samples will be collected in adjacent deeper boring | – | – | – |

# Table 1

# Interim Action Performance Monitoring Locations and Soil Samples
# Former American Linen Supply
# 700 Dexter Avenue North, Seattle, Washington

| Well Number | Site Location | Estimated Screen Depth (ft bgs) | Estimated Screen Elevation (ft) | Soil Samples Collected for Analysis During Drilling | | Soil Sample Analyses | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Number | Rationale | VOCs | GRO | Other |
| MW-155 | South side of the Roy St ROW, near MW105 | 20 to 30 | 24 to 14 | 0 | samples will be collected in adjacent deeper boring | – | – | – |
| MW-156 | East side of 8th Ave N, near MW-9 | 40 to 50 | -6 to -16 | 0 | samples will be collected in adjacent deeper boring | – | – | – |
| MW-157 | East side of 8th Ave N, near MW-9 | 70 to 80 | -26 to -36 | 0 | samples will be collected in adjacent deeper boring | – | – | – |
| MW-158 | East side of 8th Ave N, near MW-9 | 90 to 100 | -46 to -56 | 9 | 1/10 ft starting at 20 ft bgs | X | X | X |
| MW-159 | East side of 8th Ave N, near SV02 | 20 to 30 | 24 to 14 | 2 | at top and bottom of well screen | X | X | X |

Notes:

1. ft bgs = feet below ground surface, depths approximate for planned explorations
2. Elevation = feet relative to the North American Vertical Datum of 1988 (NAVD 88)
3. VOCs = volatile organic compounds
4. GRO = gasoline range organics
5. CVOCs = chlorinated VOCs
6. Other = physical and transport parameters (e.g., grain size, vertical hydraulic conductivity, dry bulk density, and foc)
7. Property = former American Linen Supply property
8. X = parameters analyzed
9. – = not applicable or not analyzed

# Table 2

## Interim Action Groundwater Monitoring Locations
## Former American Linen Supply
## 700 Dexter Avenue North, Seattle, Washington

| Monitoring Well Number | Site Location | Screen Depth (ft bgs) | Monitoring Phase: Baseline Before On-Property Injections | After Each On-Property Injection[a] | Quarterly During Dewatering[b] | Quarterly After Perimeter Well Injection[c] |
|---|---|---|---|---|---|---|
| **Existing Shallow Monitoring Wells** | | | | | | |
| F13 | Property | 10-40 | V, G | – | NA | NA |
| F5 | Property | 10-40 | V, G | – | NA | NA |
| F9 | Property | 10-40 | V, G | – | NA | NA |
| G12 | Property | 10-40 | V, G | – | NA | NA |
| J15 | Property | 10-40 | V, G | – | NA | NA |
| J5 | Property | 10-40 | V, G | – | NA | NA |
| K8 | Property | 10-40 | V, G | – | NA | NA |
| M15 | Property | 10-40 | V, G | – | NA | NA |
| MW121 | 8th Ave N ROW | 15-25 | V, G | – | V, G | V, G |
| MW125 | Valley Street ROW | 15-30 | V, G | – | V, G | V, G |
| MW-214 | Valley Street ROW | TBD | V | – | V, G | V, G |
| MW-8 | 800 Aloha St Parcel | 4.5-19 | V | – | – | – |
| MW-9 | 8th Ave N ROW | 7-22 | V, G | – | V, G | V, G |
| N7 | Property | 10-40 | V, G | – | NA | NA |
| R-MW2 | Property | 5-15 | V, G | – | NA | NA |
| R-MW3 | Property | 7-17 | V, G | – | NA | NA |
| R-MW5 | Dexter Ave N ROW | 15-30 | V, G | – | V, G | V, G |
| R-MW6 | 8th Ave N ROW | 12-22 | V, G | – | V, G | V, G |
| SCL-MW101 | Alley Between 8th & 9th Ave | TBD | V | – | – | – |
| SCL-MW105 | Alley Between 8th & 9th Ave | 25-30 | V | – | – | – |
| SCS-2 | Seattle City Light Parking Lot | TBD | V | – | – | – |
| SMW-3 | Valley Street ROW | TBD | V | – | – | – |
| **Proposed Shallow Monitoring Wells** | | | | | | |
| MW-154 | Roy St ROW, near MW106 | 25-35 | V, G | – | V, G | V, G |
| MW-155 | Roy St ROW, near MW105 | 20-30 | V, G | – | V, G | V, G |
| MW-159 | 8th Ave N ROW, near SV02 | 20-30 | V, G | – | V, G | V, G |
| **Existing Intermediate A Monitoring Wells** | | | | | | |
| BB-8 | Roy Street ROW | 30-40 | V, G, GC | – | V, G, GC | V, G, GC |
| GEI-1 | Block 37 | 26.8-36.8 | V, GC | – | V | V, GC |
| MW107 | 8th Ave N ROW | 35-45 | V, G, GC | – | V, G, GC | V, G, GC |
| MW108 | Alley Between 8th & 9th Ave | 40-50 | V, GC | – | V | V, GC |
| MW109 | Alley Between 8th & 9th Ave | 35-45 | V, GC | – | V | V, GC |
| MW110 | Alley Between 8th & 9th Ave | 35-45 | V, GC | – | V | V, GC |
| MW115 | 9th Ave N ROW | 35-45 | V, GC | – | V | V, GC |
| MW116 | 9th Ave N ROW | 35-45 | V, GC | – | V | V, GC |
| MW119 | 9th Ave N ROW S of Roy St | 35-45 | V, GC | – | V | V, GC |
| MW120 | 8th Ave N ROW | 40-50 | V, GC | – | V | V, GC |
| MW131 | Property | 44-54 | V, G, GC | V, G | NA | NA |
| **Proposed Intermediate A Monitoring Wells** | | | | | | |
| MW-142 | 8th Ave N ROW | 40-50 | V, G, GC | – | V, G, GC | V, G, GC |
| MW-144 | 8th Ave N ROW | 40-50 | V, G, GC | – | V, G, GC | V, G, GC |
| MW-146 | Roy Street ROW | 40-50 | V, G, GC | – | V, G, GC | V, G, GC |

# Table 3

## Sample Containers, Preservatives, and Holding Times
## Former American Linen Supply
## 700 Dexter Avenue North, Seattle, Washington

| Analysis | Method[a] | Container[b] |  | Preservative | Maximum Holding Time |
|---|---|---|---|---|---|
|  |  | Type | Size |  |  |
| **Soil Samples** |  |  |  |  |  |
| VOCs | 8260C | Glass | 8 oz./4 x 40 mL | 4 ± 2°C, methanol; $NaHSO_4$ | 14 days |
| Gasoline Range Organics | Ecology NWTPH-Gx | Glass | 8 oz./3 x 40 mL | 4 ± 2°C, methanol | 14 days |
| foc and TOC | Walkley-Black Method | Glass | 8 oz. | 4 ± 2°C | 28 days |
| **Groundwater Samples** |  |  |  |  |  |
| VOCs | 8260C | Glass | 3 x 40 mL | 4 ± 2°C, HCl to pH < 2 | 14 days |
| Gasoline Range Organics | Ecology NWTPH-Gx | Glass | 3 x 40 mL | 4 ± 2°C, HCl to pH < 2 | 14 days |
| Alkalinity | 2320 B-2011 | Poly | 1 liter | 4 ± 2°C | 28 days |
| Chloride, Sulfate | 9056A | Poly | 250 mL | 4 ± 2°C | 28 days |
| Nitrate | 9056A | Poly | 250 mL | 4 ± 2°C | 48 hours |
| TOC | 9060A | Amber Glass | 250 mL | 4 ± 2°C, $H_2SO_4$ to pH < 2 | 28 days |
| Total Iron and Manganese | 6020A | Poly | 500 mL | 4 ± 2°C, $HNO_3$ to pH < 2 | 6 months |
| Methane, Ethane, Ethene | RSK175 | Glass | 3 x 40 mL | 4 ± 2°C, HCl to pH < 2 | 14 days |
| **Groundwater Field Parameters** |  |  |  |  |  |
| pH | Probe/150.1 | – | – | – | – |
| Specific conductance | Probe/120.1 | – | – | – | – |
| Temperature | Probe/170.1 | – | – | – | – |
| Dissolved oxygen (DO) | Probe/SM 4500 | – | – | – | – |
| Oxidation/reduction potential (ORP) | Probe | – | – | – | – |
| Ferrous Iron | Hach Kit IR-18C | – | – | – | – |

Notes:

[a] EPA methods unless noted otherwise

[b] The size and number of containers may be modified by the analytical laboratories. Samples for multiple analyses may be obtained from the same container

# Table 4

## Analytical Parameters and Reporting Limits – Soil
## Former American Linen Supply
## 700 Dexter Avenue North, Seattle, Washington

| Analyte | CAS Registry Number | ESC Lab Sciences | | |
|---|---|---|---|---|
| | | Lab Method | MDL (mg/kg) | RDL[a] (mg/kg) |
| Volatile Organic Compounds (VOCs) | | | | |
| 1,1,1,2-Tetrachloroethane | 630-20-6 | 8260C | 0.000264 | 0.001 |
| 1,1,1-Trichloroethane | 71-55-6 | 8260C | 0.000286 | 0.001 |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 8260C | 0.000365 | 0.001 |
| 1,1,2-Trichloroethane | 79-00-5 | 8260C | 0.000277 | 0.001 |
| CFC-113 | 76-13-1 | 8260C | 0.000365 | 0.001 |
| 1,1-Dichloroethane | 75-34-3 | 8260C | 0.000199 | 0.001 |
| 1,1-Dichloroethene | 75-35-4 | 8260C | 0.000303 | 0.001 |
| 1,1-Dichloropropene | 563-58-6 | 8260C | 0.000317 | 0.001 |
| 1,2,3-Trichlorobenzene | 87-61-6 | 8260C | 0.000306 | 0.001 |
| 1,2,3-Trichloropropane | 96-18-4 | 8260C | 0.000741 | 0.0025 |
| Benzene, 1,2,3-Trimethyl- | 526-73-8 | 8260C | 0.000287 | 0.001 |
| 1,2,4-Trichlorobenzene | 120-82-1 | 8260C | 0.000388 | 0.001 |
| 1,2,4-Trimethylbenzene | 95-63-6 | 8260C | 0.000211 | 0.001 |
| 1,2-Dibromo-3-Chloropropane | 96-12-8 | 8260C | 0.00105 | 0.005 |
| Ethylene dibromide | 106-93-4 | 8260C | 0.000343 | 0.001 |
| 1,2-Dichlorobenzene | 95-50-1 | 8260C | 0.000305 | 0.001 |
| 1,2-Dichloroethane | 107-06-2 | 8260C | 0.000265 | 0.001 |
| 1,2-Dichloropropane | 78-87-5 | 8260C | 0.000358 | 0.001 |
| 1,3,5-Trimethylbenzene | 108-67-8 | 8260C | 0.000266 | 0.001 |
| 1,3-Dichlorobenzene | 541-73-1 | 8260C | 0.000239 | 0.001 |
| 1,3-Dichloropropane | 142-28-9 | 8260C | 0.000207 | 0.001 |
| 1,4-Dichlorobenzene | 106-46-7 | 8260C | 0.000226 | 0.001 |
| 2,2-Dichloropropane | 594-20-7 | 8260C | 0.000279 | 0.001 |
| Methyl ethyl ketone | 78-93-3 | 8260C | 0.00468 | 0.01 |
| 2-Chlorotoluene | 95-49-8 | 8260C | 0.000301 | 0.001 |
| 2-Hexanone | 591-78-6 | 8260C | NA | NA |
| 4-Chlorotoluene | 106-43-4 | 8260C | 0.00024 | 0.001 |
| Methyl isobutyl ketone | 108-10-1 | 8260C | 0.00188 | 0.01 |
| Acetone | 67-64-1 | 8260C | 0.01 | 0.05 |
| Acrylonitrile | 107-13-1 | 8260C | 0.00179 | 0.01 |
| Benzene | 71-43-2 | 8260C | 0.00027 | 0.001 |
| Bromobenzene | 108-86-1 | 8260C | 0.000284 | 0.001 |
| Bromochloromethane | 74-97-5 | 8260C | NA | NA |
| Dichlorobromomethane | 75-27-4 | 8260C | 0.000254 | 0.001 |
| Bromoform | 75-25-2 | 8260C | 0.000424 | 0.001 |
| Bromomethane | 74-83-9 | 8260C | 0.00134 | 0.005 |
| Carbon Disulfide | 75-15-0 | 8260C | NA | NA |
| Carbon Tetrachloride | 56-23-5 | 8260C | 0.000328 | 0.001 |
| Chlorobenzene | 108-90-7 | 8260C | 0.000212 | 0.001 |
| Chlorodibromomethane | 124-48-1 | 8260C | 0.000373 | 0.001 |
| Chloroethane | 75-00-3 | 8260C | 0.000946 | 0.005 |
| Chloroform | 67-66-3 | 8260C | 0.000229 | 0.005 |
| Chloromethane | 74-87-3 | 8260C | 0.000375 | 0.0025 |
| Cis-1,2-Dichloroethene | 156-59-2 | 8260C | 0.000235 | 0.001 |
| Cis-1,3-Dichloropropene | 10061-01-5 | 8260C | 0.000262 | 0.001 |
| Isopropyl ether | 108-20-3 | 8260C | 0.000248 | 0.001 |

# Table 4

## Analytical Parameters and Reporting Limits – Soil
## Former American Linen Supply
## 700 Dexter Avenue North, Seattle, Washington

| Analyte | CAS Registry Number | ESC Lab Sciences | | |
|---|---|---|---|---|
| | | Lab Method | MDL (mg/kg) | RDL[a] (mg/kg) |
| Dibromomethane | 74-95-3 | 8260C | 0.000382 | 0.001 |
| CFC-12 | 75-71-8 | 8260C | 0.000713 | 0.005 |
| Ethylbenzene | 100-41-4 | 8260C | 0.000297 | 0.001 |
| Hexachlorobutadiene | 87-68-3 | 8260C | 0.000342 | 0.001 |
| Methyl Iodide | 74-88-4 | 8260C | NA | NA |
| Cumene (isopropylbenzene) | 98-82-8 | 8260C | 0.000243 | 0.001 |
| Methyl t-butyl ether | 1634-04-4 | 8260C | 0.000212 | 0.001 |
| Methylene Chloride | 75-09-2 | 8260C | 0.001 | 0.005 |
| n-Butylbenzene | 104-51-8 | 8260C | 0.000258 | 0.001 |
| Hexane | 110-54-3 | 8260C | NA | NA |
| n-Propylbenzene | 103-65-1 | 8260C | 0.000206 | 0.001 |
| Naphthalene | 91-20-3 | 8260C | 0.001 | 0.005 |
| p-Isopropyltoluene | 99-87-6 | 8260C | 0.000204 | 0.001 |
| Sec-Butylbenzene | 135-98-8 | 8260C | 0.000201 | 0.001 |
| Styrene | 100-42-5 | 8260C | 0.000234 | 0.001 |
| Tert-Butylbenzene | 98-06-6 | 8260C | 0.000206 | 0.001 |
| Tetrachloroethene | 127-18-4 | 8260C | 0.000276 | 0.001 |
| Toluene | 108-88-3 | 8260C | 0.000434 | 0.005 |
| Trans-1,2-Dichloroethene | 156-60-5 | 8260C | 0.000264 | 0.001 |
| Trans-1,3-Dichloropropene | 10061-02-6 | 8260C | 0.000267 | 0.001 |
| Trans-1,4-Dichloro-2-butene | 110-57-6 | 8260C | NA | NA |
| Trichloroethene | 79-01-6 | 8260C | 0.000279 | 0.001 |
| CFC-11 (trichlorofluoromethane) | 75-69-4 | 8260C | 0.000382 | 0.005 |
| Vinyl Acetate | 108-05-4 | 8260C | NA | NA |
| Vinyl Chloride | 75-01-4 | 8260C | 0.000291 | 0.001 |
| Total Xylenes | 1330-20-7 | 8260C | 0.000698 | 0.003 |
| Petroleum Hydrocarbons | | | | |
| Gasoline Range Organics | NA | NWTPH-Gx | NA | NA |

Notes:

MDL = Method detection limit

RDL = Reported detection limits, which are provided for guidance and may not always be achievable

mg/kg = milligrams per kilogram

NA = not available or not applicable

[a] The RDL represents the level of the lowest calibration standard (i.e., the laboratory practical quantitation limit [PQL])

## Table 5

## Analytical Parameters and Reporting Limits – Water
## Former American Linen Supply
## 700 Dexter Avenue North, Seattle, Washington

| Analyte | CAS Registry Number | ESC Lab Sciences Lab Method | ESC Lab Sciences MDL (µg/L) | ESC Lab Sciences RDL[a] (µg/L) |
|---|---|---|---|---|
| Volatile Organic Compounds (VOCs) | | | | |
| 1,1,1,2-Tetrachloroethane | 630-20-6 | 8260C | 0.120 | 0.500 |
| 1,1,1-Trichloroethane | 71-55-6 | 8260C | 0.0940 | 0.500 |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 8260C | 0.130 | 0.500 |
| 1,1,2-Trichloroethane | 79-00-5 | 8260C | 0.186 | 0.500 |
| CFC-113 | 76-13-1 | 8260C | 0.164 | 0.500 |
| 1,1-Dichloroethane | 75-34-3 | 8260C | 0.114 | 0.500 |
| 1,1-Dichloroethene | 75-35-4 | 8260C | 0.188 | 0.500 |
| 1,1-Dichloropropene | 563-58-6 | 8260C | 0.128 | 0.500 |
| 1,2,3-Trichlorobenzene | 87-61-6 | 8260C | 0.164 | 0.500 |
| 1,2,3-Trichloropropane | 96-18-4 | 8260C | 0.247 | 2.50 |
| Benzene, 1,2,3-Trimethyl- | 526-73-8 | 8260C | 0.0739 | 0.500 |
| 1,2,4-Trichlorobenzene | 120-82-1 | 8260C | 0.355 | 0.500 |
| 1,2,4-Trimethylbenzene | 95-63-6 | 8260C | 0.123 | 0.500 |
| 1,2-Dibromo-3-Chloropropane | 96-12-8 | 8260C | 0.325 | 1.00 |
| Ethylene dibromide | 106-93-4 | 8260C | 0.193 | 0.500 |
| 1,2-Dichlorobenzene | 95-50-1 | 8260C | 0.101 | 0.500 |
| 1,2-Dichloroethane | 107-06-2 | 8260C | 0.108 | 0.500 |
| 1,2-Dichloropropane | 78-87-5 | 8260C | 0.190 | 0.500 |
| 1,3,5-Trimethylbenzene | 108-67-8 | 8260C | 0.124 | 0.500 |
| 1,3-Dichlorobenzene | 541-73-1 | 8260C | 0.130 | 0.500 |
| 1,3-Dichloropropane | 142-28-9 | 8260C | 0.147 | 0.500 |
| 1,4-Dichlorobenzene | 106-46-7 | 8260C | 0.121 | 0.500 |
| 2,2-Dichloropropane | 594-20-7 | 8260C | 0.0929 | 0.500 |
| Methyl ethyl ketone | 78-93-3 | 8260C | 1.28 | 2.50 |
| 2-Chlorotoluene | 95-49-8 | 8260C | 0.111 | 0.500 |
| 2-Hexanone | 591-78-6 | 8260C | 0.757 | 2.50 |
| 4-Chlorotoluene | 106-43-4 | 8260C | 0.0972 | 0.500 |
| Methyl isobutyl ketone | 108-10-1 | 8260C | 0.823 | 2.50 |
| Acetone | 67-64-1 | 8260C | 1.05 | 25.0 |
| Acrylonitrile | 107-13-1 | 8260C | 0.873 | 2.50 |
| Benzene | 71-43-2 | 8260C | 0.0896 | 0.500 |
| Bromobenzene | 108-86-1 | 8260C | 0.133 | 0.500 |
| Bromochloromethane | 74-97-5 | 8260C | 0.145 | 0.500 |
| Dichlorobromomethane | 75-27-4 | 8260C | 0.0800 | 0.500 |
| Bromoform | 75-25-2 | 8260C | 0.186 | 0.500 |
| Bromomethane | 74-83-9 | 8260C | 0.157 | 0.500 |
| Carbon Disulfide | 75-15-0 | 8260C | 0.101 | 0.500 |
| Carbon Tetrachloride | 56-23-5 | 8260C | 0.159 | 0.500 |
| Chlorobenzene | 108-90-7 | 8260C | 0.140 | 0.500 |
| Chlorodibromomethane | 124-48-1 | 8260C | 0.128 | 0.500 |
| Chloroethane | 75-00-3 | 8260C | 0.141 | 0.500 |
| Chloroform | 67-66-3 | 8260C | 0.0860 | 0.500 |
| Chloromethane | 74-87-3 | 8260C | 0.153 | 0.500 |
| Cis-1,2-Dichloroethene | 156-59-2 | 8260C | 0.0933 | 0.500 |
| Cis-1,3-Dichloropropene | 10061-01-5 | 8260C | 0.0976 | 0.500 |
| Isopropyl ether | 108-20-3 | 8260C | 0.0924 | 0.500 |

# Table 5

## Analytical Parameters and Reporting Limits – Water
## Former American Linen Supply
## 700 Dexter Avenue North, Seattle, Washington

| Analyte | CAS Registry Number | ESC Lab Sciences Lab Method | MDL (µg/L) | RDL[a] (µg/L) |
|---|---|---|---|---|
| Dibromomethane | 74-95-3 | 8260C | 0.117 | 0.500 |
| CFC-12 | 75-71-8 | 8260C | 0.127 | 0.500 |
| Ethylbenzene | 100-41-4 | 8260C | 0.158 | 0.500 |
| Hexachlorobutadiene | 87-68-3 | 8260C | 0.157 | 1.00 |
| Methyl Iodide | 74-88-4 | 8260C | 0.377 | 2.50 |
| Cumene | 98-82-8 | 8260C | 0.126 | 0.500 |
| Methyl t-butyl ether | 1634-04-4 | 8260C | 0.102 | 0.500 |
| Methylene Chloride | 75-09-2 | 8260C | 1.07 | 2.50 |
| n-Butylbenzene | 104-51-8 | 8260C | 0.143 | 0.500 |
| Hexane | 110-54-3 | 8260C | 0.305 | 1.00 |
| n-Propylbenzene | 103-65-1 | 8260C | 0.162 | 0.500 |
| Naphthalene | 91-20-3 | 8260C | 0.174 | 0.500 |
| p-Isopropyltoluene | 99-87-6 | 8260C | 0.138 | 0.500 |
| Sec-Butylbenzene | 135-98-8 | 8260C | 0.134 | 0.500 |
| Styrene | 100-42-5 | 8260C | 0.117 | 0.500 |
| Tert-Butylbenzene | 98-06-6 | 8260C | 0.183 | 0.500 |
| Tetrachloroethene | 127-18-4 | 8260C | 0.199 | 0.500 |
| Toluene | 108-88-3 | 8260C | 0.412 | 1.00 |
| Trans-1,2-Dichloroethene | 156-60-5 | 8260C | 0.152 | 0.500 |
| Trans-1,3-Dichloropropene | 10061-02-6 | 8260C | 0.222 | 0.500 |
| Trans-1,4-Dichloro-2-butene | 110-57-6 | 8260C | 0.257 | 5.00 |
| Trichloroethene | 79-01-6 | 8260C | 0.153 | 0.500 |
| CFC-11 | 75-69-4 | 8260C | 0.130 | 0.500 |
| Vinyl Acetate | 108-05-4 | 8260C | 0.645 | 2.50 |
| Vinyl Chloride | 75-01-4 | 8260C | 0.118 | 0.500 |
| Total Xylenes | 1330-20-7 | 8260C | 0.316 | 1.50 |
| Petroleum Hydrocarbons | | | | |
| Gasoline Range Organics | NA | NWTPH-Gx | 31.6 | 100 |
| EVO Injection Monitoring | | | | |
| Alkalinity, Total | NA | 2320B | 20,000 | 2,710 |
| Chloride | 16887-00-6 | 9056A | 1,000 | 51.9 |
| Nitrate | 14797-55-8 | 9056A | 100 | 22.7 |
| Sulfate | 14808-79-8 | 9056A | 5,000 | 77.4 |
| Total Organic Carbon (TOC) | NA | 9060A | 1,000 | 102 |
| Iron | 7439-89-6 | 6020A | 100 | 15.0 |
| Manganese | 7439-96-5 | 6020A | 5.00 | 0.250 |

# Table 6

## Laboratory and Field Quality Control Sample Summary
## Former American Linen Supply
## 700 Dexter Avenue North, Seattle, Washington

| Matrix | QA/QC Analyses | Frequency |
|---|---|---|
| **Laboratory** | | |
| Water | Laboratory control sample (LCS) | Every analytical batch. |
| | MS/MSD | 1 per 20 project samples with a minimum of 1 per event. |
| | Method blank | Every analytical batch. |
| Soil | Laboratory control sample (LCS) | Every analytical batch. |
| | MS/MSD | 1 per 20 project samples with a minimum of 1 per event. |
| | Method blank | Every analytical batch. |
| **Field** | | |
| Water | Equipment blank/field rinsate[a] | 1 per 20 project samples when non-dedicated sampling equipment is used, with mimum of 1 per event. Analyze consistent with project samples. |
| | Transport (Trip) blank | 1 per 20 project samples with maximum of 1 per shipment, when samples are analyzed |
| | | for VOCs or NWTPH-Gx. |
| | Field duplicate | 1 per 20 project samples. Analyze consistent with project samples. |
| Soil | Equipment blank/field rinsate | 1 per 20 project samples when non-dedicated sampling equipment is used, with mimum of 1 per event. Analyze consistent with project samples. |
| | Transport (Trip) blank | 1 per 20 project samples with maximum of 1 per shipment, when samples are analyzed |
| | | for VOCs or NWTPH-Gx. |
| | Field duplicate | 1 per 20 project samples. Analyze consistent with project samples. |

# Table 7

## Field Equipment and Supplies
## Former American Linen Supply
## 700 Dexter Avenue North, Seattle, Washington

| **Forms/Documentation** |
|---|
| Field logbooks |
| Field sampling data sheets |
| Chain-of-custody/laboratory analysis report form |
| Custody seal |
| Project photo log |
| Health and Safety Plan (HASP) |
| Field sampling and analysis plan (SAP) |
| Large scale site map |
| **Tools** |
| Fiberglass tape with stainless-steel weight |
| Tape measure calibrated to 0.1 inch |
| Decon brushes |
| Flashlight |
| Tool kit |
| Electric cordless drill |
| Shovel |
| **Well Development Equipment** |
| Down well pump |
| Generator/Battery |
| Water Level Indicator |
| Turbidity Meter |
| Stainless Steel Bailer and rope |
| Oil/water interface probe |
| Hydrocarbon finding paste and measuring tool |
| **Groundwater Sampling Equipment** |
| Multi Meter |
| Flow-through cell |
| Peristaltic pump |
| Silicone tubing |
| Polyethylene tubing |
| Water level indicator |
| Oil/water interface probe |
| Glass sample collection containers, Teflon® lined caps, and labels. |
| 0.45-µm groundwater filters |
| Distilled water |
| Hydrocarbon findingpaste and measuring tool |
| **Soil Sampling Equipment** |
| Photo-ionization Detector |
| EPA Method 5035 sampling equipment (e.g. Terra Core Samplers) |
| Stainless-steel mixing bowl |
| Stainless-steel mixing implements (i.e., spoons, rods, etc.) |
| Labels |
| Plastic baggies |

# Table 7

# Field Equipment and Supplies
# Former American Linen Supply
# 700 Dexter Avenue North, Seattle, Washington

| NAPL Monitoring and Recovery |
|---|
| Electronic oil-water interface probe |
| Hydrocarbon findingpaste and measuring tool |
| Distilled water |
| Peristaltic pump |
| Silicone tubing |
| Polyethylene tubing |
| **Aquifer Testing (Slug Tests)** |
| Polyethylene rope |
| Solid slugs |
| Transducer |
| Field computer |
| Electronic oil-water interface probe or Water level indicator |
| **Health and Safety Equipment** |
| Fire extinguisher |
| First aid kits |
| Safety glasses |
| Ear plugs |
| Respirator and organic vapor cartridges |
| Gloves – nitrile, vinyl, neoprene |
| Duct tape |
| **Miscellaneous Equipment** |
| Stainless- steel work surface |
| Spray paint, pencils, pens, labels |
| Metal or wooden rod |
| Waterproof markers |
| Water jugs and sprayers |
| Hazardous materials packaging |
| Bubble wrap and tape for shipping |
| Camera |
| Resealable plastic bags |
| Paper towels |
| Visqueen sheets |
| Buckets |
| Squirt bottle (wash) |
| Cotton gloves |
| Nalgene wash bottles |
| Reagent bottles |
| Coolers with foam dividers (sample transport and shipping) |
| Scrub brushes |
| Plastic tubs |
| Ice, in leak-proof bags |
| Drinking water |

# ILLUSTRATIONS

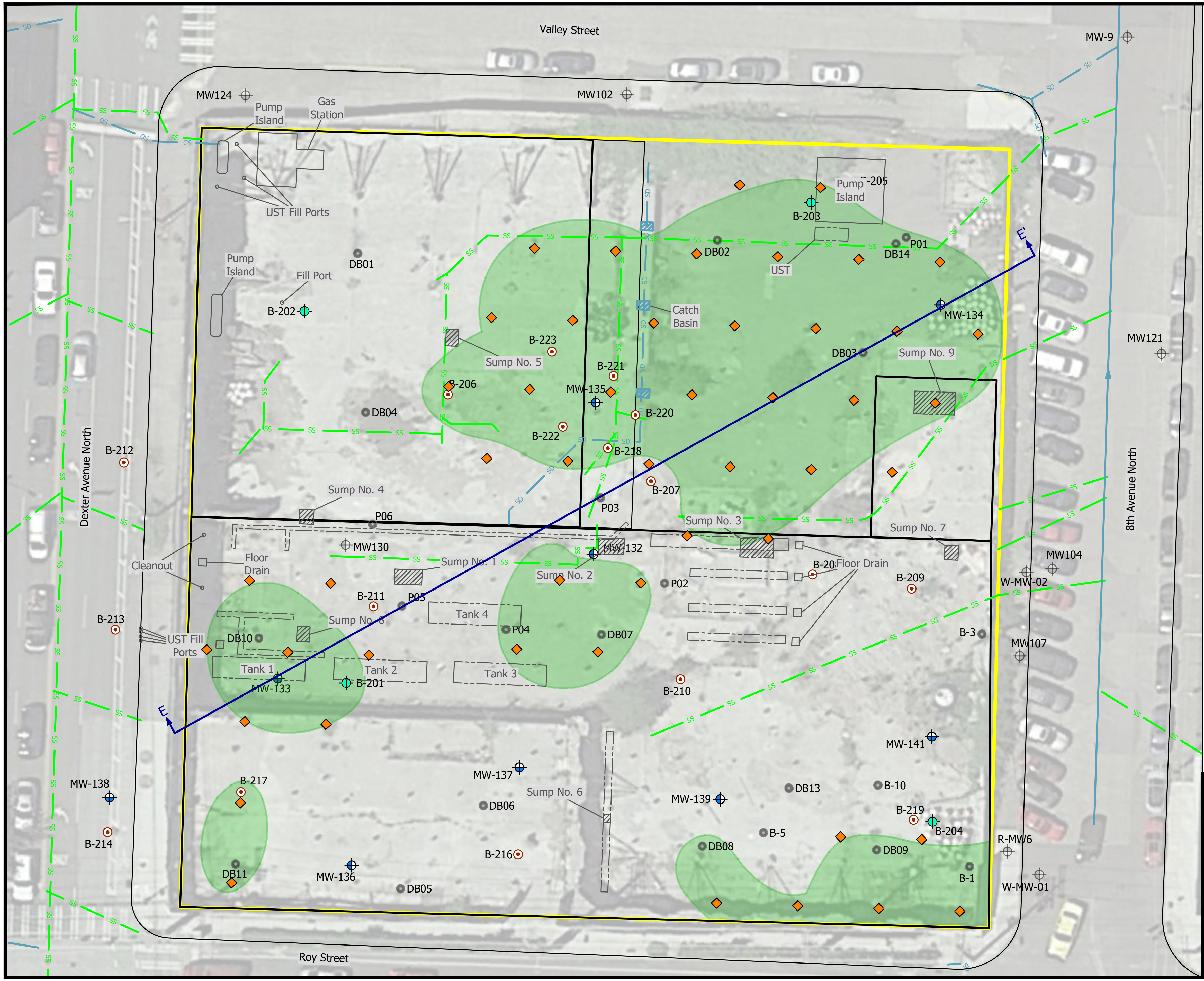
Aerial Photo: June 27, 2016 (Google 2017)

**PES Environmental, Inc.**
Engineering & Environmental Services

**Property Location**
Former American Linen Supply
700 Dexter Avenue North
Seattle, Washington

FIGURE
1

| 1412.004.02.004 | 141300102004_SAP_1 | WRH | 1/18 |
|---|---|---|---|
| JOB NUMBER | DRAWING NUMBER | REVIEWED BY | DATE |



## Explanation

| | |
|---|---|
| | Approximate Property Boundary |
| | Sanitary Sewer Line |
| | Storm Drain Line |
| | Combined Main |
| MW101 | Shallow Monitoring Well |
| MW107 | Intermediate A Monitoring Well |
| W-MW-02 | Intermediate B Monitoring Well |
| MW105 | Deep Monitoring Well |
| B-2 | Soil Boring Location |
| MW-132 | 2017 Intermediate A Monitoring Well |
| MW-134 | 2017 Intermediate B Monitoring Well |
| MW-133 | 2017 Deep Monitoring Well |
| B-205 | 2017 Soil Boring Location |
| B-201 | 2017 Geotechnical Boring Location |
| N 231800<br>E 1268300 | Coordinate Reference Point<br>(NAD83, Washington State Plane North, US Feet) |
| 🟩 | Treatment Zone Horizontal Extent |
| E E' | Cross Section Location<br>(Arrows show direction of view) |
| | Note: Only boring and well locations with soil data used in modeling are shown for clarity. |
| ◆ | Proposed Injection Well Location |

N

0 30
SCALE IN FEET

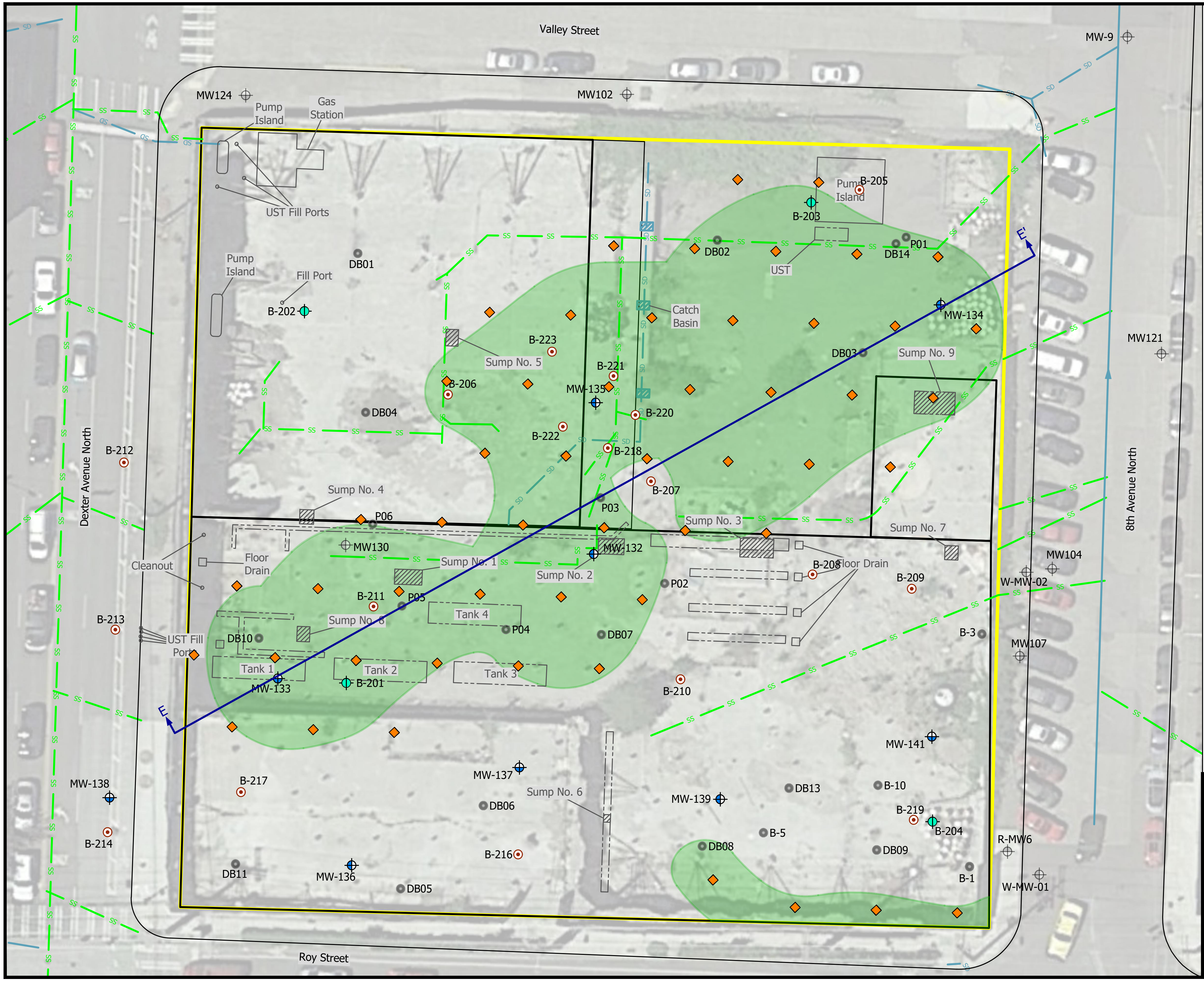
Aerial Photo: June 27, 2016 (Google 2017)

**PES Environmental, Inc.**
Engineering & Environmental Services

**Interim Action Treatment Zone A**
**Injection Well Plan**
Former American Linen Supply
700 Dexter Avenue North
Seattle, Washington

FIGURE
2

| JOB NUMBER | DRAWING NUMBER | REVIEWED BY | DATE |
|---|---|---|---|
| 1413.001.02.004 | 141300102004_SAP_2 | WRH | 1/18 |



## Explanation

| | |
|---|---|
| | Approximate Property Boundary |
| SS | Sanitary Sewer Line |
| SD | Storm Drain Line |
| | Combined Main |
| MW101 ⌖ | Shallow Monitoring Well |
| MW107 ⌖ | Intermediate A Monitoring Well |
| W-MW-02 ⌖ | Intermediate B Monitoring Well |
| MW105 ⌖ | Deep Monitoring Well |
| B-2 ● | Soil Boring Location |
| MW-132 ⌖ | 2017 Intermediate A Monitoring Well |
| MW-134 ⌖ | 2017 Intermediate B Monitoring Well |
| MW-133 ⌖ | 2017 Deep Monitoring Well |
| B-205 ◉ | 2017 Soil Boring Location |
| B-201 ⌖ | 2017 Geotechnical Boring Location |
| N 231800<br>E 1268300 + | Coordinate Reference Point<br>(NAD83, Washington State Plane North, US Feet) |
| 🟩 | Treatment Zone Horizontal Extent |
| E E' | Cross Section Location<br>(Arrows show direction of view) |
| | Note: Only boring and well locations with soil data used in modeling are shown for clarity. |
| ◆ | Proposed Injection Well Location |

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SCALE IN FEET

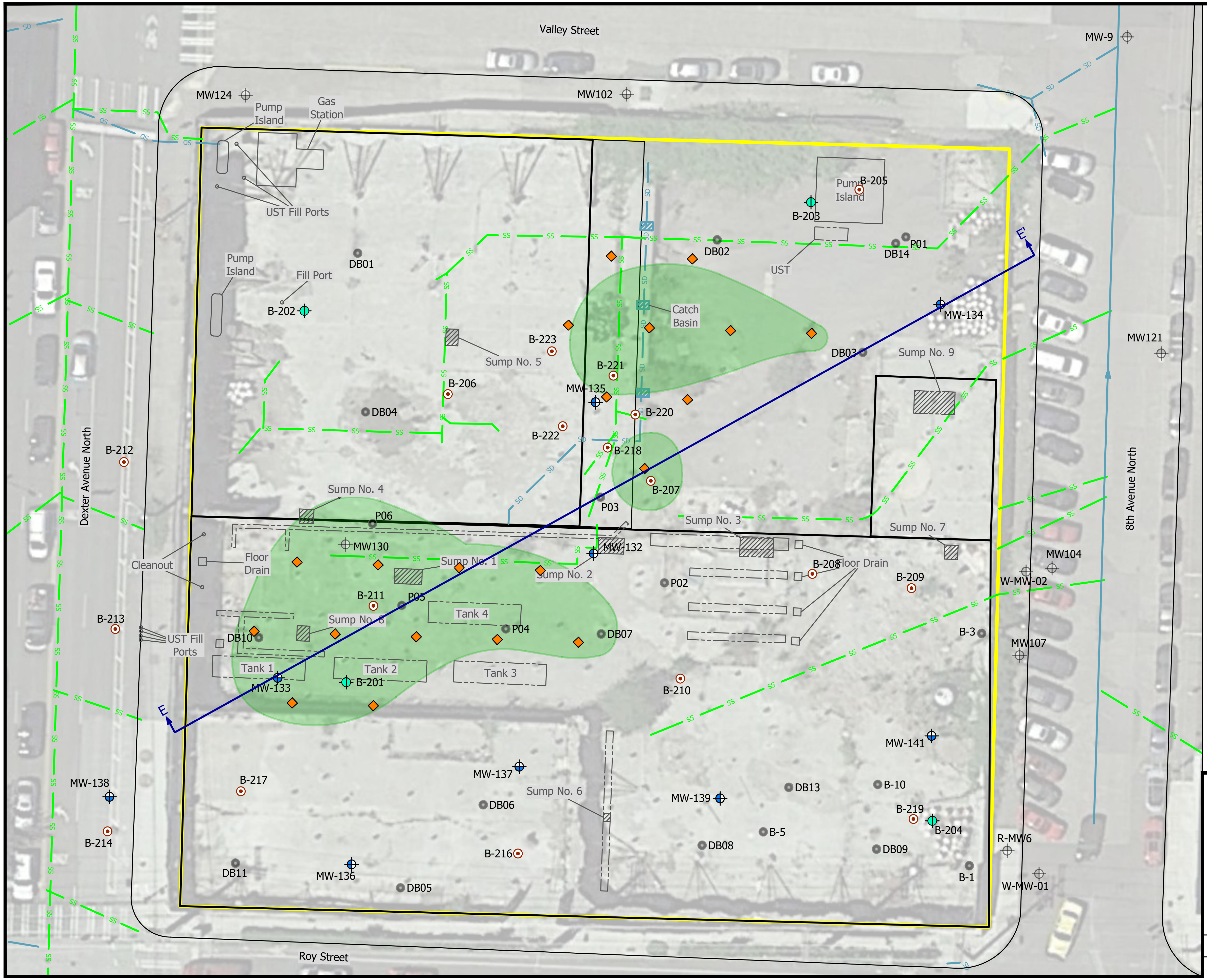
Aerial Photo: June 27, 2016 (Google 2017)

**PES Environmental, Inc.**
Engineering & Environmental Services

**Interim Action Treatment Zone B**
**Injection Well Plan**
Former American Linen Supply
700 Dexter Avenue North
Seattle, Washington

FIGURE
3

| JOB NUMBER | DRAWING NUMBER | REVIEWED BY | DATE |
|---|---|---|---|
| 1413.001.02.004 | 141300102004_SAP_3 | WRH | 1/18 |



Aerial Photo: June 27, 2016 (Google 2017)

## Explanation

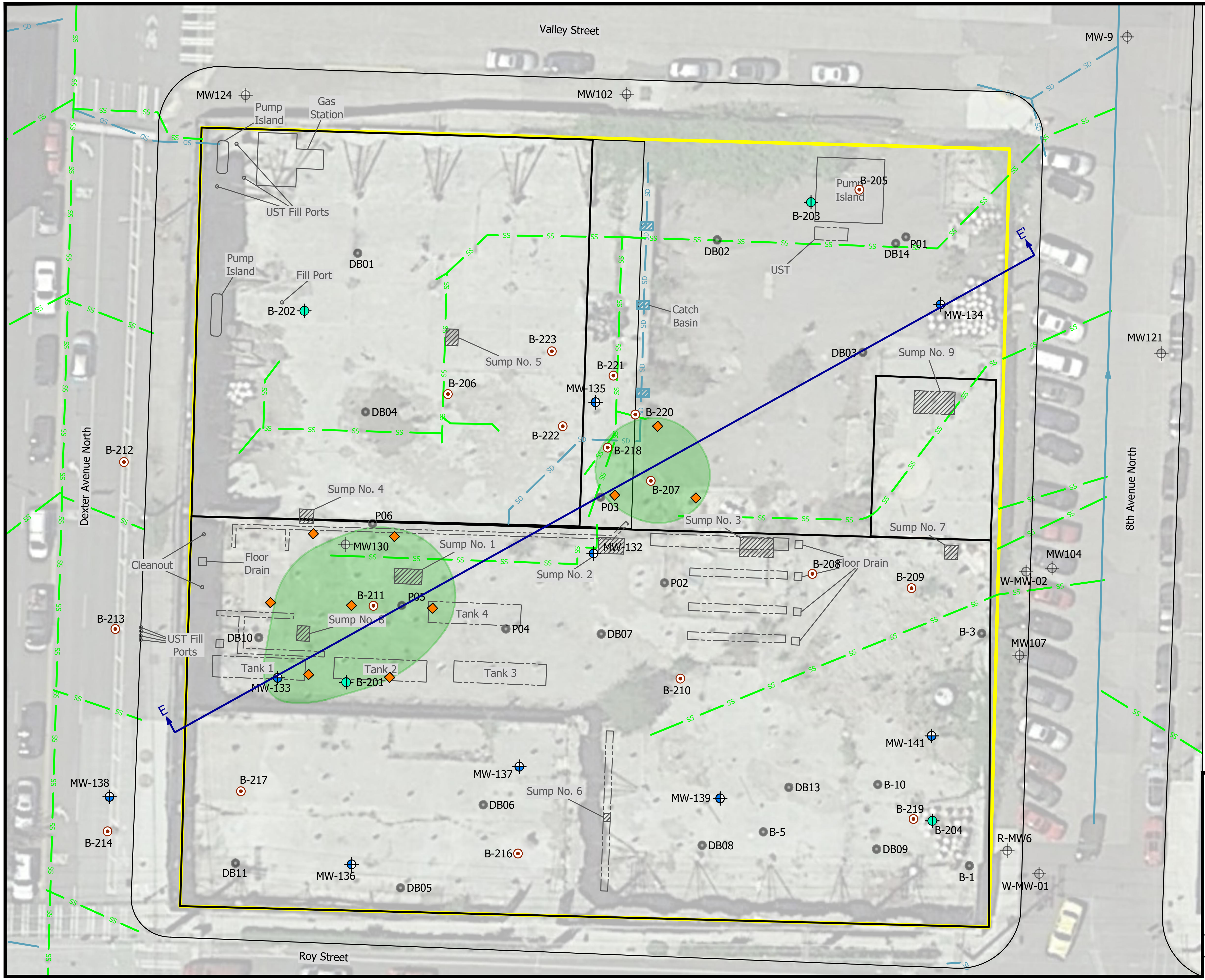
| | |
|---|---|
| 🟨 | Approximate Property Boundary |
| — SS — | Sanitary Sewer Line |
| — SD — | Storm Drain Line |
| — | Combined Main |
| MW101 ⊕ | Shallow Monitoring Well |
| MW107 ⊕ | Intermediate A Monitoring Well |
| W-MW-02 ⊕ | Intermediate B Monitoring Well |
| MW105 ⊕ | Deep Monitoring Well |
| B-2 ● | Soil Boring Location |
| MW-132 ⊕ | 2017 Intermediate A Monitoring Well |
| MW-134 ⊕ | 2017 Intermediate B Monitoring Well |
| MW-133 ⊕ | 2017 Deep Monitoring Well |
| B-205 ◉ | 2017 Soil Boring Location |
| B-201 ⊕ | 2017 Geotechnical Boring Location |
| N 231800<br>E 1268300 + | Coordinate Reference Point<br>(NAD83, Washington State Plane North, US Feet) |
| 🟩 | Treatment Zone Horizontal Extent |
| E E' | Cross Section Location<br>(Arrows show direction of view) |
| | Note: Only boring and well locations with soil data used in modeling are shown for clarity. |
| ◆ | Proposed Injection Well Location |

**PES Environmental, Inc.**
Engineering & Environmental Services

**Interim Action Treatment Zone C**
**Injection Well Plan**
Former American Linen Supply
700 Dexter Avenue North
Seattle, Washington

FIGURE
4

| JOB NUMBER | DRAWING NUMBER | REVIEWED BY | DATE |
|---|---|---|---|
| 1413.001.02.004 | 141300102004_SAP_4 | WRH | 1/18 |



## Explanation

| | |
|---|---|
| 🟨 | Approximate Property Boundary |
| SS | Sanitary Sewer Line |
| SD | Storm Drain Line |
| | Combined Main |
| MW101 ⌖ | Shallow Monitoring Well |
| MW107 ⌖ | Intermediate A Monitoring Well |
| W-MW-02 ⌖ | Intermediate B Monitoring Well |
| MW105 ⌖ | Deep Monitoring Well |
| B-2 ● | Soil Boring Location |
| MW-132 ⌖ | 2017 Intermediate A Monitoring Well |
| MW-134 ⌖ | 2017 Intermediate B Monitoring Well |
| MW-133 ⌖ | 2017 Deep Monitoring Well |
| B-205 ⊙ | 2017 Soil Boring Location |
| B-201 ⌖ | 2017 Geotechnical Boring Location |
| N 231800<br>E 1268300 + | Coordinate Reference Point<br>(NAD83, Washington State Plane North, US Feet) |
| 🟩 | Treatment Zone Horizontal Extent |
| E E' | Cross Section Location<br>(Arrows show direction of view) |
| | Note: Only boring and well locations with soil data used in modeling are shown for clarity. |
| ◆ | Proposed Injection Well Location |

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SCALE IN FEET

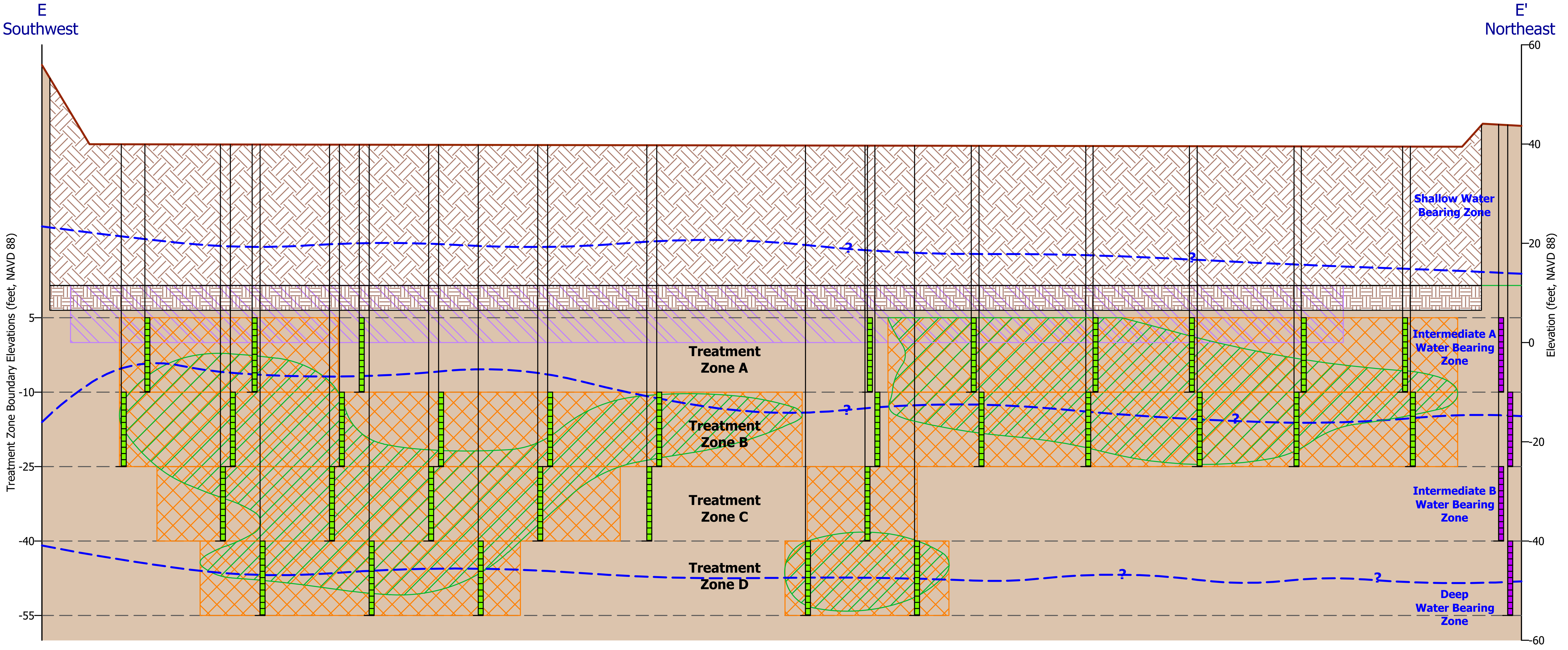
Aerial Photo: June 27, 2016 (Google 2017)

PES Environmental, Inc.
Engineering & Environmental Services

**Interim Action Treatment Zone D**
**Injection Well Plan**
Former American Linen Supply
700 Dexter Avenue North
Seattle, Washington

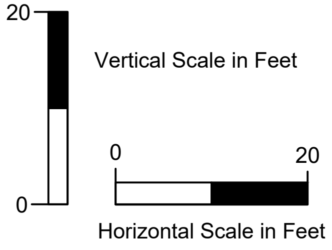
FIGURE
5

| JOB NUMBER | DRAWING NUMBER | REVIEWED BY | DATE |
|---|---|---|---|
| 1413.001.02.004 | 141300102004_SAP_5 | WRH | 1/18 |



## Explanation

- Approximate Ground Surface Elevation
- Excavation Boundary
- Approximate Water Bearing Zone Boundary (Queried where uncertain)
- ▨ Soil to be Excavated for Parking Garage
- ▨ Thickened Foundation Interval to be Excavated where Required
- ■ Soil not to be Excavated
- ▨ Interpolated areas with Tetrachloroethene (PCE) concentration greater than 0.5 milligram per kilogram
- ▨ Soil Previously Treated using ERH/SVE
- ▨ Treatment Zone
- Source Area Injection Well
- Perimeter Injection Well



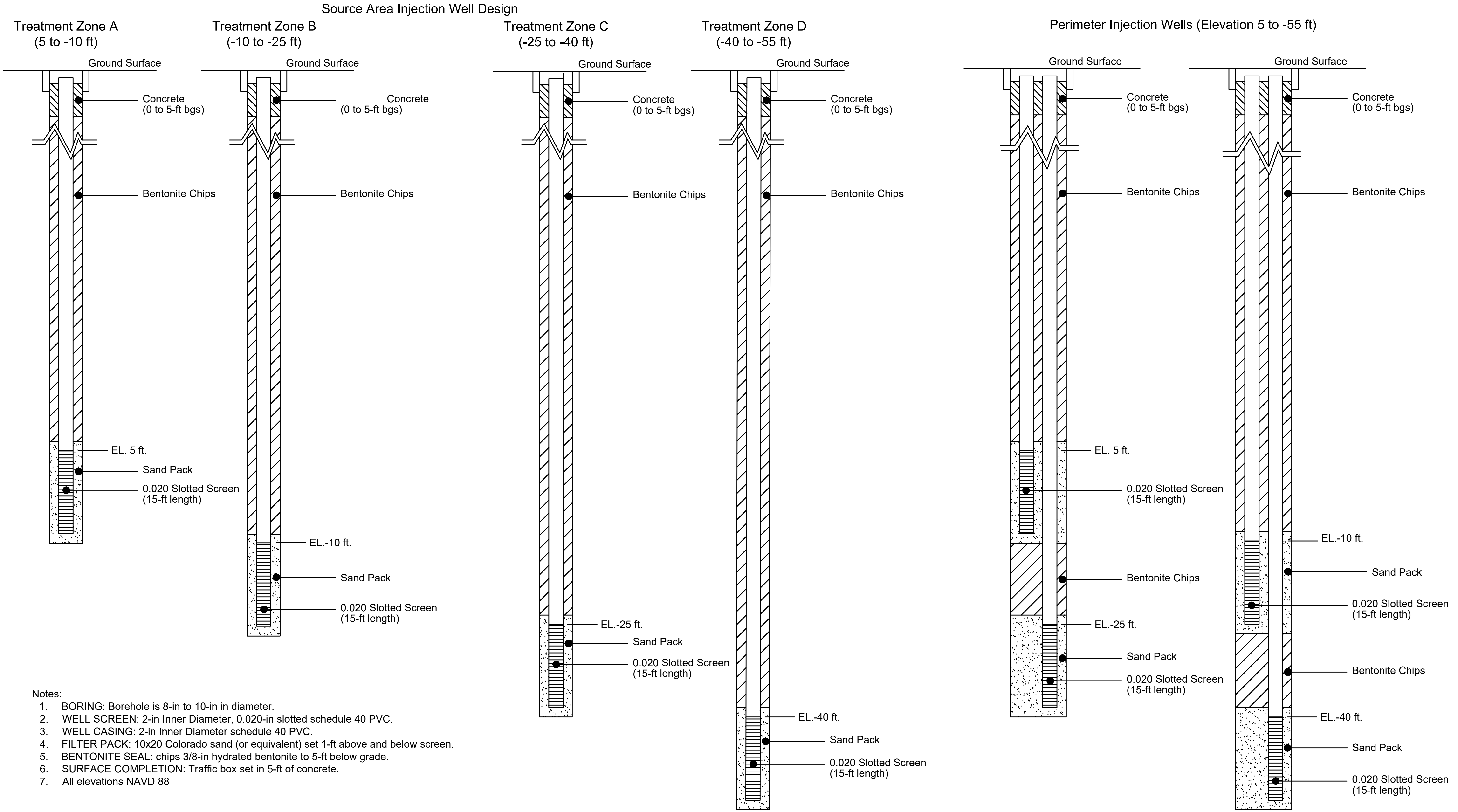
Notes:
1. All wells shown are within 10 ft of the cross-section line.
2. See Figure 40 for injection well construction details.

**PES Environmental, Inc.**
Engineering & Environmental Services

**Injection Wells and Treatment Zones**
**Cross Section E-E'**
Former American Linen Supply
700 Dexter Avenue North
Seattle, Washington

FIGURE
6

| 1413.001.02.004 | 141300102004_SAP_6 | WRH | 1/18 |
|---|---|---|---|
| JOB NUMBER | DRAWING NUMBER | REVIEWED BY | DATE |



Notes:

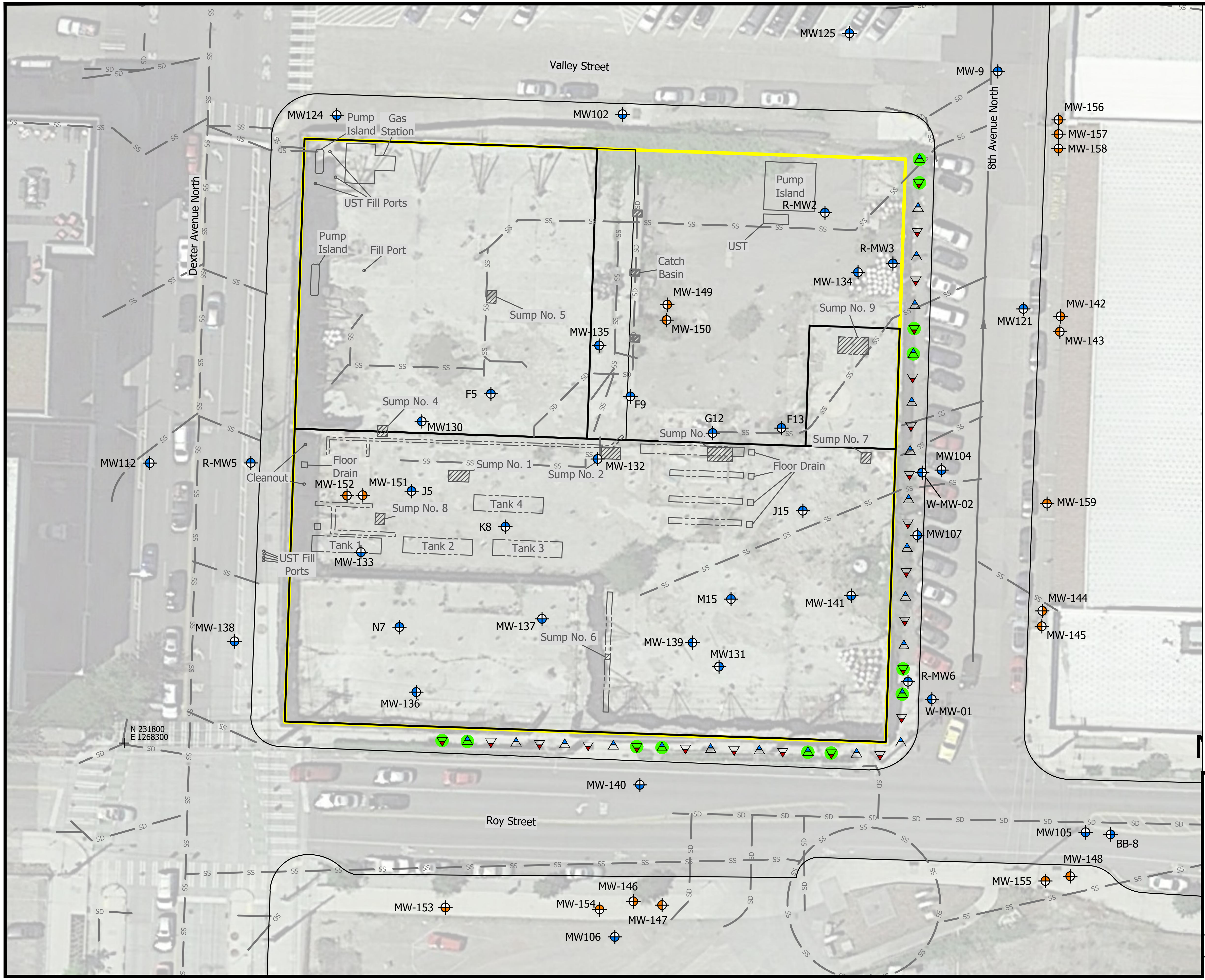
1. BORING: Borehole is 8-in to 10-in in diameter.
2. WELL SCREEN: 2-in Inner Diameter, 0.020-in slotted schedule 40 PVC.
3. WELL CASING: 2-in Inner Diameter schedule 40 PVC.
4. FILTER PACK: 10x20 Colorado sand (or equivalent) set 1-ft above and below screen.
5. BENTONITE SEAL: chips 3/8-in hydrated bentonite to 5-ft below grade.
6. SURFACE COMPLETION: Traffic box set in 5-ft of concrete.
7. All elevations NAVD 88

**PES Environmental, Inc.**
Engineering & Environmental Services

**Injection Well Construction Schematics**
Former American Linen Supply
700 Dexter Avenue North
Seattle, Washington

FIGURE
7

| JOB NUMBER | DRAWING NUMBER | REVIEWED BY | DATE |
|---|---|---|---|
| 1413.001.02.004 | 141300102004_SAP_7 | WRH | 1/18 |



## Explanation

| | |
|---|---|
| 🟨 | Approximate Property Boundary |
| — SS — | Sanitary Sewer Line |
| — SD — | Storm Drain Line |
| — | Combined Main |
| MW101 ⊕ | Shallow Monitoring Well |
| MW107 ⊕ | Intermediate A Monitoring Well |
| W-MW-02 ⊕ | Intermediate B Monitoring Well |
| MW105 ⊕ | Deep Monitoring Well |
| N 231800<br>E 1268300 + | Coordinate Reference Point<br>(NAD83, Washington State Plane North, US Feet) |
| △ | Type 1 Perimeter Injection Well |
| ▽ | Type 2 Perimeter Injection Well |
| ⊕ | Proposed Shallow Monitoring Well |
| ⊕ | Proposed Intermediate A Monitoring Well |
| ⊕ | Proposed Intermediate B Monitoring Well |
| ⊕ | Proposed Deep Monitoring Well |
| ● | Perimeter Injection wells to be sampled prior to injecting EVO |

N

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SCALE IN FEET

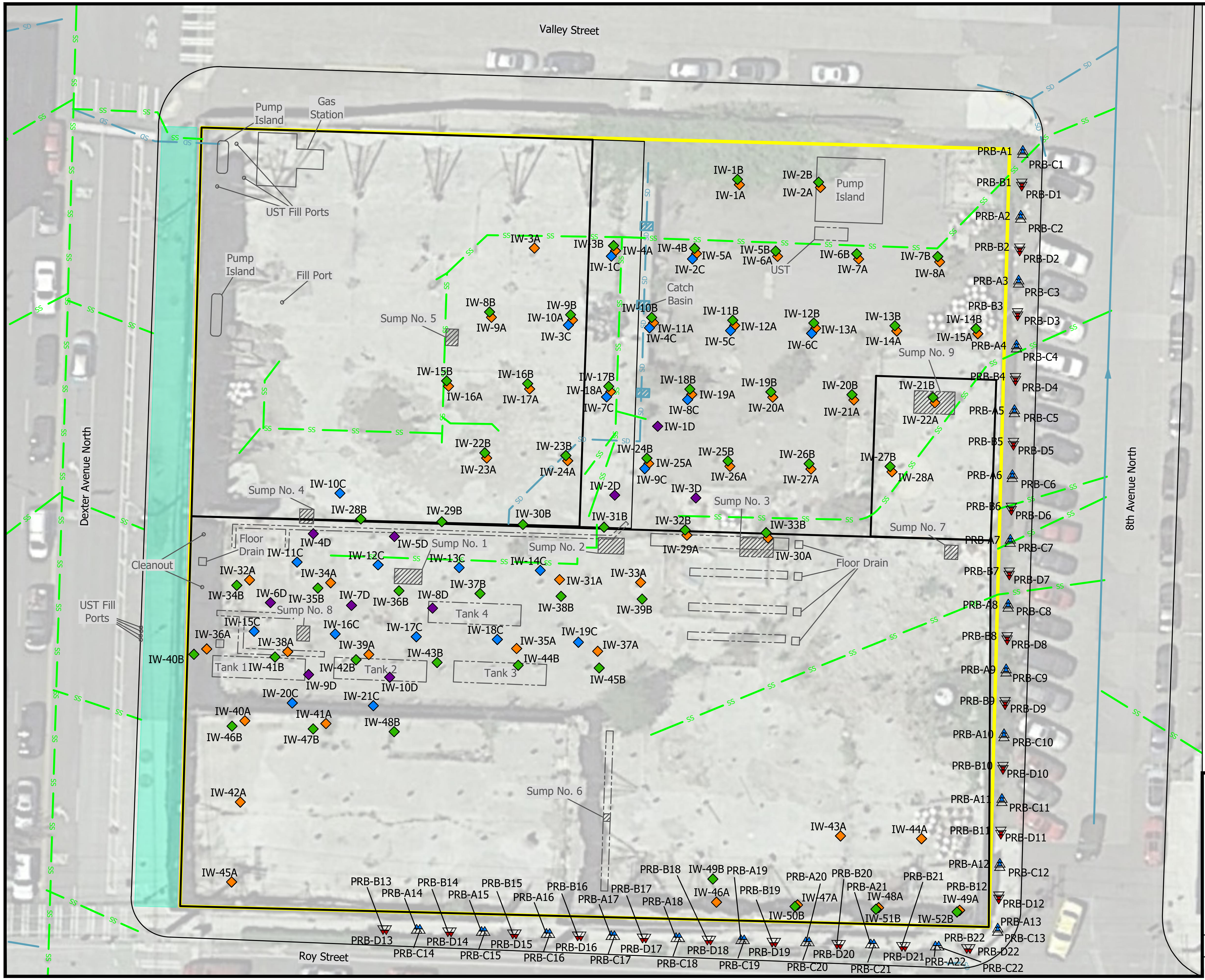
Aerial Photo: June 27, 2016 (Google 2017)

**PES Environmental, Inc.**
Engineering & Environmental Services

**Interim Action Performance Monitoring Wells**
Former American Linen Supply
700 Dexter Avenue North
Seattle, Washington

FIGURE
8

| JOB NUMBER | DRAWING NUMBER | REVIEWED BY | DATE |
|---|---|---|---|
| 1413.001.02.004 | 141300102004_SAP_8 | WRH | 1/18 |



## Explanation

| | |
|---|---|
| ━ | Approximate Property Boundary |
| – SS – | Sanitary Sewer Line |
| – SD – | Storm Drain Line |
| ━ | Combined Main |
| N 231800<br>E 1268300 + | Coordinate Reference Point<br>(NAD83, Washington State Plane North, US Feet) |
| ◆ | Proposed Treatment Zone A Injection Well |
| ◆ | Proposed Treatment Zone B Injection Well |
| ◆ | Proposed Treatment Zone C Injection Well |
| ◆ | Proposed Treatment Zone D Injection Well |
| △ | Type 1 Perimeter Injection Well |
| ▽ | Type 2 Perimeter Injection Well |
| ▭ | Location of Contingent Upgradient Injection Wells |

Note: Building design and construction activities will create space within the new utility alignment on Dexter Avenue to allow installation of the contingent upgradient injection wells, if Ecology determines they are necessary.

N

0 30

SCALE IN FEET

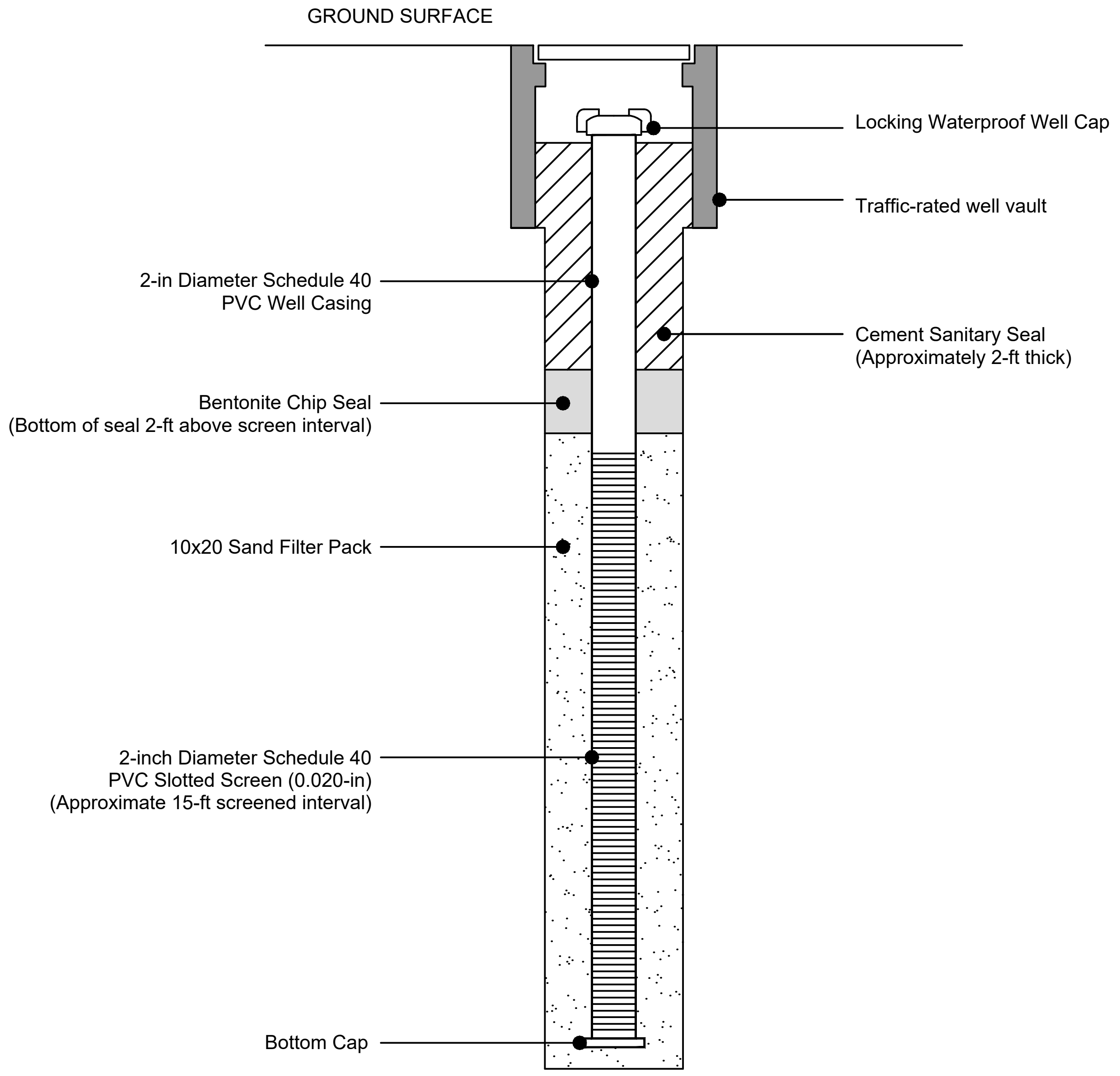
Aerial Photo: June 27, 2016 (Google 2017)

**PES Environmental, Inc.**
Engineering & Environmental Services

**Interim Action Injection Wells and Contingency Injection Wells Plan**
Former American Linen Supply
700 Dexter Avenue North
Seattle, Washington

FIGURE
9

| 1413.001.02.004 | 141300102004_SAP_9 | WRH | 1/18 |
|---|---|---|---|
| JOB NUMBER | DRAWING NUMBER | REVIEWED BY | DATE |



NOT TO SCALE

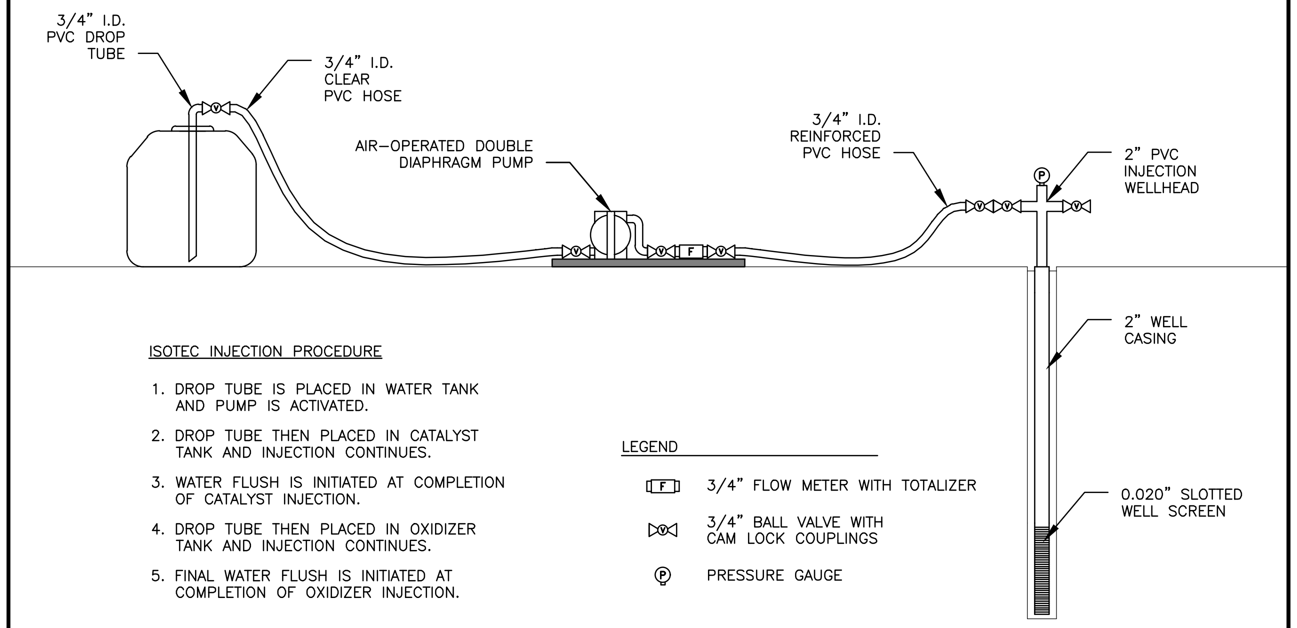
**PES Environmental, Inc.**
Engineering & Environmental Services

**Typical Performance Monitoring**
**Well Completion**
Former American Linen Supply
700 Dexter Avenue North
Seattle, Washington

FIGURE
10

| JOB NUMBER | DRAWING NUMBER | REVIEWED BY | DATE |
|---|---|---|---|
| 1413.001.03.001 | 141300102004_SAP_10 | WRH | 1/18 |

## REAGENT INJECTION DIAGRAM



### ISOTEC INJECTION PROCEDURE

1. DROP TUBE IS PLACED IN WATER TANK AND PUMP IS ACTIVATED.
2. DROP TUBE THEN PLACED IN CATALYST TANK AND INJECTION CONTINUES.
3. WATER FLUSH IS INITIATED AT COMPLETION OF CATALYST INJECTION.
4. DROP TUBE THEN PLACED IN OXIDIZER TANK AND INJECTION CONTINUES.
5. FINAL WATER FLUSH IS INITIATED AT COMPLETION OF OXIDIZER INJECTION.

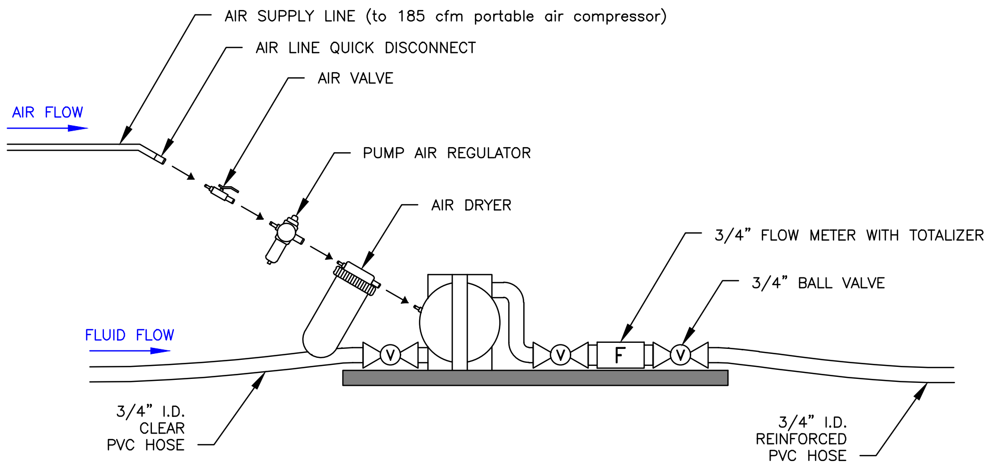
LEGEND

F 3/4" FLOW METER WITH TOTALIZER

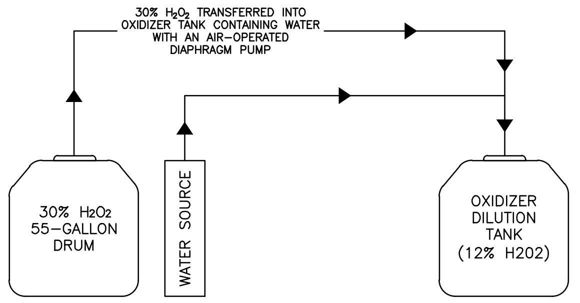
⋈ 3/4" BALL VALVE WITH CAM LOCK COUPLINGS

Ⓟ PRESSURE GAUGE

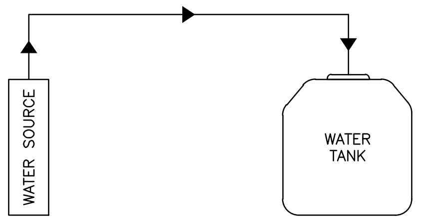
## INJECTION PUMP INSTALLATION



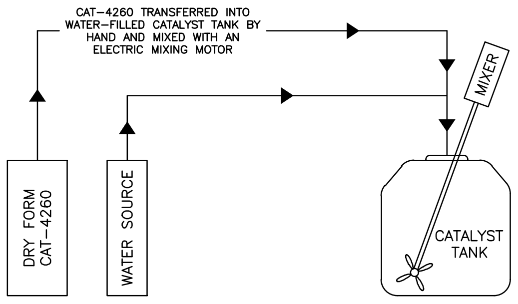
## OXIDIZER TANK POCEDURES



## WATER TANK PROCEDURES



## CATALYST TANK PROCEDURES



**PES Environmental, Inc.**
Engineering & Environmental Services

**Injection Details**
Former American Linen Supply
700 Dexter Avenue North
Seattle, Washington

PLATE
11

| 1413.001.02.004 | 141300102004_SAP_11 | WRH | 1/18 |
|---|---|---|---|
| JOB NUMBER | DRAWING NUMBER | REVIEWED BY | DATE |

# APPENDIX A

# FIELD FORMS

**PES Environmental, Inc.**
Engineering & Environmental Services

PAGE OF
DATE:

PROJECT:
JOB No:
PROJECT MANAGER:
RECORDED BY:

# DAILY FIELD REPORT

| TIME | DESCRIPTION, COMMENTS, NOTES, ETC. |
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ATTACHMENTS: ☐ NO ☐ YES

DESCRIPTION:

SIGNATURE

# PES ENVIRONMENTAL
# DAILY SAFETY MEETING CHECKLIST

Project Name: ______________________________ Date: ________________________________________

Project Number: ____________________________ Presented by: __________________________________

Check the Topics/Information Reviewed:

☐ Safety glasses, hard hat, safety boots
☐ Site safety plan review and location
☐ Equipment and machinery familiarization
☐ Employee right-to-know/MSDS location
☐ Open pits, excavations, and site hazards
☐ Vehicle safety and driving/road conditions
☐ Portable tool safety and awareness
☐ Overhead utility locations and clearance
☐ First aid, safety, and PPE location
☐ Sharp object, rebar, and scrap metal hazards
☐ Safety is everyone's responsibility
☐ Latex gloves inner/nitrile gloves outer
☐ Excavation/trenching inspections/documentation
☐ Full-face respirators with proper cartridges
☐ Upgrade to level ___ at: PID(___eV)>___ppm
☐ Work stoppage at: PID(___eV) >___ppm, %LEL>10%
☐ Slips, trips, and falls
☐ Directions to hospital
☐ Anticipated visitors
☐ Electrical ground fault
☐ Public safety and fences
☐ Excavator swing and loading
☐ Orderly site and housekeeping
☐ Smoking in designated areas
☐ Leather gloves for protection
☐ Effects of the night before
☐ Vibration related injuries
☐ Fire extinguisher locations
☐ Eye wash station locations
☐ Decontamination procedures
☐ Daily work scope
☐ Emergency protocol
☐ Parking and laydown
☐ Hot work permits
☐ Strains and sprains
☐ Noise hazards
☐ No horseplay
☐ Heat and cold stress
☐ Backing up hazards
☐ Accidents are costly
☐ Dust and vapor control
☐ Refueling procedures
☐ Confined space entry
☐ Flying debris hazards

Discussion/Comments/Follow-up Actions: ________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

| **NAME** | **SIGNATURE** | **COMPANY** |
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Instructions:

- Conduct a daily safety meeting prior to beginning each day's site activities.
- Complete form, obtain signatures, and file with the Daily Summary.
- Follow up on any noted items and document resolution of any action items.

PES Environmental, Inc.

# FIELD LITHOLOGIC LOG

Date: Page: of

**BORING NO:**

Job Number:

Project:

Project Manager:

Logged by:

LOCATION SKETCH SCALE 1' =

Contractor:

Drilling Equipment:

Borehole Diameter:

Total Depth of Boring: / Backfill Method:

Sampling Method:

Surface Conditions:

Comments:

| SAMPLE ID (Date/Time) | PID (PPM) | SOIL DRIVE INTERVAL | BLOWS /6INCHES | SAMPLE RECOVERED (Inches) | GW DEPTH | DEPTH (FEET) | GRAPHIC LOG | **LITHOLOGIC DESCRIPTION** COLOR, SOIL TYPE (SYMBOL) Munsell Number, Moisture, Consistency, Grain Size, Estimated Percentages ( % gravel, % sand, % fines), Other (Angularity, Shape, Odor, Structure. Strength, Dilatancy, Toughness, Plasticity, etc. ) |
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PES Environmental, Inc.

# FIELD LITHOLOGIC LOG (CONT.)

Page: of

Date:

Job Number:

**BORING NO:**

Project:

Logged by:

| SAMPLE ID (Date/Time) | PID (PPM) | SOIL DRIVE INTERVAL | BLOWS /6INCHES | SAMPLE RECOVERED (Inches) | GW DEPTH | DEPTH (FEET) | GRAPHIC LOG | **LITHOLOGIC DESCRIPTION**<br>COLOR, SOIL TYPE (SYMBOL) Munsell Number, Moisture, Consistency, Grain Size, Estimated Percentages ( % gravel, % sand, % fines), Other (Angularity, Shape, Odor, Structure. Strength, Dilatancy, Toughness, Plasticity, etc. ) |
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LOGGED BY: ________________________________

EDITED BY: ________________________________

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**PES Environmental, Inc.**

Engineering & Environmental Services

# WELL DEVELOPMENT FORM

Page: of
Date/Time:
Project Name:
Job No:
Recorded By:
Sampled By:

Well Type: ____________________

**Well ID:**

Well Material: ☐ PVC ☐ Stainless Steel ☐ Other

## WELL PURGING

PURGE VOLUME

Casing Diameter (D in inches)

☐ 2-inch ☐ 4-inch ☐ 6-inch ☐ Other __________

Total Depth of Casing (ft. below TOC) (Pre-DV): ___________

Total Depth of Casing (ft. below TOC) (Post-DV): ___________

Water-Level Depth (feet below TOC): __________

PURGING METHOD

☐ Bailer - type: ________________________

☐ Submersible ☐ Centrifugal ☐ Bladder

☐ Other - Type: _________________________

PUMP INTAKE SETTING

☐ Near Bottom ☐ Near Top ☐ Other: __________

Depth in feet (BTOC): ________________

Screen interval feet (BTOC) from ______ to ______

*Est.Target Development Volume: 3x Borehole [sat.screen only] + water added during drilling*

FIELD PARAMETERS MEASUREMENT

| Time | Total Gallons Removed | Flow Rate (GPM) | Depth to Water (fbgs) | Pump Intake (fbgs) | Turbidity | | Observations (color, well condition, odor, cloudiness, etc. ) |
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----------- > STOP TIME: ___________ ----------- > TOTAL GALLONS REMOVED __________

PES Environmental, Inc.
Engineering & Environmental Services

PROJECT:
JOB No:
FIELD PERSONNEL:

# WATER LEVEL DATA FORM

MEASURING INSTRUMENT: ☐ ELECTRONIC SOUNDER ☐ OTHER-TYPE INSTRUMENT
RECORDED BY:
TIME ON-SITE: TIME OFF-SITE:
MEASURING POINT: TOP of PVC
WEATHER : Temperature: Precipitation:

| Well I.D. | Total Well Depth (feet) | Time | Depth to Water (feet) | Time | Depth to Water (feet) | Time | Depth to Water (feet) | Comments |
|---|---|---|---|---|---|---|---|---|
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# PES GROUNDWATER SAMPLING FORM

| | |
|---|---|
| **Facility:** | **Well I.D.:** |
| **Project No.:** | **Date:** |

## Site Description
☐ Monitoring Well ☐ Extraction Well ☐ Borehole ☐ Spring/Creek ☐ Pond/Lagoon ☐ Outfall ☐ Other:

Air Temp: ☐ °C ☐ °F Weather:

Well Locked? ☐ yes ☐ no Damaged/Repairs Needed:

☐ TOC ☐ MP Description of MP (e.g., well monument at grade surface):

TOC/MP Stickup: ☐ ft ☐ m above/below ground Well Inside Diameter (ID): ☐ 2-inch ☐ 4-inch Other:

## Water Level Data
Measurement Units: ☐ ft ☐ m

| ☐ E-Tape, # ____________<br>☐ Steel Tape ☐ Other | Pre-Purge[1] Initial | Pre-Purge[2] Confirmation | Purging Start | During Purging | Purging End | After Sampling | Remarks |
|---|---|---|---|---|---|---|---|
| Time (hh:mm; 24-hr clock) | __ __:__ __ | | | | | | |
| Depth to Water | | | | | | | |
| Depth to Bottom | | | | | | | |
| Water Level (WL) | | | | | | | |
| Product Thickness | | | | | | | |
| Product Recovery<br>☐ gallons ☐ liters | | | | | | | |

[1] First round of water levels; [2] Water level prior to purging

## Field Water Quality Data
Purge Depth: ☐ Top ☐ Mid ☐ Bottom ☐ Grab ☐ Bailer ☐ Pump Description:

Casing Volume: [_____(TD) - _____(WL)]•[____(Well ID)]$^2$•[_____(Conversion Factor)] = ______ ☐ gal ☐ liters
Conversion Factor = 0.0408 for feet and gallons; 0.1544 for feet and liters; 0.5066 for meters and liters; Well ID in inches

Dry While Purging ☐

| Cumulative Vol. Purged (Liters) | Depth to Water | Time (hh:mm) | pH (Temp. Corrected? ☐) | Conductivity ☐ SC ☐ EC (µS/cm) | Temp ☐°C ☐°F | D. O (mg/L) | ORP (mV) | Turbidity ☐ NTU |
|---|---|---|---|---|---|---|---|---|
| | | __ __:__ __ | __ __.__ __ | __ __ __ __ | __ __. __ | __ __. __ | __ __. __ | __ __. __ |
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| Pump Rate (ml/min) | Color/Tint/Odor |
| Meter Used | |

## Sample Data
Sample Depth: ☐ Grab ☐ Bailer ☐ Pump Description:

| Field Sample ID (unique ID on bottles) | Result Code | Date (m/d/y) | Time (hh:mm) | # of Bottles (total to lab) | Metals Filtered | Bottles (type) | Preservative | Notes |
|---|---|---|---|---|---|---|---|---|
| | P0 | | | | Y N | | Y N | |
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|---|---|
| Sampler's Name (print) | Signature |

# Field Drum Inventory Form

PES PROJECT NUMBER:

JOB NAME:

ADDRESS:

PES FIELD REPRESENTATIVE:

| Drum ID# | Generation Date | Waste Material (decon wtr, dv wtr, etc.) | Well ID(s) | Volume (gal) | Waste Description (decon water, development water, etc.) |
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PES Environmental, Inc.
Engineering & Environmental Services

# SAMPLING ALTERATION CHECKLIST

Sample program identification: ______________________

Material to be sampled: ______________ Sample Date: ______________

Measurement variable: ______________________

Standard procedure for analysis: ______________________

______________________

Reference: ______________________

______________________

______________________

Variation from standard procedure: ______________________

______________________

______________________

______________________

______________________

Reason for variation: ______________________

______________________

______________________

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Resultant change in field sampling procedure: ______________________

______________________

______________________

______________________

Special equipment, material, or personnel required: ______________________

______________________

______________________

Authorizing name: ______________ Date: ______________

Approval: ______________

Title: ______________

# APPENDIX M

# QUALITY ASSURANCE PROJECT PLAN

**PES Environmental, Inc.**
**Engineering & Environmental Services**

A Report Prepared for:
BMR-Dexter LLC
17190 Bernardo Center Drive
San Diego, CA 92128

# QUALITY ASSURANCE PROJECT PLAN
# FORMER AMERICAN LINEN SUPPLY
# 700 DEXTER AVENUE NORTH
# SEATTLE, WASHINGTON

**JANUARY 8, 2018**

By:

Karsten W. Springstead
Project Geologist

William R. Haldeman

William R. Haldeman, LHG
Associate Hydrogeologist

**1413.001.02**

1215 Fourth Avenue • Suite 1350 • Seattle, Washington 98161 • Tel (206) 529-3980 • Fax (206) 529-3985

# TABLE OF CONTENTS

TABLES

ILLUSTRATIONS

APPENDICES

# LIST OF TABLES

# LIST OF ILLUSTRATIONS

## 1.0 INTRODUCTION

PES Environmental, Inc. (“PES”) has prepared this Quality Assurance Project Plan (“QAPP”) to support interim action activities to be conducted at and around the Former American Linen Supply (“American Linen”) property (“Property”) located at 700 Dexter Avenue North, Seattle, Washington (Figure 1). This QAPP is part of an Interim Action Work Plan (referred to as the Work Plan or plan) that has been prepared on behalf of BMR-Dexter LLC (“BMRD”) for the Property. The Work Plan includes a Sampling and Analysis Plan (“SAP”) to identify specific data collection procedures and this QAPP to specify laboratory procedures and quality control documentation.

### 1.1 Purpose

This QAPP documents the planning, implementation, and assessment procedures for quality assurance and quality control (“QA/QC”) activities to be used during the interim action field work. The purpose of this QAPP is to ensure that data of sufficiently high quality are generated to support the project data quality objectives (“DQOs”) identified in the Work Plan. This QAPP describes both quantitative and qualitative measures of data quality to ensure that the DQOs are achieved. The QAPP will address project management responsibilities, sampling and analytical procedures, assessment and oversight, and data reduction, validation, and reporting. Should the Work Plan be modified in the future, this QAPP will be modified and amended as necessary to address the Work Plan modifications.

This QAPP was prepared consistent with Ecology’s QAPP guidance (Lombard and Kirchmer, 2004) and the United States Environmental Protection Agency’s (“EPA’s”) guidance for QAPP preparation (EPA, 2002). Analytical QA/QC procedures were also developed based on the analytical protocols and quality assurance guidance of EPA’s solid waste test method procedures (EPA, 1986) and EPA’s contract laboratory program guidelines (EPA, 2017a and 2017b).

### 1.2 Project Overview

As discussed in the Work Plan, the interim action will consist of source treatment at the Property using *in-situ* chemical oxidation (“ISCO”) and enhanced reductive dechlorination (“ERD”). ISCO will be used for aggressive, short-term treatment, and ERD will be used for long-term, post development treatment. Modified Fenton’s Reagent (“MFR”) will be used as the oxidant, and emulsified vegetable oil (“EVO”) will be used as the ERD amendment. Both MFR and EVO will be injected in wells installed in the areas to be treated. The interim action will include the following tasks:

- Injection Well Installation and Development;
- Performance Monitoring Well Installation and Development;
- On-Property Well Decommissioning;
- Installation and Development of the Perimeter Injection Well Network;
- ISCO Injection;
- EVO Injection; and

- Interim Action Performance Groundwater Monitoring.

## 1.3 Project/Task Description and Schedule

The primary interim action objectives for the Property are to (1) reduce the mass of contamination (chlorinated volatile organic compounds ("CVOCs") and petroleum hydrocarbons) remaining in saturated soil and groundwater in the on-Property area, to the extent practicable, (2) provide for continued treatment of residual on-Property contamination, as necessary, after the Property development activities are completed and consistent with the final overall Site feasibility study ("FS"), and (3) control migration of contaminants from the Property, to the extent practicable, to provide long-term protection of downgradient off-Property human and environmental receptors. The interim action approach will be to (1) aggressively treat contaminated soil and groundwater with MFR below the planned development excavation depth, (2) just prior to Property redevelopment, treat the same zone with long-lasting EVO, (3) install perimeter injection wells for use after Property redevelopment, and (4) conduct performance monitoring during and after the injection events.

## 1.4 Document Organization

Ecology's guidance for developing QAPPs (Lombard and Kirchmer, 2004) specifies four groups of information that must be included in QAPP: Project Management, Data Generation and Acquisition, Assessment and Oversight, and Data Validation and Usability. Each group is comprised of several QAPP elements. Consistent with this general guidance, this QAPP is organized into the following sections:

- **Section 1 – Introduction.** This section contains an overview of the QAPP.
- **Section 2 – Project Management.** This section discusses the project organization, training requirements, documentation, and records.
- **Section 3 – Data Quality Objectives.** This section discusses the data quality objectives, including precision, accuracy, bias, representativeness, comparability, completeness, and sensitivity.
- **Section 4 – Overview of Data Generation and Acquisition.** This section details the analytical methods, QA/QC, laboratory instruments, and data management.
- **Section 5 – Assessment and Responsive Actions.** This section discusses the compliance assessments, response and corrective actions, and reports to management.
- **Section 6 – Data Validation and Usability.** This section details data review, validation, and verification.
- **Section 7 – References.** The references cited in the document are listed in this section.

## 2.0 PROJECT MANAGEMENT

This section identifies key project personnel, describes the rationale for conducting the sampling and analysis, identifies the studies to be performed and their respective schedules, outlines project DQOs and criteria, lists training and certification requirements for sampling personnel, and describes documentation and record keeping procedures.

### 2.1 Project/Task Organization

Responsibilities of the team members, as well as laboratory project managers, are described in the following paragraphs. Since the individuals listed below may change over time, this QAPP has been written to include "designee" as an alternate to the current project organization. The following paragraphs define their functional responsibilities.

The Project Manager for BMRD is John Moshy. He is responsible for implementing the project and has the authority to commit the resources necessary to meet project objectives and requirements. His primary function is to ensure that technical, financial, and scheduling objectives are achieved successfully. Mr. Moshy will review the work performed and he will approve all reports prior to submittal to Ecology. Mr. Moshy can be reached at (858) 485-9840.

The Ecology Project Manager is Tamara Cardona. She responsible for reviewing and approving the work performed and ensuring successful completion of the interim action.

The PES Project Manager, Dan Balbiani, will report to John Moshy. The PES Project Manager will act as the direct line of communication between PES and BMRD, and is responsible for implementing activities described in this QAPP. He will also be responsible for production of work plans, producing all project deliverables, and performing the administrative tasks needed to ensure timely and successful completion of these studies. The PES Project Manager will provide the overall programmatic guidance to support staff and will ensure that all documents, procedures, and project activities meet the objectives contained within this QAPP. The PES Project Manager will also be responsible for resolving project concerns or conflicts related to technical matters. The PES Project Manager, who can be reached at (206) 529-3980, will notify BMRD and Ecology of any long-term changes in core personnel.

Bill Haldeman (PES) and Karsten Springstead (PES) will serve as the Field Coordinator (FCs). The FCs are responsible for day-to-day technical and QA/QC oversight. They will ensure that appropriate protocols for sample collection, preservation, and holding times are observed and will submit environmental samples to the designated laboratories for chemical and physical analyses.

Jessie Compeau (PES) will serve as the QA/QC Manager. She will provide QA oversight for both the field sampling and laboratory programs, ensuring that samples are collected and documented appropriately, coordinating with the analytical laboratory, ensuring data quality, and conducting data validation to ensure all data verification and data validation criteria are met.

Karsten Springstead (PES) and Russ Stolsen (PES) will serve as the Data Managers. They will compile field observations and analytical data into summary tables, review the data for completeness and consistency, and append the database with qualifiers assigned by the data validator. Other PES personnel may be used as necessary to implement the Work Plan.

The Laboratory Managers of ESC Lab Sciences will oversee all laboratory operations associated with the receipt of the environmental samples, chemical/physical analyses, and laboratory report preparation for this project. The Laboratory Managers will review all laboratory reports and prepare case narratives describing any anomalies and exceptions that occurred during analysis.

## 2.2 Special Training Requirements/Certifications

For sample preparation tasks, it is important that field crews are trained in standardized data collection requirements, so that the data collected are consistent among the field crew. All field crew are fully trained in the collection, processing, and handling of groundwater and subsurface soil samples; decontamination protocols; visual inspections; and chain-of-custody ("COC") procedures.

In addition, the 29 CFR 1910.120 Occupational Safety and Health Administration ("OSHA") regulations require training to provide employees with the knowledge and skills enabling them to perform their jobs safely and with minimum risk to their personal health. All sampling personnel will have completed the 40-hour Hazardous Waste Operations training course and 8-hour refresher courses, as necessary, to meet the OSHA regulations.

## 2.3 Documentation and Records

This project will require central project files to be maintained at PES. Project records will be stored and maintained in a secure manner. Each project team member is responsible for filing all necessary project information or providing it to the person responsible for the filing system. Individual team members may maintain files for individual tasks, but must provide such files to the central project files upon completion of each task. A project-specific index of file contents is to be kept with the project files. Hard copy documents will be kept on file at PES throughout the duration of the project, and all electronic data will be maintained in the applicable program files (e.g., Microsoft Excel™ spreadsheet or database). A summary of the documentation and field records is provided below.

### 2.3.1 Field Records

All documents generated during the field effort are controlled documents that become part of the project file. Field team members will keep a daily record of significant events, observations, and measurements on field forms. Field forms will be the main source of field documentation for all field activities. Copies of the field forms to be used are included in the SAP. The on-site field representative will record on the field forms information pertinent to the investigation program. The sampling documentation will contain information on each sample collected, and will include at a minimum the following information:

- Project name;
- Field personnel on site;

- Facility visitors;
- Weather conditions;
- Field observations;
- Notes on maps and/or drawings;
- Date and time sample collected;
- Sampling method and description of activities;
- Identification or serial numbers of instruments or equipment used;
- Deviations from the Work Plan, SAP, and QAPP; and
- Conferences associated with field sampling activities.

In general, sufficient information will be recorded during sampling so that reconstruction of the event can occur without relying on the memory of the field personnel. To assist field sampling activities, sample collection checklists may be prepared prior to a sampling event. The checklist will include location designations, types of samples to be collected, QC samples to be collected, and any specific instructions about the field event.

### 2.3.2 Analytical and Chemistry Records

The laboratory performing sample analyses will be required to submit summary data and QA information to permit independent determination of data quality. The determination of data quality will be performed using the EPA Contract Laboratory Program National Functional Guidelines for inorganic and organic data review as guidelines for data review (EPA, 2017a and 2017b).

An EPA Level II or equivalent data report will be obtained from the analytical laboratory. Laboratory deliverable requirements for lab analyses are outlined below:

- Narrative cover letters for each sample batch will include a summary of any QC, sample, shipment, or analytical problems, and will document all internal decisions. Problems will be outlined and final solutions documented. A copy of the signed COC form for each batch of samples will be included in the results packet;
- Sample concentrations will be reported on standard data sheets in proper units and to the appropriate number of significant figures. For undetected values, the lower limit of detection for each compound will be reported separately for each sample. Dates of sample extraction or preparation and analysis must be included;
- A method blank summary;
- Surrogate percent recovery will be calculated and reported for gas chromatograph (“GC”) and gas chromatography/mass spectrometry (“GS/MS”) analyses;
- Laboratory control sample (“LCS”) results;
- Matrix spike/matrix spike duplicate (“MS/MSD”) percent recoveries (“%R”), spike level, and relative percent difference (“RPD”) will be included;

- Laboratory duplicate results; and
- Laboratory reports will be e-mailed to the PES task managers. Copies of the full data set and electronic data deliverables formatted per PES requirements (e.g. Ecology's Environmental Information Management ["EIM"] database format) will also be transmitted to the PES task managers.

All instrument data shall be fully restorable at the laboratory from electronic backup. The analytical laboratory will be required to maintain all records relevant to project analyses for a minimum of 10 years. Data validation reports will be maintained in the PES project files with the analytical data reports.

### 2.3.3 Data Reduction

Data reduction is the process by which original data (analytical measurements) are converted or reduced to a specified format or unit to facilitate analysis of the data. Data reduction requires that all aspects of sample preparation that could affect the test result, such as sample volume analyzed or dilutions required, be considered in the final result. It is the laboratory analyst's responsibility to reduce the data, which are subjected to further review by the Laboratory Manager, the Project Manager, the QA/QC Manager, and independent reviewers. Data reduction may be performed manually or electronically. If performed electronically, all software used must be demonstrated to be true and free from unacceptable error.

### 2.3.4 Data Report

The analytical results and evaluation of the results will be prepared and submitted to Ecology as described in the work plan.

## 3.0 DATA QUALITY OBJECTIVES

The DQOs for this project will be used to develop and implement procedures to ensure that data collected during the field activities is of sufficient quality to adequately address the objectives defined in the Work Plan. The quality of the laboratory data is assessed by precision, accuracy, representativeness, comparability, and completeness (the "PARCC" parameters). Definitions of the PARCC parameters and the applicable QC procedures are given below. Applicable quantitative goals for these data quality parameters are included in Appendix A.

### 3.1 Precision

Precision is the ability of an analytical method or instrument to reproduce its own measurement. It is a measure of the variability, or random error, in sampling, sample handling, and in laboratory analysis. The American Society of Testing and Materials (ASTM, 2002) recognizes two levels of precision: repeatability (the random error associated with measurements made by a single test operator on identical aliquots of test material in a given laboratory, with the same apparatus, under constant operating conditions) and reproducibility (the random error associated with measurements made by different test operators, in different laboratories, using the same method but different equipment to analyze identical samples of test material).

In the laboratory, "within-batch" precision is measured using replicate samples or QC analyses and is expressed as the RPD between the measurements. The "batch-to-batch" precision is determined from the variance observed in the analysis of standard solutions or laboratory control samples from multiple analytical batches.

Field precision will be evaluated by the collection of blind field duplicates for chemistry samples at a frequency of one in 20 samples. Field chemistry duplicate precision will be screened against a RPD of 50 percent for soil samples and 35 percent for water samples. However, no data will be qualified based solely on duplicate precision.

Precision measurements can be affected by the nearness of a chemical concentration to the MDL, where the percent error (expressed as RPD) increases. The equation used to express precision is as follows:

$$\text{RPD} = \frac{(C_1 - C_2) \times 100\%}{(C_1 + C_2)/2}$$

Where:

RPD = relative percent difference

C1 = larger of the two observed values

C2 = smaller of the two observed values

## 3.2 Accuracy

Accuracy is a measure of the closeness of an individual measurement (or an average of multiple measurements) to the true or expected value. Accuracy is determined by calculating the mean value of results from ongoing analyses of laboratory-fortified blanks, standard reference materials, and standard solutions. In addition, laboratory-fortified (i.e., matrix-spiked) samples are also measured; this indicates the accuracy or bias in the actual sample matrix. Accuracy is expressed as %R of the measured value, relative to the true or expected value. If a measurement process produces results for which the mean is not the true or expected value, the process is said to be biased. Bias is the systematic error either inherent in a method of analysis (e.g., extraction efficiencies) or caused by an artifact of the measurement system (e.g., contamination). Analytical laboratories utilize several QC measures to eliminate analytical bias, including systematic analysis of method blanks, laboratory control samples, and independent calibration verification standards. Because bias can be positive or negative, and because several types of bias can occur simultaneously, only the net, or total, bias can be evaluated in a measurement.

Laboratory accuracy will be evaluated against quantitative MS and surrogate spike recovery performance criteria provided by the laboratory. Accuracy can be expressed as a percentage of the true or reference value, or as a %R in those analyses where reference materials are not available and spiked samples are analyzed. The equation used to express accuracy is as follows:

$$\%R = 100\% \times (S-U)/Csa$$

Where:

%R = percent recovery

S = measured concentration in the spiked aliquot

U = measured concentration in the unspiked aliquot

Csa = actual concentration of spike added

Field accuracy will be controlled by adherence to sample collection procedures outlined in the Work Plan.

## 3.3 Bias

Bias is the systematic or persistent distortion of a measurement process that causes errors in one direction. Bias assessments for environmental measurements are made using personnel, equipment, and spiking materials or reference materials as independent as possible from those used in the calibration of the measurement system. When possible, bias assessments should be based on analysis of spiked samples rather than reference materials so that the effect of the matrix on recovery is incorporated into the assessment. A documented spiking protocol and consistency in following that protocol are important to obtaining meaningful data quality estimates.

## 3.4 Representativeness

Representativeness expresses the degree to which data accurately and precisely represents an environmental condition. The list of analytes has been identified to provide a comprehensive assessment of the potential chemicals of concern ("COCs") stemming from historical and/or current activities at the Property.

## 3.5 Comparability

Comparability expresses the confidence that one data set can be evaluated in relation to another data set. For this program, comparability of data will be established through the use of standard analytical methodologies and reporting formats, and of common traceable calibration and reference materials.

## 3.6 Completeness

Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected. Completeness will be calculated as follows:

$$C = \frac{(\text{Number of acceptable data points}) \times 100}{(\text{Total number of data points})}$$

The DQO for completeness for all data components of this project is 90 percent. Data that have been qualified as estimated because the QC criteria were not met will be considered valid for the purpose of assessing completeness. Data that have been qualified as rejected will not be considered valid for the purpose of assessing completeness.

## 3.7 Sensitivity

The method detection level ("MDL") is defined as the minimum concentration at which a given target analyte can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. Laboratory practical quantitation limits ("PQLs") or reported detection limits ("RDLs") are defined as the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. Laboratory MDLs and RDLs will be used to evaluate the method sensitivity and/or applicability prior to the acceptance of a method for this program.

The sample-specific MDL and RDL will be reported by the laboratory and will take into account any factors relating to the sample analysis that might decrease or increase the reporting limit (e.g., dilution factor, percent moisture, sample volume, and sparge volume). In the event that the MDL and RDL are elevated for a sample due to matrix interferences and subsequent dilution or reduction in the sample aliquot, the data will be evaluated by PES and the laboratory to determine if an alternative course of action is required or possible. If this situation cannot be resolved readily (i.e., detection limits less than criteria are achieved), Ecology may be contacted to discuss an acceptable resolution.

## 4.0 OVERVIEW OF DATA GENERATION AND ACQUISTION

The rationale for the sampling design and the design assumptions for locating and selecting environmental samples are detailed in the Work Plan. The methods and procedures for collection of field samples are detailed in the SAP (Appendix L of the work plan). All sampling will be conducted in accordance with the work plan and SAP. Deviations to the methods and/or procedures will be documented.

### 4.1 Analytical Methods

Chemical and physical testing will be conducted by ESC Lab Sciences of Mount Juliet, Tennessee, a laboratory accredited by Ecology and by the National Environmental Laboratories Accreditation Program ("NELAP").

The analytical methods and the target reporting limits for the proposed soil and groundwater samples and field QA/QC samples (i.e., field replicates, equipment rinsate blanks, and trips blanks) are summarized in Tables 1 and 2 for soil and groundwater, respectively. Project samples will be analyzed for volatile organic compounds ("VOCs"), with select samples also analyzed for gasoline-range organics ("GRO"), general chemistry parameters, metals, physical parameters, and remediation parameters.

Soil samples collected during drilling will be analyzed as outlined in Tables 1 and 3 using the following methods:

- VOCs by EPA Method 8260;
- GRO by Ecology Method NWTPH-Gx;
- Grain-size analysis with sieve and hydrometer (or laser) by American Society for Testing and Materials ("ASTM") Methods D421/D422/D4464;
- Dry bulk density by ASTM Method D2937;
- Total organic carbon ("TOC") and fraction organic carbon ("foc") by the Walkley-Black method; and
- Vertical hydraulic conductivity analysis using a flexible water parameter by ASTM Method D5084.

Residual soil samples will be analyzed as outlined in Table 3 using the following methods:

- VOCs by EPA Method 8260C; and
- GRO by Ecology Method NWTPH-Gx.

The groundwater samples collected at each location will be analyzed as detailed in Tables 2 and 3 using the following methods:

- VOCs by EPA Method 8260C;
- GRO by Ecology Method NWTPH-Gx;

- Alkalinity by Standard Methods 2320B-2011;
- Chloride, Nitrate, Sulfate by EPA Method 9056A;
- TOC by EPA Method 9060A;
- Total Iron and Manganese by EPA Method 6020A;
- Ferrous Iron (in the field) by Hach Kit IR-18C; and
- Methane, Ethane, Ethene by EPA Method RSK175.

In completing chemical analyses for this project, the laboratory is expected to meet the following minimum requirements:

- Adhere to the methods outlined in this QAPP, including methods referenced for each analytical procedure;
- Provide a detailed discussion to any modifications made to approved analytical methods (e.g., Standard Operating Procedures [“SOPs”]);
- Deliver electronic data as specified;
- Meet reporting requirements for deliverables;
- Meet turnaround times for deliverables;
- Implement QA/QC procedures, including the QAPP data quality requirements, laboratory QA requirements, and performance evaluation testing requirements; and
- Allow laboratory and data audits to be performed, if deemed necessary;

## 4.2 Quality Assurance and Quality Control

Field and laboratory activities must be conducted in such a manner that the results meet specified quality objectives and are fully defensible. Guidance for QA/QC is derived from the protocols developed for the EPA (EPA, 1986), the EPA Contract Laboratory Program (EPA, 2017a and 2017b), and the cited methods.

### 4.2.1 Field Quality Control

PES personnel will identify and label samples in a consistent manner to ensure that field samples are traceable and that labels provide all information necessary for the laboratory to conduct required analyses properly. Samples will be placed in appropriate containers defined in the SAP and properly preserved for shipment to the laboratory.

#### 4.2.1.1 Sample Containers

Sample containers with the appropriate preservatives will be provided by the laboratory. The laboratory will maintain documentation certifying the cleanliness of bottles and the purity of preservatives provided. Specific container requirements are summarized in Table 3.

### 4.2.1.2 Sample Identification and Labels

Each sample will have an adhesive plastic or waterproof paper label affixed to the container and will be labeled at the time of collection. The following information will be recorded on the container label at the time of collection:

- Project name;
- Sample identification;
- Date and time of sample collection;
- Preservative type (if applicable); and
- Analysis to be performed.

Samples will be uniquely identified with a sample identification that at a minimum specifies sample matrix, sample number, sample location, and type of sample. The sample nomenclature is identified in the SAP.

### 4.2.1.3 Sample Custody and Shipping Requirements

Samples are considered to be in one's custody if they are: (1) in the custodian's possession or view, (2) in a secured location (under lock) with restricted access, or (3) in a container that is secured with official COC seals such that the sample cannot be reached without breaking the seals.

COC procedures will be followed for all samples throughout the collection, handling, and analysis process. The principal document used to track possession and transfer of samples is the COC form. Each sample will be represented on a COC form the day it is collected. All data entries will be made using indelible ink.

Corrections will be made by drawing a single line through the error, writing in the correct information, then dating and initialing the change. Blank lines/spaces on the COC form will be lined-out, dated, and initialed by the individual maintaining custody.

A COC form will accompany each cooler of samples to the analytical laboratory. Each person who has custody of the samples will sign the COC form and ensure that the samples are not left unattended unless properly secured. Copies of all COC forms will be retained in the project files.

All samples will be shipped to the analytical laboratory no later than the day after collection. Samples collected on Friday may be held until the following Monday for shipment provided that this does not jeopardize any hold time requirements. Specific sample shipping procedures are defined in the SAP.

Upon transfer of sample possession to the analytical laboratory, the persons transferring custody of the sample container will sign the COC form. Upon receipt of samples at the laboratory, the shipping container seal will be broken, and the receiver will record the condition of the samples on a sample receipt form. COC forms will be used internally in the laboratory to track sample handling and final disposition.

#### 4.2.1.4 Field Quality Assurance Sampling

Field QA samples will be collected along with the environmental samples. Field QA samples are useful in identifying possible problems resulting from sample collection or sample processing in the field. The collection of field QA samples is described in detail in the SAP, and includes field duplicates, equipment rinsate blanks, transfer blanks, and transport blanks. The collection frequency is summarized in Table 4.

As necessary, field QA samples may also include the collection of additional sample volume, to ensure that the laboratory has sufficient sample volume to run the program-required analytical QA/QC samples (i.e., MS/MSD) for analysis as specified in Appendix A. Additional sample volume to meet this requirement will be collected at a frequency of one per sampling event or one in 20 samples processed, whichever is more frequent.

All field QA samples will be documented in the field notes and verified by the QA/QC Manager or designee.

### 4.2.2 Laboratory Quality Control

Laboratory QC procedures, where applicable, include initial and continuing instrument calibrations, standard reference materials, laboratory control samples, matrix replicates, MS, surrogate spikes (for organic analyses), and method blanks. Table 4 lists the frequency of analysis for laboratory QA/QC samples, and the data quality objectives for precision, accuracy, and completeness for the laboratory are included in Appendix A.

Results of the QC samples from each sample group will be reviewed by the analyst immediately after a sample group has been analyzed. The QC sample results will then be evaluated to determine if control limits have been exceeded. If control limits are exceeded in the sample group, the QA/QC Manager will be contacted immediately, and corrective action (e.g., method modifications followed by reprocessing the affected samples) will be initiated prior to processing a subsequent group of samples.

#### 4.2.2.1 Laboratory Instrument Calibration and Frequency

An initial calibration will be performed on each laboratory instrument to be used at the start of the project, after each major interruption to the analytical instrument, and when any ongoing calibration does not meet method control criteria. A calibration verification will be analyzed following each initial calibration and will meet method criteria prior to analysis of samples. Continuing calibrations will be performed daily prior to any sample analysis to track instrument performance. The frequency of continuing calibration will be one continuing calibration for every 10 samples analyzed, or daily, dependent upon the method. If the ongoing continuing calibration is out of control, the analysis must come to a halt until the source of the control failure is eliminated or reduced to meet control specifications. All project samples analyzed while instrument calibration was out of control will be reanalyzed.

Instrument blanks or continuing calibration blanks provide information on the stability of the baseline established. Continuing calibration blanks will be analyzed immediately prior to or after continuing calibration verification at the instrument for each type of applicable analysis.

#### 4.2.2.2 Laboratory Duplicates/Replicates

Analytical duplicates provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Analytical duplicates and replicates are subsamples of the original sample that are prepared and analyzed as a separate sample and provide information on the precision of the method for inorganic analyses.

#### 4.2.2.3 Matrix Spike/Matrix Spike Duplicate

Analysis of MS samples provides information on the extraction efficiency of the method on the sample matrix. By performing MSD analyses, information on the precision of the method is also provided for organic analyses.

#### 4.2.2.4 Method Blanks

Method blanks are analyzed to assess possible laboratory contamination at all stages of sample preparation and analysis. The method blank for all analyses must contain less than five times the method detection limit of any single target analyte/compound. If a laboratory method blank exceeds this criterion for any analyte/compound and the concentration of the analyte/compound in any of the samples is less than five times the concentration found in the blank, analyses must stop, and the source of contamination must be eliminated or reduced.

#### 4.2.2.5 Laboratory Control Samples

Laboratory control samples are analyzed to assess possible laboratory bias at all stages of sample preparation and analysis. The laboratory control sample is a matrix-dependent spiked sample prepared at the time of sample extraction along with the preparation of sample and MS. The laboratory control sample will provide information on the precision of the analytical process and, when analyzed in duplicate, will provide accuracy information as well.

#### 4.2.2.6 Laboratory Deliverables

Data packages will be checked for completeness immediately upon receipt from the laboratory to ensure that data and QA/QC information requested are present. Data quality will be assessed based on EPA's National Functional Guidelines for Inorganic (EPA, 2017a) or Organic (EPA, 2017b) Data Review, as appropriate, by considering the following:

- Holding times;
- All compounds of interest reported;
- Reporting limits;
- Surrogate spike results;
- MS/MSD results;

- Blank spikes;
- Laboratory control samples/laboratory control sample duplicates;
- Standard reference material results;
- Method blanks; and
- Detection limits.

## 4.3 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

This section describes procedures for testing, inspection, and maintenance of field and laboratory equipment.

### 4.3.1 Field Instruments/Equipment

In accordance with the QA program, PES shall maintain an inventory of field instruments and equipment. The frequency and types of maintenance will be based on the manufacturer's recommendations and/or previous experience with the equipment.

The PES FC will be responsible for the preparation, documentation, and implementation of the preventative maintenance program. The equipment maintenance information will be documented in the instrument's calibration log. The frequency of maintenance is dependent on the type and stability of the equipment, the methods used, the intended use of the equipment, and the recommendations of the manufacturer.

Detailed information regarding the calibration and frequency of equipment calibration is provided in specific manufacturer's instruction manuals.

All maintenance records will be verified prior to each sampling event. The FC will be responsible for verifying that required maintenance has been performed as necessary prior to using the equipment in the field.

### 4.3.2 Laboratory Instruments/Equipment

In accordance with the QA program, the laboratory shall maintain an inventory of instruments and equipment and the frequency of maintenance will be based on the manufacturer's recommendations and/or previous experience with the equipment.

The laboratory preventative maintenance program, as detailed in their QA Plan, is organized to maintain proper instrument and equipment performance, and to prevent instrument and equipment failure during use. The program considers instrumentation, equipment, and parts that are subject to wear, deterioration, or other changes in operational characteristics; the availability of spare parts; and the frequency at which maintenance is required. Any equipment that has been overloaded, mishandled, gives suspect results, or has been determined to be defective will be taken out of service, tagged with the discrepancy noted, and stored in a designated area until the equipment has been repaired. After repair, the equipment will be tested to ensure that it is in proper operational condition. PES will be promptly notified in writing if defective equipment casts doubt on the validity of analytical data. PES will also be notified immediately regarding any delays due to instrument malfunctions that could impact holding times.

The analytical laboratory will be responsible for the preparation, documentation, and implementation of the preventative maintenance program. All maintenance records will be checked according to the schedule on an annual basis and recorded by the responsible individual. The Laboratory QA/QC Manager, or designee, shall be responsible for verifying compliance.

## 4.4 Instrument Calibration

Proper calibration of equipment and instrumentation is an integral part of the process that provides quality data. Instrumentation and equipment used to generate data must be calibrated at a frequency that ensures sufficient and consistent accuracy and reproducibility.

### 4.4.1 Field Instrument/Equipment Calibration

Field equipment will be calibrated prior to each sampling event according to manufacturer's recommendations using manufacturer's standards. A calibration check will be performed at the end of the day. The equipment, calibration, and maintenance information will be documented in the instrument calibration log. The frequency of calibration is dependent on the type and stability of the equipment, the methods used, the intended use of the equipment, and the recommendations of the manufacturer.

Detailed information regarding the calibration and frequency of equipment calibration is provided in specific manufacturer's instruction manuals.

Equipment that fails calibration or becomes inoperable during use will be removed from service and tagged (time and date of action) to prevent inadvertent use. Such equipment will be satisfactorily recalibrated or repaired and tagged (date and time of return to service) prior to use.

### 4.4.2 Laboratory Instrument/Equipment Calibration

As part of their QC program, laboratories perform two types of calibrations. A periodic calibration is performed at prescribed intervals (i.e., balances, drying ovens, refrigerators and thermometers), and operational calibrations are performed daily, at a specified frequency, or prior to analysis (i.e., initial calibrations) according to method requirements. Calibration procedures and frequency are discussed in the laboratory QA Plan. Calibrations are discussed in the laboratory SOPs for analyses.

The Laboratory QA/QC Manager will be responsible for ensuring that the laboratory instrumentation is calibrated in accordance with specifications. Implementation of the calibration program shall be the responsibility of the respective laboratory Group Supervisors. Recognized procedures (EPA, ASTM, or manufacturer's instructions) shall be used when available.

Physical standards (i.e., weights or certified thermometers) shall be traceable to nationally recognized standards such as the National Institute of Standards and Technology ("NIST"). Chemical reference standards shall be NIST Standard Reference Materials ("SRMs") or vendor certified materials traceable to these standards.

The calibration requirements for each method and respective corrective actions shall be accessible, either in the laboratory SOPs or the laboratory's QA Plan for each instrument or analytical method in use. All calibrations shall be preserved on electronic media.

## 4.5 Inspection/Acceptance Requirements for Supplies and Consumables

Inspection and acceptance of field supplies, including laboratory-prepared sampling bottles, will be performed by the FC. All primary chemical standards and standard solutions used in this project, either in the field or laboratory, will be traceable to documented, reliable, commercial sources. Standards will be validated to determine their accuracy by comparison with an independent standard. Any impurities found in the standard will be documented.

## 4.6 Data Management

Field data sheets will be checked for completeness and accuracy by the FC prior to delivery to the Data Manager. All data generated in the field will be documented on hard copy and provided to the office Data Manager, who is responsible for the data's entry. All manually entered data will be checked by a second party. Field documentation will be filed in the main project file after data entry and checking are complete.

# 5.0 ASSESSMENTS AND RESPONSE ACTIONS

Once data are received from the laboratory, a number of QC procedures will be followed to provide an accurate evaluation of the data quality. Specific procedures will be followed to assess data precision, accuracy, and completeness.

## 5.1 Data Review, Validation, and Verification

During the validation process, analytical data will be evaluated for method and laboratory QC compliance, and their validity and applicability for program purposes will be determined. Based on the findings of the validation process, data validation qualifiers may be assigned. The validated project data, including qualifiers will be entered into the data summary tables, thus enabling this information to be retained or retrieved, as needed.

## 5.2 Validation and Verification Methods

Data validation includes signed entries by the field and laboratory technicians on field data sheets and laboratory datasheets (respectively), review for completeness and accuracy by the FC and Laboratory Manager, review by the Data Manager for outliers and omissions, and the use of QC criteria to accept or reject specific data. All data will be entered into a Microsoft Excel™ spreadsheet. Laboratory data will be provided to the Data Manager as Adobe PDF files and in the Ecology EIM electronic format. Data will be validated or reviewed manually, and qualifiers, if assigned, will be entered manually. The accuracy of all manually entered data will be verified by a second party.

All laboratory data will be reviewed and verified to determine whether all DQOs have been met, and that appropriate corrective actions have been taken, when necessary. The project QA/QC Manager or designee will be responsible for the final review of all data generated from analyses of samples.

The first level of review will take place in the laboratory as the data are generated. The laboratory department manager or designee will be responsible for ensuring that the data generated meet minimum QA/QC requirements and that the instruments were operating under acceptable conditions during generation of data. DQOs will also be assessed at this point by comparing the results of QC measurements with pre-established criteria as a measure of data acceptability.

The analysts and/or laboratory department manager will prepare a preliminary QC checklist for each parameter and for each sample delivery group (SDG) as soon as analysis of an SDG has been completed. Any deviations from the DQOs listed on the checklist will be brought to the attention of the Laboratory Manager to determine whether corrective action is needed and to determine the impact on the reporting schedule.

Data packages will be checked for completeness immediately upon receipt from the laboratory to ensure that data and QA/QC information requested are present. Data quality will be assessed by a reviewer using current Functional Guidelines data validation requirements (EPA, 2017a and 2017b) by considering the following:

1. Holding times
2. Initial calibrations
3. Continuing calibrations
4. Method blanks
5. Surrogate recoveries
6. Detection limits
7. Reporting limits
8. Laboratory control samples
9. MS/MSD samples
10. Standard reference material results

The data will be validated in accordance with the project specific DQOs described above, analytical method criteria, and the laboratory's internal performance standards based on their SOPs.

## 5.3 Compliance Assessments

Laboratory and field performance audits consist of on-site reviews of QA systems and equipment for sampling, calibration, and measurement. Laboratory audits will not be conducted as part of this study; however, all laboratory audit reports will be made available to the project QA/QC Manager upon request. The laboratory is required to have written procedures addressing internal QA/QC; these procedures have been submitted and will be reviewed by the project QA/QC Manager to ensure compliance with the QAPP. The laboratory must ensure that personnel engaged in sampling and analysis tasks have appropriate training. The laboratory will, as part of the audit process, provide for consultant's review written details of any and all method modifications planned.

## 5.4 Response and Corrective Actions

The following paragraphs identify the responsibilities of key project team members and actions to be taken in the event of an error, problem, or non-conformance to protocols identified in this document.

### 5.4.1 Field Activities

The FC will be responsible for correcting equipment malfunctions during the field sampling effort. The project QA/QC Manager will be responsible for resolving situations identified by the FC that may result in non-compliance with this QAPP. All corrective measures will be immediately documented in the field notes.

### 5.4.2 Laboratory

The laboratory is required to comply with their SOPs. The Laboratory Manager will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this QAPP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data.

The Laboratory Manager will be notified immediately if any QC sample exceeds the project-specified control limits. The analyst will identify and correct the anomaly before continuing with the sample analysis. The Laboratory Manager will document the corrective action taken in a memorandum submitted to the QA/QC Manager within 5 days of the initial notification. A narrative describing the anomaly, the steps taken to identify and correct the anomaly and the treatment of the relevant sample batch (i.e., recalculation, reanalysis, and re-extraction) will be submitted with the data package in the form of a cover letter.

## 5.5 Reports to Management

Quality assurance reports to management include verbal status reports, written reports on field sampling activities and laboratory processes, data validation reports, and final project reports. These reports shall be the responsibility of the QA/QC Manager. The project QA/QC Manager will also prepare progress reports after the sampling is completed and samples have been submitted for analysis, when information is received from the laboratory, and when analysis is complete. The status of the samples and analysis will be indicated with emphasis on any deviations from the QAPP. A data report will be written after validated data are available for each sampling event. These reports will be delivered electronically to the PES Project Manager.

## 6.0 REFERENCES

ASTM International (ASTM). 2002. Standard Practices for Use of the Term Precision and Bias in ASTM Test Methods. ASTM No. 177-90a.

Lombard, S.M., and C.J. Kirchmer. 2004. Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies. Washington State Department of Ecology Environmental Assessment Program. Publication Number 04-03-030. July.

U.S. Environmental Protection Agency (EPA). 1986. Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods, 3rd Edition. EPA SW-846.

U.S. Environmental Protection Agency (EPA). 2002. EPA Guidance for Quality Assurance Project Plans (QA/G-5). EPA/600/R-02/009. December.

U.S. Environmental Protection Agency. 2017a. National Functional Guidelines for Inorganic Superfund Methods Data Review. Office of Superfund Remediation and Technology Innovation. EPA-540-R-2017-001. January.

U.S. Environmental Protection Agency. 2017b. National Functional Guidelines for Organic Superfund Methods Data Review. Office of Superfund Remediation and Technology Innovation. EPA-540-R-2017-002. January.

# TABLES

## Table 1

## Analytical Parameters and Reporting Limits – Soil
## Former American Linen Supply
## 700 Dexter Avenue North, Seattle, Washington

| Analyte | CAS Registry Number | ESC Lab Sciences | | |
|---|---|---|---|---|
| | | Lab Method | MDL (mg/kg) | RDL[a] (mg/kg) |
| Volatile Organic Compounds (VOCs) | | | | |
| 1,1,1,2-Tetrachloroethane | 630-20-6 | 8260C | 0.000264 | 0.001 |
| 1,1,1-Trichloroethane | 71-55-6 | 8260C | 0.000286 | 0.001 |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 8260C | 0.000365 | 0.001 |
| 1,1,2-Trichloroethane | 79-00-5 | 8260C | 0.000277 | 0.001 |
| CFC-113 | 76-13-1 | 8260C | 0.000365 | 0.001 |
| 1,1-Dichloroethane | 75-34-3 | 8260C | 0.000199 | 0.001 |
| 1,1-Dichloroethene | 75-35-4 | 8260C | 0.000303 | 0.001 |
| 1,1-Dichloropropene | 563-58-6 | 8260C | 0.000317 | 0.001 |
| 1,2,3-Trichlorobenzene | 87-61-6 | 8260C | 0.000306 | 0.001 |
| 1,2,3-Trichloropropane | 96-18-4 | 8260C | 0.000741 | 0.0025 |
| Benzene, 1,2,3-Trimethyl- | 526-73-8 | 8260C | 0.000287 | 0.001 |
| 1,2,4-Trichlorobenzene | 120-82-1 | 8260C | 0.000388 | 0.001 |
| 1,2,4-Trimethylbenzene | 95-63-6 | 8260C | 0.000211 | 0.001 |
| 1,2-Dibromo-3-Chloropropane | 96-12-8 | 8260C | 0.00105 | 0.005 |
| Ethylene dibromide | 106-93-4 | 8260C | 0.000343 | 0.001 |
| 1,2-Dichlorobenzene | 95-50-1 | 8260C | 0.000305 | 0.001 |
| 1,2-Dichloroethane | 107-06-2 | 8260C | 0.000265 | 0.001 |
| 1,2-Dichloropropane | 78-87-5 | 8260C | 0.000358 | 0.001 |
| 1,3,5-Trimethylbenzene | 108-67-8 | 8260C | 0.000266 | 0.001 |
| 1,3-Dichlorobenzene | 541-73-1 | 8260C | 0.000239 | 0.001 |
| 1,3-Dichloropropane | 142-28-9 | 8260C | 0.000207 | 0.001 |
| 1,4-Dichlorobenzene | 106-46-7 | 8260C | 0.000226 | 0.001 |
| 2,2-Dichloropropane | 594-20-7 | 8260C | 0.000279 | 0.001 |
| Methyl ethyl ketone | 78-93-3 | 8260C | 0.00468 | 0.01 |
| 2-Chlorotoluene | 95-49-8 | 8260C | 0.000301 | 0.001 |
| 2-Hexanone | 591-78-6 | 8260C | NA | NA |
| 4-Chlorotoluene | 106-43-4 | 8260C | 0.00024 | 0.001 |
| Methyl isobutyl ketone | 108-10-1 | 8260C | 0.00188 | 0.01 |
| Acetone | 67-64-1 | 8260C | 0.01 | 0.05 |
| Acrylonitrile | 107-13-1 | 8260C | 0.00179 | 0.01 |
| Benzene | 71-43-2 | 8260C | 0.00027 | 0.001 |
| Bromobenzene | 108-86-1 | 8260C | 0.000284 | 0.001 |
| Bromochloromethane | 74-97-5 | 8260C | NA | NA |
| Dichlorobromomethane | 75-27-4 | 8260C | 0.000254 | 0.001 |
| Bromoform | 75-25-2 | 8260C | 0.000424 | 0.001 |
| Bromomethane | 74-83-9 | 8260C | 0.00134 | 0.005 |
| Carbon Disulfide | 75-15-0 | 8260C | NA | NA |
| Carbon Tetrachloride | 56-23-5 | 8260C | 0.000328 | 0.001 |
| Chlorobenzene | 108-90-7 | 8260C | 0.000212 | 0.001 |
| Chlorodibromomethane | 124-48-1 | 8260C | 0.000373 | 0.001 |
| Chloroethane | 75-00-3 | 8260C | 0.000946 | 0.005 |
| Chloroform | 67-66-3 | 8260C | 0.000229 | 0.005 |
| Chloromethane | 74-87-3 | 8260C | 0.000375 | 0.0025 |
| Cis-1,2-Dichloroethene | 156-59-2 | 8260C | 0.000235 | 0.001 |
| Cis-1,3-Dichloropropene | 10061-01-5 | 8260C | 0.000262 | 0.001 |
| Isopropyl ether | 108-20-3 | 8260C | 0.000248 | 0.001 |

# Table 1

## Analytical Parameters and Reporting Limits – Soil
## Former American Linen Supply
## 700 Dexter Avenue North, Seattle, Washington

| Analyte | CAS Registry Number | ESC Lab Sciences | | |
|---|---|---|---|---|
| | | Lab Method | MDL (mg/kg) | RDL[a] (mg/kg) |
| Dibromomethane | 74-95-3 | 8260C | 0.000382 | 0.001 |
| CFC-12 | 75-71-8 | 8260C | 0.000713 | 0.005 |
| Ethylbenzene | 100-41-4 | 8260C | 0.000297 | 0.001 |
| Hexachlorobutadiene | 87-68-3 | 8260C | 0.000342 | 0.001 |
| Methyl Iodide | 74-88-4 | 8260C | NA | NA |
| Cumene (isopropylbenzene) | 98-82-8 | 8260C | 0.000243 | 0.001 |
| Methyl t-butyl ether | 1634-04-4 | 8260C | 0.000212 | 0.001 |
| Methylene Chloride | 75-09-2 | 8260C | 0.001 | 0.005 |
| n-Butylbenzene | 104-51-8 | 8260C | 0.000258 | 0.001 |
| Hexane | 110-54-3 | 8260C | NA | NA |
| n-Propylbenzene | 103-65-1 | 8260C | 0.000206 | 0.001 |
| Naphthalene | 91-20-3 | 8260C | 0.001 | 0.005 |
| p-Isopropyltoluene | 99-87-6 | 8260C | 0.000204 | 0.001 |
| Sec-Butylbenzene | 135-98-8 | 8260C | 0.000201 | 0.001 |
| Styrene | 100-42-5 | 8260C | 0.000234 | 0.001 |
| Tert-Butylbenzene | 98-06-6 | 8260C | 0.000206 | 0.001 |
| Tetrachloroethene | 127-18-4 | 8260C | 0.000276 | 0.001 |
| Toluene | 108-88-3 | 8260C | 0.000434 | 0.005 |
| Trans-1,2-Dichloroethene | 156-60-5 | 8260C | 0.000264 | 0.001 |
| Trans-1,3-Dichloropropene | 10061-02-6 | 8260C | 0.000267 | 0.001 |
| Trans-1,4-Dichloro-2-butene | 110-57-6 | 8260C | NA | NA |
| Trichloroethene | 79-01-6 | 8260C | 0.000279 | 0.001 |
| CFC-11 (trichlorofluoromethane) | 75-69-4 | 8260C | 0.000382 | 0.005 |
| Vinyl Acetate | 108-05-4 | 8260C | NA | NA |
| Vinyl Chloride | 75-01-4 | 8260C | 0.000291 | 0.001 |
| Total Xylenes | 1330-20-7 | 8260C | 0.000698 | 0.003 |
| Petroleum Hydrocarbons | | | | |
| Gasoline Range Organics | NA | NWTPH-Gx | NA | NA |

Notes:

MDL = Method detection limit

RDL = Reported detection limits, which are provided for guidance and may not always be achievable

mg/kg = milligrams per kilogram

NA = not available or not applicable

[a] The RDL represents the level of the lowest calibration standard (i.e., the laboratory practical quantitation limit [PQL])

# Table 2

## Analytical Parameters and Reporting Limits – Water
## Former American Linen Supply
## 700 Dexter Avenue North, Seattle, Washington

| Analyte | CAS Registry Number | ESC Lab Sciences | | |
|---|---|---|---|---|
| | | Lab Method | MDL (µg/L) | RDL[a] (µg/L) |
| Volatile Organic Compounds (VOCs) | | | | |
| 1,1,1,2-Tetrachloroethane | 630-20-6 | 8260C | 0.120 | 0.500 |
| 1,1,1-Trichloroethane | 71-55-6 | 8260C | 0.0940 | 0.500 |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 8260C | 0.130 | 0.500 |
| 1,1,2-Trichloroethane | 79-00-5 | 8260C | 0.186 | 0.500 |
| CFC-113 | 76-13-1 | 8260C | 0.164 | 0.500 |
| 1,1-Dichloroethane | 75-34-3 | 8260C | 0.114 | 0.500 |
| 1,1-Dichloroethene | 75-35-4 | 8260C | 0.188 | 0.500 |
| 1,1-Dichloropropene | 563-58-6 | 8260C | 0.128 | 0.500 |
| 1,2,3-Trichlorobenzene | 87-61-6 | 8260C | 0.164 | 0.500 |
| 1,2,3-Trichloropropane | 96-18-4 | 8260C | 0.247 | 2.50 |
| Benzene, 1,2,3-Trimethyl- | 526-73-8 | 8260C | 0.0739 | 0.500 |
| 1,2,4-Trichlorobenzene | 120-82-1 | 8260C | 0.355 | 0.500 |
| 1,2,4-Trimethylbenzene | 95-63-6 | 8260C | 0.123 | 0.500 |
| 1,2-Dibromo-3-Chloropropane | 96-12-8 | 8260C | 0.325 | 1.00 |
| Ethylene dibromide | 106-93-4 | 8260C | 0.193 | 0.500 |
| 1,2-Dichlorobenzene | 95-50-1 | 8260C | 0.101 | 0.500 |
| 1,2-Dichloroethane | 107-06-2 | 8260C | 0.108 | 0.500 |
| 1,2-Dichloropropane | 78-87-5 | 8260C | 0.190 | 0.500 |
| 1,3,5-Trimethylbenzene | 108-67-8 | 8260C | 0.124 | 0.500 |
| 1,3-Dichlorobenzene | 541-73-1 | 8260C | 0.130 | 0.500 |
| 1,3-Dichloropropane | 142-28-9 | 8260C | 0.147 | 0.500 |
| 1,4-Dichlorobenzene | 106-46-7 | 8260C | 0.121 | 0.500 |
| 2,2-Dichloropropane | 594-20-7 | 8260C | 0.0929 | 0.500 |
| Methyl ethyl ketone | 78-93-3 | 8260C | 1.28 | 2.50 |
| 2-Chlorotoluene | 95-49-8 | 8260C | 0.111 | 0.500 |
| 2-Hexanone | 591-78-6 | 8260C | 0.757 | 2.50 |
| 4-Chlorotoluene | 106-43-4 | 8260C | 0.0972 | 0.500 |
| Methyl isobutyl ketone | 108-10-1 | 8260C | 0.823 | 2.50 |
| Acetone | 67-64-1 | 8260C | 1.05 | 25.0 |
| Acrylonitrile | 107-13-1 | 8260C | 0.873 | 2.50 |
| Benzene | 71-43-2 | 8260C | 0.0896 | 0.500 |
| Bromobenzene | 108-86-1 | 8260C | 0.133 | 0.500 |
| Bromochloromethane | 74-97-5 | 8260C | 0.145 | 0.500 |
| Dichlorobromomethane | 75-27-4 | 8260C | 0.0800 | 0.500 |
| Bromoform | 75-25-2 | 8260C | 0.186 | 0.500 |
| Bromomethane | 74-83-9 | 8260C | 0.157 | 0.500 |
| Carbon Disulfide | 75-15-0 | 8260C | 0.101 | 0.500 |
| Carbon Tetrachloride | 56-23-5 | 8260C | 0.159 | 0.500 |
| Chlorobenzene | 108-90-7 | 8260C | 0.140 | 0.500 |
| Chlorodibromomethane | 124-48-1 | 8260C | 0.128 | 0.500 |
| Chloroethane | 75-00-3 | 8260C | 0.141 | 0.500 |
| Chloroform | 67-66-3 | 8260C | 0.0860 | 0.500 |
| Chloromethane | 74-87-3 | 8260C | 0.153 | 0.500 |
| Cis-1,2-Dichloroethene | 156-59-2 | 8260C | 0.0933 | 0.500 |
| Cis-1,3-Dichloropropene | 10061-01-5 | 8260C | 0.0976 | 0.500 |
| Isopropyl ether | 108-20-3 | 8260C | 0.0924 | 0.500 |

# Table 2

## Analytical Parameters and Reporting Limits – Water
## Former American Linen Supply
## 700 Dexter Avenue North, Seattle, Washington

| Analyte | CAS Registry Number | ESC Lab Sciences | | |
|---|---|---|---|---|
| | | Lab Method | MDL (µg/L) | RDL[a] (µg/L) |
| Dibromomethane | 74-95-3 | 8260C | 0.117 | 0.500 |
| CFC-12 | 75-71-8 | 8260C | 0.127 | 0.500 |
| Ethylbenzene | 100-41-4 | 8260C | 0.158 | 0.500 |
| Hexachlorobutadiene | 87-68-3 | 8260C | 0.157 | 1.00 |
| Methyl Iodide | 74-88-4 | 8260C | 0.377 | 2.50 |
| Cumene | 98-82-8 | 8260C | 0.126 | 0.500 |
| Methyl t-butyl ether | 1634-04-4 | 8260C | 0.102 | 0.500 |
| Methylene Chloride | 75-09-2 | 8260C | 1.07 | 2.50 |
| n-Butylbenzene | 104-51-8 | 8260C | 0.143 | 0.500 |
| Hexane | 110-54-3 | 8260C | 0.305 | 1.00 |
| n-Propylbenzene | 103-65-1 | 8260C | 0.162 | 0.500 |
| Naphthalene | 91-20-3 | 8260C | 0.174 | 0.500 |
| p-Isopropyltoluene | 99-87-6 | 8260C | 0.138 | 0.500 |
| Sec-Butylbenzene | 135-98-8 | 8260C | 0.134 | 0.500 |
| Styrene | 100-42-5 | 8260C | 0.117 | 0.500 |
| Tert-Butylbenzene | 98-06-6 | 8260C | 0.183 | 0.500 |
| Tetrachloroethene | 127-18-4 | 8260C | 0.199 | 0.500 |
| Toluene | 108-88-3 | 8260C | 0.412 | 1.00 |
| Trans-1,2-Dichloroethene | 156-60-5 | 8260C | 0.152 | 0.500 |
| Trans-1,3-Dichloropropene | 10061-02-6 | 8260C | 0.222 | 0.500 |
| Trans-1,4-Dichloro-2-butene | 110-57-6 | 8260C | 0.257 | 5.00 |
| Trichloroethene | 79-01-6 | 8260C | 0.153 | 0.500 |
| CFC-11 | 75-69-4 | 8260C | 0.130 | 0.500 |
| Vinyl Acetate | 108-05-4 | 8260C | 0.645 | 2.50 |
| Vinyl Chloride | 75-01-4 | 8260C | 0.118 | 0.500 |
| Total Xylenes | 1330-20-7 | 8260C | 0.316 | 1.50 |
| Petroleum Hydrocarbons | | | | |
| Gasoline Range Organics | NA | NWTPH-Gx | 31.6 | 100 |
| EVO Injection Monitoring | | | | |
| Alkalinity, Total | NA | 2320B | 20,000 | 2,710 |
| Chloride | 16887-00-6 | 9056A | 1,000 | 51.9 |
| Nitrate | 14797-55-8 | 9056A | 100 | 22.7 |
| Sulfate | 14808-79-8 | 9056A | 5,000 | 77.4 |
| Total Organic Carbon (TOC) | NA | 9060A | 1,000 | 102 |
| Iron | 7439-89-6 | 6020A | 100 | 15.0 |
| Manganese | 7439-96-5 | 6020A | 5.00 | 0.250 |

# Table 3

## Sample Containers, Preservatives, and Holding Times
## Former American Linen Supply
## 700 Dexter Avenue North, Seattle, Washington

| Analysis | Method[a] | Container[b] |  | Preservative | Maximum Holding Time |
|---|---|---|---|---|---|
|  |  | Type | Size |  |  |
| **Soil Samples** |  |  |  |  |  |
| VOCs | 8260C | Glass | 8 oz./4 x 40 mL | 4 ± 2°C, methanol; $NaHSO_4$ | 14 days |
| Gasoline Range Organics | Ecology NWTPH-Gx | Glass | 8 oz./3 x 40 mL | 4 ± 2°C, methanol | 14 days |
| foc and TOC | Walkley-Black Method | Glass | 8 oz. | 4 ± 2°C | 28 days |
| **Groundwater Samples** |  |  |  |  |  |
| VOCs | 8260C | Glass | 3 x 40 mL | 4 ± 2°C, HCl to $pH < 2$ | 14 days |
| Gasoline Range Organics | Ecology NWTPH-Gx | Glass | 3 x 40 mL | 4 ± 2°C, HCl to $pH < 2$ | 14 days |
| Alkalinity | 2320 B-2011 | Poly | 1 liter | 4 ± 2°C | 28 days |
| Chloride, Sulfate | 9056A | Poly | 250 mL | 4 ± 2°C | 28 days |
| Nitrate | 9056A | Poly | 250 mL | 4 ± 2°C | 48 hours |
| TOC | 9060A | Amber Glass | 250 mL | 4 ± 2°C, $H_2SO_4$ to $pH < 2$ | 28 days |
| Total Iron and Manganese | 6020 | Poly | 500 mL | 4 ± 2°C, $HNO_3$ to $pH < 2$ | 6 months |
| Methane, Ethane, Ethene | RSK175 | Glass | 3 x 40 mL | 4 ± 2°C, HCl to $pH < 2$ | 14 days |
| **Groundwater Field Parameters** |  |  |  |  |  |
| pH | Probe/150.1 | – | – | – | – |
| Specific conductance | Probe/120.1 | – | – | – | – |
| Temperature | Probe/170.1 | – | – | – | – |
| Dissolved oxygen (DO) | Probe/SM 4500 | – | – | – | – |
| Oxidation/reduction potential (ORP) | Probe | – | – | – | – |
| Ferrous Iron | Hach Kit IR-18C | – | – | – | – |

Notes:

[a] EPA methods unless noted otherwise

[b] The size and number of containers may be modified by the analytical laboratories. Samples for multiple analyses may be obtained from the same container

# Table 4

## Laboratory and Field Quality Control Sample Summary
## Former American Linen Supply
## 700 Dexter Avenue North, Seattle, Washington

| Matrix | QA/QC Analyses | Frequency |
|---|---|---|
| **Laboratory** | | |
| Water | Laboratory control sample (LCS) | Every analytical batch. |
| | MS/MSD | 1 per 20 project samples with a minimum of 1 per event. |
| | Method blank | Every analytical batch. |
| Soil | Laboratory control sample (LCS) | Every analytical batch. |
| | MS/MSD | 1 per 20 project samples with a minimum of 1 per event. |
| | Method blank | Every analytical batch. |
| **Field** | | |
| Water | Equipment blank/field rinsate[a] | 1 per 20 project samples when non-dedicated sampling equipment is used, with mimum of 1 per event. Analyze consistent with project samples. |
| | Transport (Trip) blank | 1 per 20 project samples with maximum of 1 per shipment, when samples are analyzed for VOCs or NWTPH-Gx. |
| | Field duplicate | 1 per 20 project samples. Analyze consistent with project samples. |
| Soil | Equipment blank/field rinsate | 1 per 20 project samples when non-dedicated sampling equipment is used, with mimum of 1 per event. Analyze consistent with project samples. |
| | Transport (Trip) blank | 1 per 20 project samples with maximum of 1 per shipment, when samples are analyzed for VOCs or NWTPH-Gx. |
| | Field duplicate | 1 per 20 project samples. Analyze consistent with project samples. |

# ILLUSTRATIONS

Aerial Photo: June 27, 2016 (Google 2017)

**PES Environmental, Inc.**
Engineering & Environmental Services

**Property Location**
Former American Linen Supply
700 Dexter Avenue North
Seattle, Washington

FIGURE
1

| 1412.004.02.004 | 141300102004_SAP_1 | WRH | 1/18 |
|---|---|---|---|
| JOB NUMBER | DRAWING NUMBER | REVIEWED BY | DATE |

# APPENDIX A

# LABORATORY QUALITY CONTROL ACCEPTANCE CRITERIA

| PARAMETER | FORMULA |
|---|---|
| Solids, Total Suspended | $\frac{\text{((mg wt of dried residue + filter) - mg wt of filter) x 1000}}{\text{mL sample}}$ |

## 12.2 VALIDATION

The validation process consists of data generation, reduction review, and reporting results. Once data reduction is complete, validation is conducted by verification that the QC samples are within acceptable QC limits and that all documentation is complete, including the analytical report and associated QC. See Table 12.3 by method for current QC targets, controls and current reporting limits.

## 12.3 REPORTING

Reporting procedures are documented in *SOP 030201 Data Handling and Reporting.*

*Inorganic Control Limits:* Inorganic QC targets are statutory. The laboratory calculated limits verify the validity of the regulatory limits. The Wet Lab QC targets for all inorganic analyses are within the range of ± 5 to 15% for accuracy, depending on determinative method requirements, and, where applicable, ≤20 RPD for precision, unless laboratory-generated data indicate that tighter control limits can be routinely maintained. When using a certified reference material for QC sample analysis, the acceptance limits used in the laboratory will conform to the provider's certified ranges for accuracy and precision.

**Table 12.3: QC Targets for Wet Lab Accuracy (LCS), Precision and RLs**

This table is subject to revision without notice

| Analyte | Analysis Method | Matrix | Accuracy Range (%) | Precision (RPD) | RL (ppm) |
|---|---|---|---|---|---|
| Acidity | SM 2310B | w | 85 - 115 | <20 | 10 |
| Acidity | SM 2310B | s | 85 - 115 | <20 | 10 |
| Alkalinity | SM 2320B | w | 85 - 115 | <20 | 20 |
| Ammonia | 350.1, SM 4500-NH3-B | w | 90 - 110 | <20 | 0.25 |
| Ammonia | 350.1 (mod.) | s | Certified Values | <20 | 5.0 |
| Ash | ASTM D482-07 | s | 90 - 110 | <20 | n/a |
| Bromide | 300.0/9056/9056A/ SM 4110B | w | 90 - 110 | <20 | 1.0 |
| Bromide | 9056/9056A | s | Certified Values | <20 | 10 |
| Chloride | 300.0/9056/SM 4110B | w | 90 - 110 | <20 | 1.0 |
| Chloride | 9056A | w | 90 - 110 | <15 | 1.0 |
| Chloride | 300.0/9056 | s | Certified Values | <20 | 10 |
| Color | SM 2120B | w | n/a | <20 | 1 CU |
| Conductivity | 120.1/9050A, 2510B | w | 85 - 115 | <20 | n/a |
| Cyanide | 335.4, 335.2 (CLP- | w | 90 - 110 | <20 | 0.005 |

**Table 12.3: QC Targets for Wet Lab Accuracy (LCS), Precision and RLs**

This table is subject to revision without notice

| Analyte | Analysis Method | Matrix | Accuracy Range (%) | Precision (RPD) | RL (ppm) |
|---|---|---|---|---|---|
| | M), 9012B, SM 4500-CN-E | | | | |
| Cyanide | 335.2 (CLP-M), 9012B | s | Certified Values | <20 | 0.25 |
| Ferrous Iron | 3500FE B | w | 85 - 115 | <20 | 15 |
| Fluoride | 300.0/9056/9056A/ SM 4110B | w | 90 - 110 | <20 | 100 |
| Fluoride | 9056A | s | Certified Values | <20 | 1.0 |
| Hardness | 130.1 | w | 85 - 115 | <20 | 30 |
| Hardness | 130.2/SM 2340C | w | 85 - 115 | <20 | 5.0 |
| Hexavalent Chromium | SM3500 Cr B/7196A | w | 85 - 115 | <20 | 10 |
| Hexavalent Chromium | 7196A | s | Certified Values | <20 | 2.0 |
| Hexavalent Chromium | 7199 | w | 90 - 110 | <20 | 0.0005 |
| Hexavalent Chromium | 218.7 | w | 85 - 115 | <15 | 0.00002 |
| Hexavalent Chromium | 7199 | s | 80 - 120 | <20 | 1.0 |
| Ignitability | 1010A | w/s | ±3 degrees C | <20 | n/a |
| Methylene Blue Active Substances | 5540C SM20th | w | 85 - 115 | <20 | 0.10 |
| Nitrate-Nitrite | 300.0/9056/9056A/ SM 4110B | w | 90 - 110 | <20 | 1.0 |
| Nitrate-Nitrite | 9056A | w | 90 - 110 | <15 | 1.0 |
| Nitrate-Nitrite | 300.0/9056 | s | Certified Values | <20 | 10 |
| Nitrate | 300.0/9056/SM 4110B | w | 90 - 110 | <20 | 0.1 |
| Nitrate | 9056A | w | 90 - 110 | <15 | 0.1 |
| Nitrate | 300.0/9056 | s | Certified Values | <20 | 1.0 |
| Nitrite | 300.0/9056/SM 4110B | w | 90 - 110 | <20 | 0.1 |
| Nitrite | 9056A | w | 90 - 110 | <15 | 0.1 |
| Nitrite | 300.0/9056 | s | Certified Values | <20 | 1.0 |
| pH | SM 4500-H, 9040C | w | n/a | <1 | n/a |
| pH | 9045D | s | n/a | <1 | n/a |
| Phosphate (ortho) | SM 4500-P E | w | 85 - 115 | <20 | 25 |
| Phosphate (ortho) | SM 4500-P E | s | 85 - 115 | <20 | 250 |
| Phosphorous/Total | 365.1, SM 4500-P | w | 90 - 110 | <20 | 3.0 |
| Phosphorous/Total | 365.4 | w | 90 - 110 | <20 | 100 |
| Phosphorous/Total | 9056 | s | Certified Values | <20 | 1.0 |
| Residual Chlorine | SM 4500Cl G | w | 90 - 110 | <20 | 0.1 |
| Residue, Total (TS) | SM 2540-B, SM2540-G | w | 85 - 115 | <20 | 10 |
| Residue, Total (TS) | SM2540-G | s | 85 - 115 | <20 | 100 |
| Residue, Filterable | SM 2540-C | w | 95 - 105 | <20 | 10 |

**Table 12.3: QC Targets for Wet Lab Accuracy (LCS), Precision and RLs**

This table is subject to revision without notice

| Analyte | Analysis Method | Matrix | Accuracy Range (%) | Precision (RPD) | RL (ppm) |
|---|---|---|---|---|---|
| (TDS) | | | | | |
| Residue Non-Filterable (TSS) | SM 2540-D | w | 95 - 105 | <20 | 2.5 |
| Residue, Total Volatile (TVS) | SM 2540-E | w | 80 - 120 | <20 | 1.0 (% of TS) |
| Residue, Total Volatile (TVS) | 160.4/SM 2540-E, | s | 80 - 120 | <20 | 1.0 (% of TS) |
| Sulfate | 300.0/9056/SM 4110B | w | 90 - 110 | <20 | 5.0 |
| Sulfate | 9056A | w | 90 - 110 | <15 | 5.0 |
| Sulfate | 300.0/9056 | s | Certified Values | <20 | 50 |
| Sulfide | SM 4500S2 D | w | 85 - 115 | <20 | 20 |
| Sulfite | SM 4500SO3 B | w | 85 - 115 | <20 | 3.0 |
| Total Kjeldahl Nitrogen | 351.2 | w | 90 - 110 | <20 | 0.25 |
| Total Kjeldahl Nitrogen | SM 4500NOrg C | s | Certified Values | <20 | 20 |
| Total Organic Carbon | 415.1, SM 5310B,9060A | w | 85 - 115 | <20 | 1.0 |
| Total Organic Carbon | SM 5310C | w | 85 - 115 | <20 | 0.5 |
| Total Organic Carbon | USDA LOI, ASTM F1647-02A | s | 50 - 150 | <20 | 10 |
| Total Organic Carbon | Walkley-Black, | s | 50 - 150 | <20 | 100 |
| Dissolved Organic Carbon | 415.1, SM 5310B,9060A | w | 85 - 115 | <20 | 1.0 |
| Dissolved Organic Carbon | SM 5310C | w | 85 - 115 | <20 | 0.5 |
| Total Organic Halogens | 9020A, SM 5320B | w | 85 - 115 | <20 | 0.1 |
| EOX | 9023 | s | 85 - 115 | <20 | 25 |
| Total Phenol | 420.2 | w | 90 - 110 | <20 | 0.04 |
| Total Phenol | 9066 | w | 90 - 110 | <20 | 0.04 |
| Total Phenol | 9066 | s | 90 - 110 | <20 | 0.67 |
| Turbidity | 180.1, SM 2130B | w | 90 - 110 | <20 | 0.1 NTU |

## *13.0 CORRECTIVE ACTIONS*

13.1 In the event that a nonconformance occurs in conjunction with the analytical batch, a corrective action response (CAR) form must be completed. The cause of the event is stated on the form and the measures taken to correct the nonconformance clearly defined. The effectiveness of the corrective action must be assessed and noted. The CARs are kept on file by the Regulatory Affairs Department. Corrective action procedures are documented in SOP #030208, *Corrective and Preventive Action*

### 13.2 Required Corrective Action

Control limits have been established for each type of analysis. When these control limits are exceeded, corrective action must be taken. Calculated sample spike control limits are also used.

All samples and procedures are governed by ESC's quality assurance program. General corrective actions are as follows; however additional and more specific direction is provided in the specific determinative procedure. For more information, see the appropriate determinative SOP.

### 13.2.1 Laboratory QC Criteria and Appropriate Corrective Actions

If the analytical method contains acceptance/rejection criteria and it is more stringent than those controls generated by the laboratory, the method criteria takes precedence.

### 13.2.2 Calibration Verification Criteria Are Not Met: Inorganic Analysis

<u>Rejection Criteria</u> - See Table 8.5.

<u>Corrective Action</u> - If a standard curve linearity is not acceptable and/or the absorbance for specific standard(s) is not analogous to historic data, the instrument settings, etc. are examined to ensure that nothing has been altered, clogged, etc. Check the standard curve for linearity and re-analyze the standards once. If the failure persists, the working standards are made fresh, intermediate dilutions are re-checked and the instrument is re-calibrated. If a problem persists, the Supervisor or Regulatory Affairs Department is notified for further action.

If the initial reference check sample is out of control, the instrument is re-calibrated and the check sample is re-analyzed. If the problem continues the check sample is re-prepared. If the problem still exists then the standards and reagent blank are re-prepared. If the problem persists, the Supervisor or Regulatory Affairs Department is notified for further action.

### 13.2.3 Out Of Control Blanks: Applies to Method, Trip, Rinsate & Instrument Blanks

<u>Rejection Criteria</u> - Blank reading is more than twice the background absorbance or more than MDL.

Corrective Action - Blanks are re-analyzed and the response is assessed. Standard curves and samples are evaluated for any obvious contamination that may be isolated or uniform throughout the run. If necessary, reagents are re-prepared. Field sample analyses are not started until the problem is identified and solved. If samples have already been partially prepared or analyzed, the Supervisor or Regulatory Affairs Department is consulted to determine if data needs to be rejected or if samples need to be re-prepped.

13.2.4 Out Of Control Laboratory Control Standards (LCS)

Rejection Criteria - If the performance of associated laboratory control sample(s) is outside of control limits either method defined or calculated as the mean of at least 20 data points ± 3 times the standard deviation of those points. (Listed in Section 12).

Corrective Action - Instrument settings are checked, LCS standard is re-analyzed. If the LCS is still out of control, re-calibration is performed, and samples affected since the last “in control” reference standard are re-analyzed. The Supervisor or Regulatory Affairs Department is consulted for further action.

13.2.5 Out Of Control Matrix Spike Samples

Rejection Criteria - If either the MS or MSD sample is outside the established control limits.

Corrective Action - Any compound that is outside of these limits is considered to be ‘out of control’ and must be qualified appropriately. Batch acceptance, however, is based on method blank and LCS performance, not on MS/MSD recoveries. Specific methods, customers, and programs may require further corrective action in some cases.

13.2.6 Out Of Control Duplicate Samples

Rejection Criteria - Lab-generated or method required maximum RPD limit (as listed under precision in Section 12)

Corrective Action - Instrument and samples are checked to see if precision variance is likely (i.e., high suspended solids content, high viscosity, etc.). They are re-analyzed in duplicate and samples just preceding and following the duplicated sample are re-analyzed. If problem still exists, the Supervisor or Regulatory Affairs Department is notified to review the analytical techniques.

13.2.7 Out Of Control Calibration Standards: ICV, CCV, SSCV

Rejection Criteria - If the performance is outside of method requirements.

Corrective Action - Instrument settings are checked, calibration verification standard is reanalyzed. If the standard is still out of control, re-calibration is performed, and samples affected since the last “in control” reference standard are re-analyzed. The Supervisor or Regulatory Affairs Department is consulted for further action.

- The blank contamination is greater than 1/10 of the specified regulatory limit.

The concentrations of common laboratory contaminants must not exceed the reporting limit. Any samples associated with a blank that fail these criteria are re-processed in a subsequent preparation batch, except when the sample analysis resulted in non-detected results for the failing analytes.

**NOTE:** Any detection in a method blank associated with samples being analyzed in conjunction with the Ohio EPA/VAP must be at or below the RL. Otherwise corrective action(s) listed in the Ohio EPA/VAP SOPs (see Table 10.1) must occur.

## *12.0 DATA REDUCTION, VALIDATION, AND REPORTING*

### 12.1 DATA REDUCTION

The analyst performs the data calculation and is responsible for the initial examination of the finished data. Data reduction steps applied to the raw data are outlined in ESC SOP #030201, *Data Handling and Reporting.* A secondary review of the data package is performed according to ESC SOP #030227, *Data Review*. The reviewer verifies that the analysis has been performed as required and meets method criteria, all associate data is present and complete, and also ensures that any additional documentation is completed as required (i.e. Ohio VAP checklists, required flags on test reports, etc.)

### 12.2 VALIDATION

The validation process consists of data generation, reduction review, and reporting results. Once data reduction is complete, validation is conducted by verification that the QC samples are within acceptable QC limits and that all documentation is complete, including the analytical report and associated QC. See Table 12.1 for current QC targets and controls and current reporting limits.

### 12.3 REPORTING

Reporting procedures are documented in SOP #030201, *Data Handling and Reporting.*

**Table 12.3: QC Targets for Environmental Metals Accuracy (LCS), Precision and RLs**
***(subject to revision without notice)***

| Class | Analyte | Prep Method | Analysis Method | Matrix | Accuracy Range (%) | Precision* (RPD) | RL (ppm) |
|---|---|---|---|---|---|---|---|
| (ICP-AES) | Aluminum | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.20 |
| (ICP-AES) | Aluminum | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.20 |
| (ICP-AES) | Aluminum | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 10 |
| (ICP-MS) | Aluminum | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.10 |
| (ICP-MS) | Aluminum | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.1 |

## Table 12.3: QC Targets for Environmental Metals Accuracy (LCS), Precision and RLs

***(subject to revision without notice)***

| Class | Analyte | Prep Method | Analysis Method | Matrix | Accuracy Range (%) | Precision* (RPD) | RL (ppm) |
|---|---|---|---|---|---|---|---|
| (ICP-MS) | Aluminum | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 10 |
| (ICP-AES) | Antimony | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.01 |
| (ICP-AES) | Antimony | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.01 |
| (ICP-AES) | Antimony | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 2.0 |
| (ICP-MS) | Antimony | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.001 |
| (ICP-MS) | Antimony | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.002 |
| (ICP-MS) | Antimony | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 0.10 |
| (ICP-AES) | Arsenic | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.01 |
| (ICP-AES) | Arsenic | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.01 |
| (ICP-AES) | Arsenic | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 2.0 |
| (ICP-MS) | Arsenic | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.001 |
| (ICP-MS) | Arsenic | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.002 |
| (ICP-MS) | Arsenic | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 0.10 |
| (ICP-AES) | Barium | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.005 |
| (ICP-AES) | Barium | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.005 |
| (ICP-AES) | Barium | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 0.50 |
| (ICP-MS) | Barium | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.002 |
| (ICP-MS) | Barium | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.005 |
| (ICP-MS) | Barium | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 0.20 |
| (ICP-AES) | Beryllium | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.002 |
| (ICP-AES) | Beryllium | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.002 |
| (ICP-AES) | Beryllium | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 0.20 |
| (ICP-MS) | Beryllium | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.001 |
| (ICP-MS) | Beryllium | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.002 |
| (ICP-MS) | Beryllium | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 0.10 |
| (ICP-AES) | Boron | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.20 |
| (ICP-AES) | Boron | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.20 |
| (ICP-AES) | Boron | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 10 |
| (ICP-MS) | Boron | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.02 |
| (ICP-MS) | Boron | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.02 |
| (ICP-MS) | Boron | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 1.0 |
| (ICP-AES) | Cadmium | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.002 |
| (ICP-AES) | Cadmium | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.002 |
| (ICP-AES) | Cadmium | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 0.50 |
| (ICP-MS) | Cadmium | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.001 |
| (ICP-MS) | Cadmium | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.001 |
| (ICP-MS) | Cadmium | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 0.10 |
| (ICP-AES) | Calcium | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 1.0 |

**Table 12.3: QC Targets for Environmental Metals Accuracy (LCS), Precision and RLs**

***(subject to revision without notice)***

| Class | Analyte | Prep Method | Analysis Method | Matrix | Accuracy Range (%) | Precision* (RPD) | RL (ppm) |
|---|---|---|---|---|---|---|---|
| (ICP-AES) | Calcium | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 1.0 |
| (ICP-AES) | Calcium | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 100 |
| (ICP-MS) | Calcium | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 1.0 |
| (ICP-MS) | Calcium | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 1.0 |
| (ICP-MS) | Calcium | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 50 |
| (ICP-AES) | Chromium | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.01 |
| (ICP-AES) | Chromium | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.01 |
| (ICP-AES) | Chromium | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 1.0 |
| (ICP-MS) | Chromium | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.001 |
| (ICP-MS) | Chromium | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.002 |
| (ICP-MS) | Chromium | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 0.10 |
| (ICP-AES) | Cobalt | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.01 |
| (ICP-AES) | Cobalt | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.01 |
| (ICP-AES) | Cobalt | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 1.0 |
| (ICP-MS) | Cobalt | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.001 |
| (ICP-MS) | Cobalt | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.002 |
| (ICP-MS) | Cobalt | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 0.10 |
| (ICP-AES) | Copper | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.01 |
| (ICP-AES) | Copper | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.01 |
| (ICP-AES) | Copper | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 2.0 |
| (ICP-MS) | Copper | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.002 |
| (ICP-MS) | Copper | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.005 |
| (ICP-MS) | Copper | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 0.20 |
| (ICP-AES) | Iron | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.10 |
| (ICP-AES) | Iron | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.10 |
| (ICP-AES) | Iron | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 10 |
| (ICP-MS) | Iron | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.10 |
| (ICP-MS) | Iron | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.10 |
| (ICP-MS) | Iron | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 250 |
| (ICP-AES) | Lead | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.005 |
| (ICP-AES) | Lead | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.005 |
| (ICP-AES) | Lead | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 0.50 |
| (ICP-MS) | Lead | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.001 |
| (ICP-MS) | Lead | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.002 |
| (ICP-MS) | Lead | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 0.10 |
| (ICP-AES) | Lithium | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.015 |
| (ICP-AES) | Lithium | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.015 |
| (ICP-AES) | Lithium | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 5.0 |

## Table 12.3: QC Targets for Environmental Metals Accuracy (LCS), Precision and RLs

***(subject to revision without notice)***

| Class | Analyte | Prep Method | Analysis Method | Matrix | Accuracy Range (%) | Precision* (RPD) | RL (ppm) |
|---|---|---|---|---|---|---|---|
| (ICP-AES) | Magnesium | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 1.0 |
| (ICP-AES) | Magnesium | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 1.0 |
| (ICP-AES) | Magnesium | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 100 |
| (ICP-MS) | Magnesium | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 1.0 |
| (ICP-MS) | Magnesium | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 1.0 |
| (ICP-MS) | Magnesium | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 50 |
| (ICP-AES) | Manganese | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.01 |
| (ICP-AES) | Manganese | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.01 |
| (ICP-AES) | Manganese | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 1.0 |
| (ICP-MS) | Manganese | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.002 |
| (ICP-MS) | Manganese | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.005 |
| (ICP-MS) | Manganese | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 0.20 |
| (CVAA) | Mercury | 7471A/B | 7471A/B | Solid | 80 - 120 | <20 | 0.02 |
| (CVAA) | Mercury | 7470A | 7470A | Liquid/Aqueous | 80 - 120 | <20 | 0.0002 |
| (CVAA) | Mercury | 245.1 /7470A | 245.1 | Liquid/Aqueous | 85 - 115 | <20 | 0.0002 |
| (ICP-AES) | Molybdenum | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.005 |
| (ICP-AES) | Molybdenum | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.005 |
| (ICP-AES) | Molybdenum | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 0.50 |
| (ICP-MS) | Molybdenum | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.002 |
| (ICP-MS) | Molybdenum | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.005 |
| (ICP-MS) | Molybdenum | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 0.20 |
| (ICP-AES) | Nickel | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.01 |
| (ICP-AES) | Nickel | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.01 |
| (ICP-AES) | Nickel | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 2.0 |
| (ICP-MS) | Nickel | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.001 |
| (ICP-MS) | Nickel | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.002 |
| (ICP-MS) | Nickel | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 0.10 |
| (ICP-AES) | Potassium | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 1.0 |
| (ICP-AES) | Potassium | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 1.0 |
| (ICP-AES) | Potassium | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 100 |
| (ICP-MS) | Potassium | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 1.0 |
| (ICP-MS) | Potassium | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 1.0 |
| (ICP-MS) | Potassium | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 50 |
| (ICP-AES) | Selenium | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.01 |
| (ICP-AES) | Selenium | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.01 |
| (ICP-AES) | Selenium | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 2.0 |
| (ICP-MS) | Selenium | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.001 |
| (ICP-MS) | Selenium | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.002 |

**Table 12.3: QC Targets for Environmental Metals Accuracy (LCS), Precision and RLs**

***(subject to revision without notice)***

| Class | Analyte | Prep Method | Analysis Method | Matrix | Accuracy Range (%) | Precision* (RPD) | RL (ppm) |
|---|---|---|---|---|---|---|---|
| (ICP-MS) | Selenium | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 0.10 |
| (ICP-AES) | Silicon | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.20 |
| (ICP-AES) | Silicon | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.20 |
| (ICP-AES) | Silicon | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 20 |
| (ICP-AES) | Silver | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.005 |
| (ICP-AES) | Silver | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.005 |
| (ICP-AES) | Silver | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 1.0 |
| (ICP-MS) | Silver | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.001 |
| (ICP-MS) | Silver | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.002 |
| (ICP-MS) | Silver | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 0.20 |
| (ICP-AES) | Sodium | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 1.0 |
| (ICP-AES) | Sodium | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 1.0 |
| (ICP-AES) | Sodium | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 100 |
| (ICP-MS) | Sodium | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 1.0 |
| (ICP-MS) | Sodium | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 1.0 |
| (ICP-MS) | Sodium | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 50 |
| (ICP-AES) | Strontium | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.01 |
| (ICP-AES) | Strontium | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.01 |
| (ICP-AES) | Strontium | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 1.0 |
| (ICP-MS) | Strontium | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.01 |
| (ICP-MS) | Strontium | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.01 |
| (ICP-MS) | Strontium | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 0.50 |
| (ICP-AES) | Sulfur | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 1.0 |
| (ICP-AES) | Sulfur | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 1.0 |
| (ICP-AES) | Sulfur | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 100 |
| (ICP-AES) | Thallium | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.01 |
| (ICP-AES) | Thallium | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.01 |
| (ICP-AES) | Thallium | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 2.0 |
| (ICP-MS) | Thallium | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.001 |
| (ICP-MS) | Thallium | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.002 |
| (ICP-MS) | Thallium | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 0.10 |
| (ICP-MS) | Thorium | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.01 |
| (ICP-MS) | Thorium | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.01 |
| (ICP-MS) | Thorium | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 1 |
| (ICP-AES) | Tin | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.05 |
| (ICP-AES) | Tin | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.05 |
| (ICP-AES) | Tin | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 5.0 |
| (ICP-MS) | Tin | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.001 |

**Table 12.3: QC Targets for Environmental Metals Accuracy (LCS), Precision and RLs**
***(subject to revision without notice)***

| Class | Analyte | Prep Method | Analysis Method | Matrix | Accuracy Range (%) | Precision* (RPD) | RL (ppm) |
|---|---|---|---|---|---|---|---|
| (ICP-MS) | Tin | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.002 |
| (ICP-MS) | Tin | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 0.10 |
| (ICP-AES) | Titanium | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.05 |
| (ICP-AES) | Titanium | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.05 |
| (ICP-AES) | Titanium | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 5.0 |
| (ICP-MS) | Titanium | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.01 |
| (ICP-MS) | Titanium | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.01 |
| (ICP-MS) | Titanium | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 0.50 |
| (ICP-AES) | Vanadium | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.02 |
| (ICP-AES) | Vanadium | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.02 |
| (ICP-AES) | Vanadium | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 2.0 |
| (ICP-MS) | Vanadium | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.002 |
| (ICP-MS) | Vanadium | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.005 |
| (ICP-MS) | Vanadium | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 0.20 |
| (ICP-MS) | Uranium | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.01 |
| (ICP-MS) | Uranium | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.01 |
| (ICP-MS) | Uranium | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 1 |
| (ICP-AES) | Zinc | 200.2 NPDES | 200.7 | Liquid/Aqueous | 85 - 115 | <20 | 0.05 |
| (ICP-AES) | Zinc | 3015/3010 | 6010B/C/D | Liquid/Aqueous | 80 - 120 | <20 | 0.05 |
| (ICP-AES) | Zinc | 3050B/3051A | 6010B/C/D | Solid | 80 - 120 | <20 | 5.0 |
| (ICP-MS) | Zinc | 200.2 NPDES | 200.8 | Liquid/Aqueous | 85 - 115 | <20 | 0.01 |
| (ICP-MS) | Zinc | 3015/3010 | 6020/A/B | Liquid/Aqueous | 80 - 120 | <20 | 0.025 |
| (ICP-MS) | Zinc | 3050B/3051A | 6020/A/B | Solid | 80 - 120 | <20 | 1.0 |

*** NOTE:** Duplicate LCS analyses are not analyzed for Ohio/EPA VAP projects
**All target analytes and criteria listed in this table may not be applicable to samples analyzed for the Ohio EPA/VAP.**

## *13.0 CORRECTIVE ACTIONS*

All target analytes and criteria listed in this section may not be applicable to samples analyzed for the Ohio EPA/VAP.

13.1 In the event that a nonconformance occurs in conjunction with the analytical batch, a corrective action response (CAR) form must be completed. The cause of the event is stated on the form and the measures taken to correct the nonconformance clearly defined. The effectiveness of the corrective action must be assessed and noted. The CARs are kept on file by the Regulatory Affairs Department. Corrective action procedures are documented in SOP #030208, *Corrective and Preventive Action*

### 13.2 Required Corrective Action

Control limits have been established for each type of analysis. When these control limits are exceeded, corrective action must be taken. Calculated sample spike control limits are also used.

All samples and procedures are governed by ESC's quality assurance program. General corrective actions are as follows; however additional and more specific direction is provided in the specific determinative procedure. For more information, see the appropriate determinative SOP

### 13.2.1 Laboratory QC Criteria and Appropriate Corrective Actions

If the analytical method contains acceptance/rejection criteria and it is more stringent than those controls generated by the laboratory, the method criteria takes precedence.

### 13.2.2 Calibration Verification Criteria Are Not Met: Inorganic Analysis

<u>Rejection Criteria</u> - See Table 8.5.

<u>Corrective Action</u> - If a standard curve linearity is not acceptable and/or the absorbance for specific standard(s) is not analogous to historic data, the instrument settings, nebulizer, etc. are examined to ensure that nothing has been altered, clogged, etc. The working standards are made fresh, intermediate dilutions are re-checked and the instrument is re-calibrated. If a problem persists, the Department Supervisor is notified for further action.

If the initial reference check sample is out of control, the instrument is re-calibrated and the check sample is rerun. If the problem continues the check sample is re-prepared. If the problem still exists then the standards and reagent blank are re-prepared. If the problem persists, the Department Supervisor is notified for further action.

### 13.2.3 Out Of Control Blanks: Applies to Method, Trip, Rinsate & Instrument Blanks

<u>Rejection Criteria</u> - Blank reading is more than the RL for Method Blanks and/or Instrument Blanks. (½ the RL for Method Blanks and/or instrument blanks for DoD work and also may be required for some customers and programs.)

<u>Corrective Action</u> - Standard curves and samples are evaluated for any obvious contamination that may be isolated or uniform throughout the sequence. If necessary, reagents, QC samples and field samples are re-prepared and re-analyzed. Re-analyses are not initiated until the cause of the contamination is identified and resolved. If samples have already been partially prepared or analyzed, the Department Supervisor is consulted to determine if data needs to be rejected or if samples need to be re-prepped.

### 13.2.4 Out Of Control Laboratory Control Standards (LCS)

<u>Rejection Criteria</u> - If the performance is outside of lab-generated control (Listed in Table 12.3).

Corrective Action - Instrument settings are checked. The LCS standard is re-analyzed. If the LCS is still out of control, re-calibration is performed, and samples affected since the last in control reference standard are re-analyzed. If the LCS fails again after re-calibration, the entire workgroup must be re-prepped. The Department Supervisor is consulted for further action.

13.2.5 Out Of Control Matrix Spike Samples

Rejection Criteria - If either the MS or MSD sample is outside the established control limits.

Corrective Action - Any compound that is outside of these limits is considered to be 'out of control' and must be qualified appropriately. Batch acceptance, however, is based on method blank and LCS performance, not on MS/MSD recoveries. Specific methods, customers, and programs may require further corrective action in some cases.

13.2.8 Out Of Control Calibration Standards: ICV, CCV, SSCV

Rejection Criteria - If the performance is outside of method requirements.

Corrective Action - Instrument settings are checked, calibration verification standard is rerun. If the standard is still out of control, re-calibration is performed, and samples affected since the last in control reference standard are rerun. The Department Supervisor is consulted for further action.

13.3 Responsibility - It is the Department Supervisor's responsibility to evaluate the validity of the corrective action response and submit it to the QA department for processing. In addition, the Supervisor is responsible for appointing the appropriate person within the department to be responsible for correcting the nonconformance. When a corrective action warrants a cessation of analysis, the following personnel are responsible for executing the "stop work" order:

- Laboratory Manager
- QA Department
- Department Supervisor
- Technical Service Representative

## *14.0 RECORD KEEPING*

Record keeping is outlined in SOP #030230, *Standards Logger, SOP #030227, Data Review* and SOP #030201, *Data Handling and Reporting*

## *15.0 QUALITY AUDITS*

System and data quality audits are outlined in the ESC Quality Assurance Manual Version 12.0 and *SOP #010104, Internal Audits.*

**Allowable Marginal Exceedance per Event**

| Analytes in LCS: | ME Allowable |
|---|---|
| >90 | 5 |
| 71-90 | 4 |
| 51-70 | 3 |
| 31-50 | 2 |
| 11-30 | 1 |
| <11 | 0 |

***Organic Control Limits -*** The organic QC targets are statutory in nature; warning and control limits for organic analyses are initially established for groups of compounds based on preliminary method validation data. When additional data becomes available, the QC targets are reviewed. All QC targets are routinely re-evaluated at least annually (and updated, if necessary) against laboratory historical data to insure that the limits continue to reflect realistic, method achievable goals.

NOTE: The use of marginal exceedances is not allowed in the Ohio EPA/VAP.

## 12.3 REPORTING

Reporting procedures are documented in SOP #030201, *Data Handling and Reporting.*

**Table 12.3: QC Targets for Volatiles Accuracy (LCS), Precision and RLs**
***This table is subject to revision without notice***

| Class | Analyte | Method | Matrix | Accuracy (%)** | Prec.** (RPD) | RL | Unit |
|---|---|---|---|---|---|---|---|
| Volatiles | 1,1,1,2-TETRACHLOROETHANE | 8260B/C, 624, 6200B | GW, WW | 78.5-125 | 20.0 | 0.001 | mg/L |
| Volatiles | 1,1,1-TRICHLOROETHANE | 8260B/C, 624, 6200B | GW, WW | 71.1-129 | 20.0 | 0.001 | mg/L |
| Volatiles | 1,1,2,2-TETRACHLOROETHANE | 8260B/C, 624, 6200B | GW, WW | 79.3-123 | 20.0 | 0.001 | mg/L |
| Volatiles | 1,1,2-TRICHLOROETHANE | 8260B/C, 624, 6200B | GW, WW | 81.6-120 | 20.0 | 0.001 | mg/L |
| Volatiles | 1,1,2-TRICHLORO-TRIFLUOROETHANE | 8260B/C, 624, 6200B | GW, WW | 62.0-141 | 20.0 | 0.001 | mg/L |
| Volatiles | 1,1-DICHLOROETHANE | 8260B/C, 624, 6200B | GW, WW | 71.7-127 | 20.0 | 0.001 | mg/L |
| Volatiles | 1,1-DICHLOROETHENE | 8260B/C, 624, 6200B | GW, WW | 59.9-137 | 20.0 | 0.001 | mg/L |
| Volatiles | 1,1-DICHLOROPROPENE | 8260B/C, 624, 6200B | GW, WW | 72.5-127 | 20.0 | 0.001 | mg/L |
| Volatiles | 1,2,3-TRICHLOROBENZENE | 8260B/C, 624, 6200B | GW, WW | 75.7-134 | 20.0 | 0.001 | mg/L |
| Volatiles | 1,2,3-TRICHLOROPROPANE | 8260B/C, 624, 6200B | GW, WW | 74.9-124 | 20.0 | 0.0025 | mg/L |
| Volatiles | 1,2,3-TRIMETHYLBENZENE | 8260B/C, 624, 6200B | GW, WW | 79.9-118 | 20.0 | 0.001 | mg/L |
| Volatiles | 1,2,4-TRICHLOROBENZENE | 8260B/C, 624, 6200B | GW, WW | 76.1-136 | 20.0 | 0.001 | mg/L |
| Volatiles | 1,2,4-TRIMETHYLBENZENE | 8260B/C, 624, 6200B | GW, WW | 79.0-122 | 20.0 | 0.001 | mg/L |
| Volatiles | 1,2-DIBROMO-3-CHLOROPROPANE | 8260B/C, 624, 6200B | GW, WW | 64.8-131 | 20.0 | 0.005 | mg/L |
| Volatiles | 1,2-DIBROMOETHANE | 8260B/C, 624, 6200B | GW, WW | 79.8-122 | 20.0 | 0.001 | mg/L |

**Table 12.3: QC Targets for Volatiles Accuracy (LCS), Precision and RLs**
***This table is subject to revision without notice***

| Class | Analyte | Method | Matrix | Accuracy (%)** | Prec.** (RPD) | RL | Unit |
|---|---|---|---|---|---|---|---|
| Volatiles | 1,2-DICHLOROBENZENE | 8260B/C, 624, 6200B | GW, WW | 84.7-118 | 20.0 | 0.001 | mg/L |
| Volatiles | 1,2-DICHLOROETHANE | 8260B/C, 624, 6200B | GW, WW | 65.3.-126 | 20.0 | 0.001 | mg/L |
| Volatiles | 1,2-DICHLOROPROPANE | 8260B/C, 624, 6200B | GW, WW | 77.4-125 | 20.0 | 0.001 | mg/L |
| Volatiles | 1,3,5-TRIMETHYLBENZENE | 8260B/C, 624, 6200B | GW, WW | 81.0-123 | 20.0 | 0.001 | mg/L |
| Volatiles | 1,3-BUTADIENE | 8260B/C, 624, 6200B | GW, WW | 36.2-142 | 20.0 | 0.002 | mg/L |
| Volatiles | 1,3-DICHLOROBENZENE | 8260B/C, 624, 6200B | GW, WW | 77.6-127 | 20.0 | 0.001 | mg/L |
| Volatiles | 1,3-DICHLOROPROPANE | 8260B/C, 624, 6200B | GW, WW | 80.6-115 | 20.0 | 0.001 | mg/L |
| Volatiles | 1,4-DICHLOROBENZENE | 8260B/C, 624, 6200B | GW, WW | 82.2-114 | 20.0 | 0.001 | mg/L |
| Volatiles | 1-METHYLNAPHTHALENE | 8260B/C, 624, 6200B | GW, WW | 48.8-157 | 20.0 | 0.01 | mg/L |
| Volatiles | 2,2-DICHLOROPROPANE | 8260B/C, 624, 6200B | GW, WW | 61.3-134 | 20.0 | 0.001 | mg/L |
| Volatiles | 2-BUTANONE (MEK) | 8260B/C, 624, 6200B | GW, WW | 46.4-155 | 20.0 | 0.01 | mg/L |
| Volatiles | 2-CHLOROETHYL VINYL ETHER | 8260B/C, 624, 6200B | GW, WW | 23.4-162 | 23.5 | 0.05 | mg/L |
| Volatiles | 2-CHLOROTOLUENE | 8260B/C, 624, 6200B | GW, WW | 76.4-125 | 20.0 | 0.001 | mg/L |
| Volatiles | 2-HEXANONE | 8260B/C, 624, 6200B | GW, WW | 59.4-151 | 20.0 | 0.01 | mg/L |
| Volatiles | 2-METHYLNAPHTHALENE | 8260B/C, 624, 6200B | GW, WW | 55.6-154 | 20.0 | 0.01 | mg/L |
| Volatiles | 4-CHLOROTOLUENE | 8260B/C, 624, 6200B | GW, WW | 81.5-121 | 20.0 | 0.001 | mg/L |
| Volatiles | 4-ETHYLTOLUENE | 8260B/C, 624, 6200B | GW, WW | 69.5-137 | 20.0 | 0.001 | mg/L |
| Volatiles | 4-METHYL-2-PENTANONE (MIBK) | 8260B/C, 624, 6200B | GW, WW | 63.3-138 | 20.0 | 0.01 | mg/L |
| Volatiles | ACETONE | 8260B/C, 624, 6200B | GW, WW | 28.7-175 | 20.9 | 0.01 | mg/L |
| Volatiles | ACROLEIN | 8260B/C, 624, 6200B | GW, WW | 40.4-172 | 20.0 | 0.05 | mg/L |
| Volatiles | ACRYLONITRILE | 8260B/C, 624, 6200B | GW, WW | 58.2-145 | 20.0 | 0.01 | mg/L |
| Volatiles | BENZENE | 8260B/C, 624, 6200B | GW, WW | 73.0-122 | 20.0 | 0.001 | mg/L |
| Volatiles | BROMOBENZENE | 8260B/C, 624, 6200B | GW, WW | 81.5-115 | 20.0 | 0.001 | mg/L |
| Volatiles | BROMOCHLOROMETHANE | 8260B/C, 624, 6200B | GW, WW | 78.9-123 | 20.0 | 0.001 | mg/L |
| Volatiles | BROMODICHLOROMETHANE | 8260B/C, 624, 6200B | GW, WW | 75.5-121 | 20.0 | 0.001 | mg/L |
| Volatiles | BROMOFORM | 8260B/C, 624, 6200B | GW, WW | 71.5-131 | 20.0 | 0.001 | mg/L |
| Volatiles | BROMOMETHANE | 8260B/C, 624, 6200B | GW, WW | 22.4-187 | 20.0 | 0.005 | mg/L |
| Volatiles | CARBON DISULFIDE | 8260B/C, 624, 6200B | GW, WW | 53.0-134 | 20.0 | 0.001 | mg/L |
| Volatiles | CARBON TETRACHLORIDE | 8260B/C, 624, 6200B | GW, WW | 70.9-129 | 20.0 | 0.001 | mg/L |
| Volatiles | CHLOROBENZENE | 8260B/C, 624, 6200B | GW, WW | 79.7-122 | 20.0 | 0.001 | mg/L |
| Volatiles | CHLORODIBROMOMETHANE | 8260B/C, 624, 6200B | GW, WW | 78.2-124 | 20.0 | 0.001 | mg/L |
| Volatiles | CHLOROETHANE | 8260B/C, 624, 6200B | GW, WW | 41.2-153 | 20.0 | 0.005 | mg/L |
| Volatiles | CHLOROFORM | 8260B/C, 624, 6200B | GW, WW | 73.2-125 | 20.0 | 0.005 | mg/L |
| Volatiles | CHLOROMETHANE | 8260B/C, 624, 6200B | GW, WW | 55.8-134 | 20.0 | 0.025 | mg/L |
| Volatiles | CIS-1,2-DICHLOROETHENE | 8260B/C, 624, 6200B | GW, WW | 77.3-122 | 20.0 | 0.001 | mg/L |
| Volatiles | CIS-1,3-DICHLOROPROPENE | 8260B/C, 624, 6200B | GW, WW | 77.7-124 | 20.0 | 0.001 | mg/L |

**Table 12.3: QC Targets for Volatiles Accuracy (LCS), Precision and RLs**
***This table is subject to revision without notice***

| Class | Analyte | Method | Matrix | Accuracy (%)** | Prec.** (RPD) | RL | Unit |
|---|---|---|---|---|---|---|---|
| Volatiles | DIBROMOMETHANE | 8260B/C, 624, 6200B | GW, WW | 78.8-119 | 20.0 | 0.001 | mg/L |
| Volatiles | DICHLORODIFLUORO-METHANE | 8260B/C, 624, 6200B | GW, WW | 56.0-134 | 20.0 | 0.005 | mg/L |
| Volatiles | DICHLOROFLUORO-METHANE | 8260B/C, 624, 6200B | GW, WW | 53.5-145 | 20.0 | 0.005 | mg/L |
| Volatiles | DICYCLOPENTADIENE | 8260B/C, 624, 6200B | GW, WW | 73.4-126 | 20.0 | 0.001 | mg/L |
| Volatiles | DI-ISOPROPYL ETHER | 8260B/C, 624, 6200B | GW, WW | 65.1-135 | 20.0 | 0.001 | mg/L |
| Volatiles | ETHYL ETHER | 8260B/C, 624, 6200B | GW, WW | 56.6-136 | 20.0 | 0.001 | mg/L |
| Volatiles | ETHYLBENZENE | 8260B/C, 624, 6200B | GW, WW | 80.9-121 | 20.0 | 0.001 | mg/L |
| Volatiles | HEXACHLORO-1,3-BUTADIENE | 8260B/C, 624, 6200B | GW, WW | 73.7-133 | 20.0 | 0.001 | mg/L |
| Volatiles | IODOMETHANE | 8260B/C, 624, 6200B | GW, WW | 64.6-137 | 20.0 | 0.01 | mg/L |
| Volatiles | ISOPROPYLBENZENE | 8260B/C, 624, 6200B | GW, WW | 81.6-124 | 20.0 | 0.001 | mg/L |
| Volatiles | M&P-XYLENE | 8260B/C, 624, 6200B | GW, WW | 78.5-122 | 20.0 | 0.002 | mg/L |
| Volatiles | METHYL TERT-BUTYL ETHER | 8260B/C, 624, 6200B | GW, WW | 70.1-125 | 20.0 | 0.001 | mg/L |
| Volatiles | METHYLENE CHLORIDE | 8260B/C, 624, 6200B | GW, WW | 69.5-120 | 20.0 | 0.005 | mg/L |
| Volatiles | NAPHTHALENE | 8260B/C, 624, 6200B | GW, WW | 69.7-134 | 20.0 | 0.005 | mg/L |
| Volatiles | N-BUTYLBENZENE | 8260B/C, 624, 6200B | GW, WW | 75.9-134 | 20.0 | 0.001 | mg/L |
| Volatiles | N-HEXANE | 8260B/C, 624, 6200B | GW, WW | 59.5-132 | 20.0 | 0.01 | mg/L |
| Volatiles | N-PROPYLBENZENE | 8260B/C, 624, 6200B | GW, WW | 81.9-122 | 20.0 | 0.001 | mg/L |
| Volatiles | O-XYLENE | 8260B/C, 624, 6200B | GW, WW | 79.1-123 | 20.0 | 0.001 | mg/L |
| Volatiles | P-ISOPROPYLTOLUENE | 8260B/C, 624, 6200B | GW, WW | 77.6-129 | 20.0 | 0.001 | mg/L |
| Volatiles | PROPENE | 8260B/C, 624, 6200B | GW, WW | 10.0-200 | 20.0 | 0.0025 | mg/L |
| Volatiles | SEC-BUTYLBENZENE | 8260B/C, 624, 6200B | GW, WW | 80.6-126 | 20.0 | 0.001 | mg/L |
| Volatiles | STYRENE | 8260B/C, 624, 6200B | GW, WW | 79.9-124 | 20.0 | 0.001 | mg/L |
| Volatiles | TERT-BUTYLBENZENE | 8260B/C, 624, 6200B | GW, WW | 79.3-127 | 20.0 | 0.001 | mg/L |
| Volatiles | TETRACHLOROETHENE | 8260B/C, 624, 6200B | GW, WW | 73.5-130 | 20.0 | 0.001 | mg/L |
| Volatiles | TETRAHYDROFURAN | 8260B/C, 624, 6200B | GW, WW | 54.0-134 | 20.0 | 0.005 | mg/L |
| Volatiles | TOLUENE | 8260B/C, 624, 6200B | GW, WW | 77.9-116 | 20.0 | 0.005 | mg/L |
| Volatiles | TPH (GC/MS) LOW FRACTION | 8260B/C, 624, 6200B | GW, WW | 62.3-131 | 20.0 | 0.50 | mg/L |
| Volatiles | TRANS-1,2-DICHLOROETHENE | 8260B/C, 624, 6200B | GW, WW | 72.6-125 | 20.0 | 0.001 | mg/L |
| Volatiles | TRANS-1,3-DICHLOROPROPENE | 8260B/C, 624, 6200B | GW, WW | 73.5-127 | 20.0 | 0.001 | mg/L |
| Volatiles | TRANS-1,4-DICHLORO-2-BUTENE | 8260B/C, 624, 6200B | GW, WW | 58.3-129 | 20.0 | 0.0025 | mg/L |
| Volatiles | TRICHLOROETHENE | 8260B/C, 624, 6200B | GW, WW | 79.5-121 | 20.0 | 0.001 | mg/L |
| Volatiles | TRICHLOROFLUORO-METHANE | 8260B/C, 624, 6200B | GW, WW | 49.1-157 | 20.0 | 0.005 | mg/L |

**Table 12.3: QC Targets for Volatiles Accuracy (LCS), Precision and RLs**
***This table is subject to revision without notice***

| **Class** | **Analyte** | **Method** | **Matrix** | **Accuracy (%)**** | **Prec.** (RPD)** | **RL** | **Unit** |
|---|---|---|---|---|---|---|---|
| Volatiles | VINYL ACETATE | 8260B/C, 624, 6200B | GW, WW | 41.7-159 | 20.0 | 0.01 | mg/L |
| Volatiles | VINYL CHLORIDE | 8260B/C, 624, 6200B | GW, WW | 61.5-134 | 20.0 | 0.001 | mg/L |
| Volatiles | XYLENES, TOTAL | 8260B/C, 624, 6200B | GW,WW | 79.2-122 | 20.0 | 0.002 | mg/L |
| Volatiles | 1,1,1,2-TETRACHLOROETHANE | 8260B/C | Solid | 76.7-127 | 20.0 | 0.001 | mg/kg |
| Volatiles | 1,1,1-TRICHLOROETHANE | 8260B/C | Solid | 69.9-127 | 20.0 | 0.001 | mg/kg |
| Volatiles | 1,1,2,2-TETRACHLOROETHANE | 8260B/C | Solid | 78.8-124 | 20.0 | 0.001 | mg/kg |
| Volatiles | 1,1,2-TRICHLOROETHANE | 8260B/C | Solid | 81.9-119 | 20.0 | 0.001 | mg/kg |
| Volatiles | 1,1,2-RICHLOROTRIFLUORO-ETHANE | 8260B/C | Solid | 62.6-138 | 20.0 | 0.001 | mg/kg |
| Volatiles | 1,1-DICHLOROETHANE | 8260B/C | Solid | 71.7-125 | 20.0 | 0.001 | mg/kg |
| Volatiles | 1,1-DICHLOROETHENE | 8260B/C | Solid | 60.6-133 | 20.0 | 0.001 | mg/kg |
| Volatiles | 1,1-DICHLOROPROPENE | 8260B/C | Solid | 71.2-126 | 20.0 | 0.001 | mg/kg |
| Volatiles | 1,2,3-TRICHLOROBENZENE | 8260B/C | Solid | 72.5-137 | 20.0 | 0.001 | mg/kg |
| Volatiles | 1,2,3-TRICHLOROPROPANE | 8260B/C | Solid | 74.0-124 | 20.0 | 0.0025 | mg/kg |
| Volatiles | 1,2,3-TRIMETHYLBENZENE | 8260B/C | Solid | 79.4-118 | 20.0 | 0.001 | mg/kg |
| Volatiles | 1,2,4-TRICHLOROBENZENE | 8260B/C | Solid | 74.0-137 | 20.0 | 0.001 | mg/kg |
| Volatiles | 1,2,4-TRIMETHYLBENZENE | 8260B/C | Solid | 77.1-124 | 20.0 | 0.001 | mg/kg |
| Volatiles | 1,2-DIBROMO-3-CHLOROPROPANE | 8260B/C | Solid | 64.9-131 | 20.0 | 0.005 | mg/kg |
| Volatiles | 1,2-DIBROMOETHANE | 8260B/C | Solid | 78.7-123 | 20.0 | 0.001 | mg/kg |
| Volatiles | 1,2-DICHLOROBENZENE | 8260B/C | Solid | 83.6-119 | 20.0 | 0.001 | mg/kg |
| Volatiles | 1,2-DICHLOROETHANE | 8260B/C | Solid | 67.2-121 | 20.0 | 0.001 | mg/kg |
| Volatiles | 1,2-DICHLOROPROPANE | 8260B/C | Solid | 76.9-123 | 20.0 | 0.001 | mg/kg |
| Volatiles | 1,3,5-TRIMETHYLBENZENE | 8260B/C | Solid | 79.0-125 | 20.0 | 0.001 | mg/kg |
| Volatiles | 1,3-BUTADIENE | 8260B/C | Solid | 35.1-134 | 20.0 | 0.002 | mg/kg |
| Volatiles | 1,3-DICHLOROBENZENE | 8260B/C | Solid | 75.9-129 | 20.0 | 0.001 | mg/kg |
| Volatiles | 1,3-DICHLOROPROPANE | 8260B/C | Solid | 80.3-114 | 20.0 | 0.001 | mg/kg |
| Volatiles | 1,4-DICHLOROBENZENE | 8260B/C | Solid | 81.0-115 | 20.0 | 0.001 | mg/kg |
| Volatiles | 1-METHYLNAPHTHALENE | 8260B/C | Solid | 60.4-138 | 24.7 | 0.01 | mg/kg |
| Volatiles | 2,2-DICHLOROPROPANE | 8260B/C | Solid | 61.9-132 | 20.0 | 0.001 | mg/kg |
| Volatiles | 2-BUTANONE (MEK) | 8260B/C | Solid | 44.5-154 | 21.3 | 0.01 | mg/kg |
| Volatiles | 2-CHLOROETHYL VINYL ETHER | 8260B/C | Solid | 16.7-162 | 23.7 | 0.05 | mg/kg |
| Volatiles | 2-CHLOROTOLUENE | 8260B/C | Solid | 74.6-127 | 20.0 | 0.001 | mg/kg |
| Volatiles | 2-HEXANONE | 8260B/C | Solid | 62.7-150 | 20.0 | 0.01 | mg/kg |
| Volatiles | 2-METHYLNAPHTHALENE | 8260B/C | Solid | 63.3-137 | 21.5 | 0.01 | mg/kg |
| Volatiles | 4-CHLOROTOLUENE | 8260B/C | Solid | 79.5-123 | 20.0 | 0.001 | mg/kg |

**Table 12.3: QC Targets for Volatiles Accuracy (LCS), Precision and RLs**
***This table is subject to revision without notice***

| Class | Analyte | Method | Matrix | Accuracy (%)** | Prec.** (RPD) | RL | Unit |
|---|---|---|---|---|---|---|---|
| Volatiles | 4-ETHYLTOLUENE | 8260B/C | Solid | 78.0-127 | 20.0 | 0.001 | mg/kg |
| Volatiles | 4-METHYL-2-PENTANONE (MIBK) | 8260B/C | Solid | 61.1-138 | 20.0 | 0.01 | mg/kg |
| Volatiles | ACETONE | 8260B/C | Solid | 25.3-178 | 22.9 | 0.01 | mg/kg |
| Volatiles | ACROLEIN | 8260B/C | Solid | 41.0-182 | 20.0 | 0.05 | mg/kg |
| Volatiles | ACRYLONITRILE | 8260B/C | Solid | 57.8-143 | 20.0 | 0.01 | mg/kg |
| Volatiles | BENZENE | 8260B/C | Solid | 72.6-120 | 20.0 | 0.001 | mg/kg |
| Volatiles | BROMOBENZENE | 8260B/C | Solid | 80.3-115 | 20.0 | 0.001 | mg/kg |
| Volatiles | BROMOCHLOROMETHANE | 8260B/C | Solid | 79..7-123 | 20.0 | 0.001 | mg/kg |
| Volatiles | BROMODICHLOROMETHANE | 8260B/C | Solid | 75.3-119 | 20.0 | 0.001 | mg/kg |
| Volatiles | BROMOFORM | 8260B/C | Solid | 69.1-135 | 20.0 | 0.001 | mg/kg |
| Volatiles | BROMOMETHANE | 8260B/C | Solid | 23.0-191 | 20.0 | 0.005 | mg/kg |
| Volatiles | CARBON DISULFIDE | 8260B/C | Solid | 49.9-136 | 20.0 | 0.001 | mg/kg |
| Volatiles | CARBON TETRACHLORIDE | 8260B/C | Solid | 69.4-129 | 20.0 | 0.001 | mg/kg |
| Volatiles | CHLOROBENZENE | 8260B/C | Solid | 78.9-122 | 20.0 | 0.001 | mg/kg |
| Volatiles | CHLORODIBROMOMETHANE | 8260B/C | Solid | 76.4-126 | 20.0 | 0.005 | mg/kg |
| Volatiles | CHLOROETHANE | 8260B/C | Solid | 47.2-147 | 20.0 | 0.005 | mg/kg |
| Volatiles | CHLOROFORM | 8260B/C | Solid | 73.3-122 | 20.0 | 0.025 | mg/kg |
| Volatiles | CHLOROMETHANE | 8260B/C | Solid | 53.1-135 | 20.0 | 0.001 | mg/kg |
| Volatiles | CIS-1,2-DICHLOROETHENE | 8260B/C | Solid | 76.1-121 | 20.0 | 0.001 | mg/kg |
| Volatiles | CIS-1,3-DICHLOROPROPENE | 8260B/C | Solid | 77.3-123 | 20.0 | 0.001 | mg/kg |
| Volatiles | DIBROMOMETHANE | 8260B/C | Solid | 78.5-117 | 20.0 | 0.005 | mg/kg |
| Volatiles | DICHLORODIFLUORO-METHANE | 8260B/C | Solid | 50.9-139 | 20.0 | 0.005 | mg/kg |
| Volatiles | DICHLOROFLUORO-METHANE | 8260B/C | Solid | 61.8-140 | 20.0 | 0.001 | mg/kg |
| Volatiles | DICYCLOPENTADIENE | 8260B/C | Solid | 73.1-126 | 20.0 | 0.001 | mg/kg |
| Volatiles | DI-ISOPROPYL ETHER | 8260B/C | Solid | 67.2-131 | 20.0 | 0.001 | mg/kg |
| Volatiles | ETHYL ETHER | 8260B/C | Solid | 57.5-136 | 20.0 | 0.001 | mg/kg |
| Volatiles | ETHYLBENZENE | 8260B/C | Solid | 78.6-124 | 20.0 | 0.001 | mg/kg |
| Volatiles | HEXACHLORO-1,3-BUTADIENE | 8260B/C | Solid | 69.2-136 | 20.0 | 0.01 | mg/kg |
| Volatiles | IODOMETHANE | 8260B/C | Solid | 63.3-136 | 20.0 | 0.001 | mg/kg |
| Volatiles | ISOPROPYLBENZENE | 8260B/C | Solid | 79.4-126 | 20.0 | 0.002 | mg/kg |
| Volatiles | M&P-XYLENE | 8260B/C | Solid | 77.3-124 | 20.0 | 0.001 | mg/kg |
| Volatiles | METHYL TERT-BUTYL ETHER | 8260B/C | Solid | 70.2-122 | 20.0 | 0.005 | mg/kg |
| Volatiles | METHYLENE CHLORIDE | 8260B/C | Solid | 68.2-119 | 20.0 | 0.005 | mg/kg |
| Volatiles | NAPHTHALENE | 8260B/C | Solid | 69.9-132 | 20.0 | 0.001 | mg/kg |
| Volatiles | N-BUTYLBENZENE | 8260B/C | Solid | 74.2-134 | 20.0 | 0.01 | mg/kg |

**Table 12.3: QC Targets for Volatiles Accuracy (LCS), Precision and RLs**
*This table is subject to revision without notice*

| Class | Analyte | Method | Matrix | Accuracy (%)** | Prec.** (RPD) | RL | Unit |
|---|---|---|---|---|---|---|---|
| Volatiles | N-HEXANE | 8260B/C | Solid | 59.9-125 | 20.0 | 0.001 | mg/kg |
| Volatiles | N-PROPYLBENZENE | 8260B/C | Solid | 80.2-124 | 20.0 | 0.001 | mg/kg |
| Volatiles | O-XYLENE | 8260B/C | Solid | 78.5-124 | 20.0 | 0.001 | mg/kg |
| Volatiles | P-ISOPROPYLTOLUENE | 8260B/C | Solid | 75.4-132 | 20.0 | 0.0025 | mg/kg |
| Volatiles | PROPENE | 8260B/C | Solid | 10.0-192 | 26.1 | 0.001 | mg/kg |
| Volatiles | SEC-BUTYLBENZENE | 8260B/C | Solid | 77.8-129 | 20.0 | 0.001 | mg/kg |
| Volatiles | STYRENE | 8260B/C | Solid | 79.4-124 | 20.0 | 0.001 | mg/kg |
| Volatiles | TERT-BUTYLBENZENE | 8260B/C | Solid | 77.2-129 | 20.0 | 0.001 | mg/kg |
| Volatiles | TETRACHLOROETHENE | 8260B/C | Solid | 71.1-133 | 20.0 | 0.005 | mg/kg |
| Volatiles | TETRAHYDROFURAN | 8260B/C | Solid | 63.4-122 | 20.0 | 0.005 | mg/kg |
| Volatiles | TOLUENE | 8260B/C | Solid | 76.7-116 | 20.0 | 0.50 | mg/kg |
| Volatiles | TPH (GC/MS) LOW FRACTION | 8260B/C | Solid | 61.5-138 | 20.0 | 0.001 | mg/kg |
| Volatiles | TRANS-1,2-DICHLOROETHENE | 8260B/C | Solid | 70.7-124 | 20.0 | 0.001 | mg/kg |
| Volatiles | TRANS-1,3-DICHLOROPROPENE | 8260B/C | Solid | 73.0-127 | 20.0 | 0.0025 | mg/kg |
| Volatiles | TRANS-1,4-DICHLORO-2-BUTENE | 8260B/C | Solid | 58.4-125 | 20.0 | 0.001 | mg/kg |
| Volatiles | TRICHLOROETHENE | 8260B/C | Solid | 77.2-122 | 20.0 | 0.001 | mg/kg |
| Volatiles | TRICHLOROFLUORO-METHANE | 8260B/C | Solid | 51.5-151 | 20.0 | 0.005 | mg/kg |
| Volatiles | VINYL ACETATE | 8260B/C | Solid | 39.8-156 | 20.0 | 0.01 | mg/kg |
| Volatiles | VINYL CHLORIDE | 8260B/C | Solid | 58.4-134 | 20.0 | 0.001 | mg/kg |
| Volatiles | XYLENES, TOTAL | 8260B/C | Solid | 78.1-123 | 20.0 | 0.002 | mg/kg |
| Volatiles | DI-ISOPROPYL ETHER | 8260B/C | Solid | 70.4-133 | 20.0 | 0.001 | mg/kg |
| Volatiles | ETHYL TERT-BUTYL ETHER | 8260B/C | Solid | 81.4-110 | 25.0 | 0.001 | mg/kg |
| Volatiles | METHYL-TERT-BUTYL ETHER | 8260B/C | Solid | 73.0-129 | 20.0 | 0.001 | mg/kg |
| Volatiles | TERT-BUTYL ALCOHOL | 8260B/C | Solid | 59.5-170 | 25.0 | 0.050 | mg/kg |
| Volatiles | TERT-AMYL METHYL ETHER | 8260B/C | Solid | 82-115 | 25.0 | 0.001 | mg/kg |
| Volatiles | 2-PROPANOL | 8260B/C | Solid | 70.0-130 | 25.0 | 0.05 | mg/kg |
| Volatiles | GRO | 8015B/C/D | GW, WW | 66.3-133 | 20.0 | 0.100 | mg/L |
| Volatiles | BENZENE | 8021B, 602, 6200C | GW, WW | 70.0-130 | 20.0 | 0.0005 | mg/L |
| Volatiles | TOLUENE | 8021B, 602, 6200C | GW, WW | 70.0-130 | 20.0 | 0.005 | mg/L |
| Volatiles | ETHYLBENZENE | 8021B, 602, 6200C | GW, WW | 70.0-130 | 20.0 | 0.0005 | mg/L |
| Volatiles | M&P-XYLENE | 8021B, 602, 6200C | GW, WW | 70.0-130 | 20.0 | 0.001 | mg/L |
| Volatiles | O-XYLENE | 8021B, 602, 6200C | GW, WW | 70.0-130 | 20.0 | 0.0005 | mg/L |
| Volatiles | MTBE | 8021B, 602, 6200C | GW, WW | 70.0-130 | 20.0 | 0.001 | mg/L |
| Volatiles | GRO | 8015B/C/D | Solid | 63.6-136 | 20.0 | 0.10 | mg/kg |

**Table 12.3: QC Targets for Volatiles Accuracy (LCS), Precision and RLs**
*This table is subject to revision without notice*

| Class | Analyte | Method | Matrix | Accuracy (%)** | Prec.** (RPD) | RL | Unit |
|---|---|---|---|---|---|---|---|
| Volatiles | BENZENE | 8021B | Solid | 70.0 - 130 | 20.0 | 0.0005 | mg/kg |
| Volatiles | TOLUENE | 8021B | Solid | 70.0 - 130 | 20.0 | 0.005 | mg/kg |
| Volatiles | ETHYLBENZENE | 8021B | Solid | 70.0 - 130 | 20.0 | 0.001 | mg/kg |
| Volatiles | M&P-XYLENE | 8021B | Solid | 70.0 - 130 | 20.0 | 0.001 | mg/kg |
| Volatiles | O-XYLENE | 8021B | Solid | 70.0 - 130 | 20.0 | 0.0005 | mg/kg |
| Volatiles | MTBE | 8021B | Solid | 70.0 - 130 | 20.0 | 0.001 | mg/kg |
| Volatiles | 1,1,1,2-TETRACHLOROETHANE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | 1,1,1-TRICHLOROETHANE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | 1,1,2,2-TETRACHLOROETHANE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | 1,1,2-TRICHLOROETHANE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | 1,1-DICHLOROETHANE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | 1,1-DICHLOROETHENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | 1,1-DICHLOROPROPENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | 1,2,3-TRICHLOROBENZENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | 1,2,3-TRICHLOROPROPANE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | 1,2,4-TRICHLOROBENZENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | 1,2,4-TRIMETHYLBENZENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | 1,2-DIBROMO-3-CHLOROPROPANE | 524.2 | DW | 70.0-130 | 25.0 | 0.0010 | mg/L |
| Volatiles | 1,2-DIBROMOETHANE | 524.2 | DW | 70.0-130 | 25.0 | 0.0010 | mg/L |
| Volatiles | 1,2-DICHLOROBENZENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | 1,2-DICHLOROETHANE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | 1,2-DICHLOROPROPANE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | 1,3,5-TRIMETHYLBENZENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | 1,3-DICHLOROBENZENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | 1,3-DICHLOROPROPANE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | 1,4-DICHLOROBENZENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | 2,2-DICHLOROPROPANE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | 2-CHLOROTOLUENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | 4-CHLOROTOLUENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | 4-ISOPROPYLTOLUENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | ACETONE | 524.2 | DW | 70.0-130 | 25.0 | 0.01 | mg/L |
| Volatiles | BENZENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | BROMOBENZENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | BROMOCHLOROMETHANE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |

**Table 12.3: QC Targets for Volatiles Accuracy (LCS), Precision and RLs**
***This table is subject to revision without notice***

| Class | Analyte | Method | Matrix | Accuracy (%)** | Prec.** (RPD) | RL | Unit |
|---|---|---|---|---|---|---|---|
| Volatiles | BROMODICHLOROMETHANE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | BROMOFORM | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | BROMOMETHANE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | CARBON TETRACHLORIDE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | CHLOROBENZENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | CHLOROETHANE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | CHLOROFORM | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | CHLOROMETHANE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | CIS-1,2-DICHLOROETHENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | CIS-1,3-DICHLOROPROPENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0010 | mg/L |
| Volatiles | DIBROMOMETHANE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | DICHLORODIFLUORO-METHANE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | ETHYLBENZENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | HEXACHLOROBUTADIENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | ISOPROPYLBENZENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | METHYLENE CHLORIDE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | METHYL-T-BUTYL ETHER | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | NAPHTHALENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0050 | mg/L |
| Volatiles | N-BUTYLBENZENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | N-PROPYLBENZENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | SEC-BUTYLBENZENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | STYRENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | TERT-BUTYLBENZENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | TETRACHLOROETHENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | TOLUENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | TRANS-1,2-DICHLOROETHENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | TRANS-1,3-DICHLOROPROPENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0010 | mg/L |
| Volatiles | TRICHLOROETHENE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | TRICHLOROFLUORO-METHANE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | VINYL CHLORIDE | 524.2 | DW | 70.0-130 | 25.0 | 0.0005 | mg/L |
| Volatiles | XYLENES – TOTAL | 524.2 | DW | 70.0-130 | 25.0 | 0.0015 | mg/L |

** *Specific organizations may require limits that supersede the values listed. Duplicate LCS analyses are not analyzed for Ohio/EPA VAP projects.*

*All target analytes and criteria listed in this table may not be applicable to samples analyzed for the Ohio EPA/VAP.*

## *13.0 CORRECTIVE ACTION*

All target analytes and criteria listed in this section may not be applicable to samples analyzed for the Ohio EPA/VAP.

13.1 In the event that a nonconformance occurs in conjunction with the analytical batch, a corrective action response (CAR) form must be completed. The cause of the event is stated on the form and the measures taken to correct the nonconformance clearly defined. The effectiveness of the corrective action must be assessed and noted. The CARs are kept on file by the Regulatory Affairs Department. Corrective action procedures are documented in SOP #030208, *Corrective and Preventive Action*

13.2 Required Corrective Action

Control limits have been established for each type of analysis. When these limits are exceeded, corrective action must be taken. Calculated sample spike control limits are also used.

All samples and procedures are governed by ESC's quality assurance program. General corrective actions are as follows; however additional and more specific direction is provided in the specific determinative procedure. For more information, see the appropriate determinative SOP.

13.2.1 Laboratory QC Criteria and Appropriate Corrective Actions

If the analytical method contains acceptance/rejection criteria and it is more stringent than those controls generated by the laboratory, the method criteria takes precedence.

13.2.2 Out Of Control Blanks: Applies to Method, Trip, Rinsate & Instrument Blanks

<u>Rejection Criteria</u> - Blank reading is more than twice the background absorbance or more than ½RL.

<u>Corrective Action</u> - Blanks are re-analyzed and the response is assessed. Standard curves and samples are evaluated for any obvious contamination that is isolated or uniform throughout the run. If necessary, reagents are re-prepared. Analyses are not initiated until the problem is identified and solved. If samples have already been prepared or analyzed, the Department Supervisor is consulted to determine if data needs to be rejected or if samples need to be re-prepared.

**NOTE:** Any detection in a method blank associated with samples being analyzed in conjunction with the Ohio EPA/VAP must be at or below the RL. Otherwise, corrective action(s) listed in the Ohio EPA/VAP SOPs (see Table 10.1) must occur.

13.2.3 Out Of Control Laboratory Control Standards (LCS & LCSD)

Rejection Criteria - If the performance is outside of lab-generated control limits which are calculated as the mean of at least 20 data points +/- 3 times the standard deviation of those points (Listed in Section 12) and the marginal excedence allowance is surpassed (see section 12.2).

Corrective Action - Instrument settings are checked and the LCS standard is re-analyzed. If the LCS is still out of control, instrumentation is checked for systemic problems and repaired (if necessary). Re-calibration is performed and the samples affected since the last in control reference standard are reanalyzed. The group leader or Department Supervisor is consulted for further action.

**NOTE:** The use of marginal exceedances is not allowed in the Ohio EPA/VAP. Duplicate LCS analyses are not analyzed for Ohio/EPA VAP projects.

13.2.4 Out Of Control Matrix Spike Samples

Rejection Criteria - If either the MS or MSD sample is outside the established control limits.

Corrective Action - Any compound that is outside of these limits is considered to be ‘out of control’ and must be qualified appropriately. Batch acceptance, however, is based on method blank and LCS performance, not on MS/MSD recoveries. Specific methods, customers, and programs may require further corrective action in some cases.

13.2.5 Out Of Control Duplicate Samples

Rejection Criteria - Lab-generated maximum RPD limit (as listed under precision in Section 12)

Corrective Action - Any compound that is outside of these limits is considered to be ‘out of control’ and must be qualified appropriately. Batch acceptance, however, is based on method blank and LCS performance. Specific methods, customers, and programs may require further corrective action in some cases.

13.2.7 Out Of Control Calibration Standards: ICV, CCV, SSCV

Rejection Criteria - If the performance is outside of method requirements.

Corrective Action - Instrument settings are checked, calibration verification standard is re-analyzed. If the standard is still out of control, re-calibration is performed, and samples affected since the last in control reference standard are rerun. The group leader or Department Supervisor is consulted for further action.

## *14.0 RECORD KEEPING*

***TABLE 12.1 Data Reduction Formulas***
*This table is subject to revision without notice*

| PARAMETER | FORMULA |
|---|---|
| GC/MS – Analyte Response Factor | response of analyte primary ion {*area*} x concentration of analyte (ug/L)<br>response of ISTD primary ion {*area*} x concentration of ISTD (ug/L)<br>*Calculations performed by HP Enviroquant Software* |
| GC/MS – Sample Analyte Concentration | response of primary ion in analyte x int. std concentration. {*ppbv*} x dilution factor<br>response factor {*area/(mg/ml)*} x initial volume-mass {*ml or g*} x int. std cal. {area}<br>*Calculations performed by HP Enviroquant Software* |

## 12.2 VALIDATION

The validation process consists of data generation, reduction review, and reporting results. Once data reduction is complete, validation is conducted by verification that the QC samples are within acceptable QC limits and that all documentation is complete, including the analytical report and associated QC. See Table 12.3 by method for current QC targets and controls and current reporting limits.

***Organic Control Limits*** - The organic QC targets are statutory in nature; warning and control limits for organic analyses are initially established for groups of compounds based on preliminary method validation data. When additional data becomes available, the QC targets are reviewed. All QC targets are routinely re-evaluated at least annually (and updated, if necessary) against laboratory historical data to insure that the limits continue to reflect realistic, method achievable goals.

## 12.3 REPORTING

Reporting procedures are documented in SOP #030201, *Data Handling and Reporting.*

**Table 12.3: QC Targets for Air Accuracy (LCS), Precision and RLs**
***This table is subject to revision without notice***

| Analyte | Method | Matrix | Accuracy (%) | Prec.* (% RPD) | RL | Unit |
|---|---|---|---|---|---|---|
| 1,1,1-Trichloroethane | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| 1,1,2,2-Tetrachloroethane | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| 1,1,2-Trichloroethane | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| 1,1-Dichloroethane | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| 1,1-Dichloroethene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| 1,2,4-Trichlorobenzene | TO-15 | Air | 53.6-154 | 25.0 | 0.63 | ppbv |
| 1,2,4-Trimethylbenzene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |

**Table 12.3: QC Targets for Air Accuracy (LCS), Precision and RLs**
***This table is subject to revision without notice***

| **Analyte** | **Method** | **Matrix** | **Accuracy (%)** | **Prec.* (% RPD)** | **RL** | **Unit** |
|---|---|---|---|---|---|---|
| 1,2-Dibromoethane | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| 1,2-Dichlorobenzene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| 1,2-Dichloroethane | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| 1,2-Dichloropropane | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| 1,3,5-Trimethylbenzene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| 1,3-Butadiene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| 1,3-Dichlorobenzene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| 1,4-Dichlorobenzene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| 1,4-Dioxane | TO-15 | Air | 48.0-156 | 25.0 | 0.2 | ppbv |
| 1,1,1-Trichloroethane | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| 2,2,4-Trimethylpentane | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| 2-Chlorotoluene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| 2-Propanol | TO-15 | Air | 50.4-152 | 25.0 | 0.2 | ppbv |
| 4-Ethyltoluene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Acetone | TO-15 | Air | 70.0-130 | 25.0 | 1.25 | ppbv |
| Allyl Chloride | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Benzene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Benzyl Chloride | TO-15 | Air | 55.6-160 | 25.0 | 0.2 | ppbv |
| Bromomethane | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Bromodichloromethane | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Bromoform | TO-15 | Air | 70.0-130 | 25.0 | 0.6 | ppbv |
| Carbon Disulfide | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Carbon Tetrachloride | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Chlorobenzene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Chloroethane | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Chloroform | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Chloromethane | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Cis-1,2-Dichloroethene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Cis-1,3-Dichloropropene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Cyclohexane | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Dibromochloromethane | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Dichlorodifluoromethane | TO-15 | Air | 56.7-140 | 25.0 | 0.2 | ppbv |
| Ethanol | TO-15 | Air | 34.3-167 | 25.0 | 0.63 | ppbv |
| Ethyl Acetate | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Ethylbenzene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |

**Table 12.3: QC Targets for Air Accuracy (LCS), Precision and RLs**
***This table is subject to revision without notice***

| **Analyte** | **Method** | **Matrix** | **Accuracy (%)** | **Prec.* (% RPD)** | **RL** | **Unit** |
|---|---|---|---|---|---|---|
| Freon-11 | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Freon-12 | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Freon-113 | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Freon-114 | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Gasoline Range Organics | TO-15 | Air | 70.0-130 | 25.0 | 50 | ppbv |
| Heptane | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Hexachloro-1,3-Butadiene | TO-15 | Air | 62.1-143 | 25.0 | 0.63 | ppbv |
| Hexane | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Isopropylbenzene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| M&P-Xylene | TO-15 | Air | 70.0-130 | 25.0 | 0.4 | ppbv |
| Methyl Butyl Ketone | TO-15 | Air | 47.9-165 | 25.0 | 1.25 | ppbv |
| Methyl Ethyl Ketone | TO-15 | Air | 70.0-130 | 25.0 | 1.25 | ppbv |
| Methyl Isobutyl Ketone | TO-15 | Air | 55.3-154 | 25.0 | 1.25 | ppbv |
| Methyl Methacrylate | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Methyl tert Butyl Ether | TO-15 | Air | 70.0-130 | 25.0 | 0.31 | ppbv |
| Methylene Chloride | TO-15 | Air | 70.0-130 | 25.0 | 0.63 | ppbv |
| Naphthalene | TO-15 | Air | 52.0-158 | 25.0 | 0.63 | ppbv |
| N-butyl benzene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| N-propyl benzene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| o-Xylene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Propene | TO-15 | Air | 53.9-143 | 25.0 | 0.4 | ppbv |
| Sec-butyl benzene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Styrene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| t-Butyl Alcohol | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Tert-butyl benzene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Tetrachloroethylene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Tetrahydrofuran | TO-15 | Air | 65.0-140 | 25.0 | 0.2 | ppbv |
| Toluene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Trans-1,3-Dichloropropene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Trans-1,2-Dichloroethene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Trichloroethylene | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Vinyl Acetate | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Vinyl Bromide | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| Vinyl Chloride | TO-15 | Air | 70.0-130 | 25.0 | 0.2 | ppbv |
| 1,1,1-Trichloroethane | TO-15SIM | Air | 70.0-130 | 25.0 | 0.02 | ppbv |

**Table 12.3: QC Targets for Air Accuracy (LCS), Precision and RLs**
***This table is subject to revision without notice***

| **Analyte** | **Method** | **Matrix** | **Accuracy (%)** | **Prec.* (% RPD)** | **RL** | **Unit** |
|---|---|---|---|---|---|---|
| 1,1,2,2-Tetrachloroethane | TO-15SIM | Air | 70.0-130 | 25.0 | 0.02 | ppbv |
| 1,1,2-Trichloroethane | TO-15SIM | Air | 70.0-130 | 25.0 | 0.03 | ppbv |
| 1,1-Dichloroethane | TO-15SIM | Air | 70.0-130 | 25.0 | 0.02 | ppbv |
| 1,1-Dichloroethene | TO-15SIM | Air | 70.0-130 | 25.0 | 0.02 | ppbv |
| 1,2-Dibromoethane | TO-15SIM | Air | 70.0-130 | 25.0 | 0.02 | ppbv |
| 1,2-Dichloropropane | TO-15SIM | Air | 70.0-130 | 25.0 | 0.03 | ppbv |
| 1,4-Dichlorobenzene | TO-15SIM | Air | 70.0-130 | 25.0 | 0.02 | ppbv |
| Benzene | TO-15SIM | Air | 70.0-130 | 25.0 | 0.02 | ppbv |
| Carbon Tetrachloride | TO-15SIM | Air | 70.0-130 | 25.0 | 0.02 | ppbv |
| Chloroethane | TO-15SIM | Air | 70.0-130 | 25.0 | 0.04 | ppbv |
| Chloroform | TO-15SIM | Air | 70.0-130 | 25.0 | 0.02 | ppbv |
| Chloromethane | TO-15SIM | Air | 70.0-130 | 25.0 | 0.03 | ppbv |
| Cis-1,2-Dichloroethene | TO-15SIM | Air | 70.0-130 | 25.0 | 0.02 | ppbv |
| Cis-1,3-Dichloropropene | TO-15SIM | Air | 70.0-130 | 25.0 | 0.03 | ppbv |
| Ethylbenzene | TO-15SIM | Air | 70.0-130 | 25.0 | 0.03 | ppbv |
| Tetrachloroethylene | TO-15SIM | Air | 70.0-130 | 25.0 | 0.02 | ppbv |
| Trans-1,3-Dichloropropene | TO-15SIM | Air | 70.0-130 | 25.0 | 0.03 | ppbv |
| Trans-1,2-Dichloroethene | TO-15SIM | Air | 70.0-130 | 25.0 | 0.02 | ppbv |
| Trichloroethylene | TO-15SIM | Air | 70.0-130 | 25.0 | 0.02 | ppbv |
| Vinyl Acetate | TO-15SIM | Air | 70.0-130 | 25.0 | 0.02 | ppbv |
| Vinyl Chloride | TO-15SIM | Air | 70.0-130 | 25.0 | 0.02 | ppbv |
| Methane | RSK-175 | Air/ Headspace | 85.0-115 | 20.0 | 0.01 | ppmv |
| Ethane | RSK-175 | Air/ Headspace | 85.0-115 | 20.0 | 0.0129 | ppbmv |
| Ethene | RSK-175 | Air/ Headspace | 85.0-115 | 20.0 | 0.0127 | ppmv |
| Propane | RSK-175 | Air/ Headspace | 85.0-115 | 20.0 | 0.0186 | ppmv |
| Acetylene | RSK-175 | Air/ Headspace | 85.0-115 | 20.0 | 0.0208 | ppmv |
| Carbon Dioxide | ASTM D1946 | Air | 70.0-130 | 20.0 | 0.50 / 200 | % / ppmv |
| Carbon Monoxide | ASTM D1946 | Air | 70.0-130 | 20.0 | 0.50 / 200 | % / ppmv |
| Methane | ASTM D1946 | Air | 70.0-130 | 20.0 | 0.50 / 200 | % / ppmv |
| Nitrogen | ASTM D1946 | Air | 70.0-130 | 20.0 | 0.50 / 200 | % / ppmv |
| Oxygen | ASTM D1946 | Air | 70.0-130 | 20.0 | 0.50 / 200 | % / ppmv |
| Helium | ASTM D1946 | Air | 70.0-130 | 25.0 | 100 | ppmv |
| Methanol | MEETAC | Water/Soil | 70.0-130 | 20.0 | 20.0/100 | ppb / ppm |

**Table 12.3: QC Targets for Air Accuracy (LCS), Precision and RLs**
***This table is subject to revision without notice***

| **Analyte** | **Method** | **Matrix** | **Accuracy (%)** | **Prec.* (% RPD)** | **RL** | **Unit** |
|---|---|---|---|---|---|---|
| Ethanol | MEETAC | Water/Soil | 70.0-130 | 20.0 | 20.0/100 | ppb / ppm |

* Duplicate LCS analyses are not analyzed for Ohio/EPA VAP projects.
All target analytes and criteria listed in this table may not be applicable to samples analyzed for the Ohio EPA/VAP.

## *13.0 CORRECTIVE ACTION*

All target analytes and criteria listed in this section may not be applicable to samples analyzed for the Ohio EPA/VAP.

13.1 In the event that a nonconformance occurs in conjunction with the analytical batch, a corrective action response (CAR) form must be completed. The cause of the event is stated on the form and the measures taken to correct the nonconformance clearly defined. The effectiveness of the corrective action must be assessed and noted. The CARs are kept on file by the Regulatory Affairs Department. Corrective action procedures are documented in SOP #030208, *Corrective and Preventive Action*

13.2 Required Corrective Action

Control limits have been established for each type of analysis. When these limits are exceeded, corrective action must be taken. Calculated sample spike control limits are also used.

All samples and procedures are governed by ESC's quality assurance program. General corrective actions are as follows; however additional and more specific direction is provided in the specific determinative procedure. For more information, see the appropriate determinative SOP

13.2.1 Laboratory QC Criteria and Appropriate Corrective Actions

If the analytical method contains acceptance/rejection criteria and it is more stringent than those controls generated by the laboratory, the method criteria takes precedence.

13.2.2 Calibration Verification Criteria Are Not Met.

Rejection Criteria – See Table 8.5.

Corrective Action – Instrument settings are checked. The standard is reviewed for obvious cause. The standard may require re-analysis or the instrument may require recalibration.

13.2.3 Out Of Control Blanks:

Rejection Criteria - Blank reading is more than ½ the RL.

Corrective Action - Instrument settings are checked. The Blank is re-analyzed. If the blank is still out of control, bakeout of the system is performed and the blank is re-analyzed.

**NOTE:** Any detection in a method blank associated with samples being analyzed in conjunction with the Ohio EPA/VAP must be at or below the RL. Otherwise, corrective action(s) listed in the Ohio EPA/VAP SOPs (see Table 10.1) must occur.

13.2.4 Out Of Control Laboratory Control Standards (LCS)

Rejection Criteria - If the performance is outside of lab-generated control (Listed in Table 12.3).

Corrective Action - Instrument settings are checked. The LCS standard is re-analyzed. If the LCS is still out of control, re-calibration is performed, and samples affected since the last in control reference standard are re-analyzed.

**NOTE:** Duplicate LCS analyses are not analyzed for Ohio/EPA VAP projects.

## *14.0 RECORD KEEPING*

Record keeping is outlined in SOP #030230, *Standards Logger*, *SOP #030227, Data Review* and SOP #030201, *Data Handling and Reporting*

## *15.0 QUALITY AUDITS*

System and data quality audits are outlined in the ESC Quality Assurance Manual Version 13.0 and in *SOP #010104, Internal Audits*.

## *16.0 REVISIONS*

The Regulatory Affairs Department has an electronic version of this Quality Assurance Manual with tracked changes detailing all revisions made to the previous version. This version is available upon request. Revisions to the previous version of this appendix are summarized in the table below.

| **Document** | **Revision** |
|---|---|
| Quality Assurance Manual Version 16.0 (Appendix VIII) | Section 7.1 – Added note regarding Ohio EPA/VAP holding time definition.<br>Section 8.0 – Added “revision without notice” sentence.<br>Table 8.1 – Added footnote.<br>Table 8.2 – Added footnote.<br>Tables 8.5 – Added information to title and added footnote.<br>Section 9.3 – Added footnote to table.<br>Table 10.1 – Added Ohio EPA/VAP SOP Section.<br>Section 11.2 – Added note regarding Ohio EPA/VAP LCS policy.<br>Section 11.3 – Added not regarding Ohio EPA/VAP blank policy.<br>Table 12.1 – Added information to title.<br>Table 12.3 – Added 2 footnotes.<br>Table 13.0 – Added sentence regarding Ohio EPA/VAP. |

# APPENDIX N

# SITE-SPECIFIC HEALTH AND SAFETY PLAN

**PES Environmental, Inc.**
Engineering & Environmental Services

# SITE-SPECIFIC HEALTH & SAFETY PLAN

Former American Linen Supply Site
700 Dexter Avenue North
Seattle, Washington

Prepared by:
PES ENVIRONMENTAL, INC.
1215 Fourth Avenue, Suite 1350
Seattle, Washington 98161
206-529-3980

**Project Number: 1413.001.02**

**Date:** **January 8, 2018**
**Revision:** **2.0**

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# SITE HEALTH AND SAFETY PLAN REVIEW AND APPROVALS

**Former American Linen Supply Site**
**700 Dexter Avenue North**
**Seattle, Washington**

PES Environmental, Inc. ("PES") has developed this Site-Specific Health and Safety Plan ("HASP") for use by PES, its subcontractors, and visitors to the American Linen Supply ("American Linen") Site ("Site"). PES claims no responsibility for its use by others. This plan covers activities with the potential for exposure to contaminated environmental media during the project. The intent of this plan is to meet the requirements of the Washington State Division of Occupational Safety and Health ("DOSH") Hazardous Waste Operations Regulation (WAC 296-843). It is not intended to address normal safety practices on construction sites, such as those covered in the DOSH Safety Standards for Construction Work (WAC 296-155). Finally, even with this plan in place, each subcontractor remains responsible for the health and safety of their own individual employees and subcontractors.

Note: This plan is written for the specific site conditions, purposes, dates, and personnel specified. This HASP must be re-evaluated and updated annually or when site conditions or scope of work changes.

**Project Number: 1413.001.02**

**Date:** **January 8, 2018**
**Revision:** **2.0**

Approved by: Kelly Rankich
Kelly Rankich
Health and Safety Officer

Date: 1/8/18

Approved by: Bill Halden
Bill Haldeman
Project Manager

Date: 1/8/18

## TABLE OF CONTENTS

## 1.0 HEALTH AND SAFETY CONTACT INFORMATION

| | |
|---|---|
| **SITE LOCATION:** | Former American Linen Supply<br>700 Dexter Avenue North<br>Seattle, WA |

**See Attached Figure 1 for Site Plan and Directions**

| | |
|---|---|
| **PROJECT MANAGER:** | Bill Haldeman, PES Environmental<br>206-529-3980, ext. 107 (desk)<br>425-922-0254 (mobile) |
| **SITE SAFETY OFFICER:** | Karsten Springstead, PES Environmental,<br>Chris DeBoer, PES Environmental, or<br>Shannon McKernan, PES Environmental<br>206-529-3980, ext. 110 (desk)<br>206-914-0308 (Karsten mobile)<br>206-914-5055 (Chris mobile)<br>813-777-7575 (Shannon mobile) |
| **CLIENT CONTACT:** | John Moshy, BMR-Dexter LLC<br>858-485-9840 (office)<br>858-829-7709 (mobile) |
| **NEAREST WALK-IN CLINIC:** | Swedish South Lake Union Primary Care<br>510 Boren Ave N, Seattle, WA 98109<br>(206) 320-5200 |
| **NEAREST HOSPITAL:** | Harborview Medical Center<br>325 9th Avenue, Seattle, WA<br>(206)744-3000 |

**See Attached Figures 2 and 3 for Routes to the Walk-in Clinic and Hospital**

## 2.0 SCOPE OF WORK

This HASP is intended to cover activities in areas where contamination may be encountered at the American Linen Site, in Seattle, Washington. These activities include:

- Site reconnaissance;
- Groundwater monitoring and sampling;
- Monitoring well installation and development;
- Soil boring drilling;
- Aquifer testing;
- Injection well installation and development;
- ISCO and EVO injections;
- Well decommissioning; and
- Residuals management.

The PES Safety Practices for Field Personnel is included with this plan as Appendix A. A job hazard analysis that evaluates the hazards associated with each of these tasks is included with this HASP as Appendix B. The job hazard analysis includes more detail on specific tasks to be performed as part of this project.

This HASP is limited to the activities listed above. If PES personnel are involved in any additional activities for this project, this HASP must be revised to address the specific health and safety concerns related to those activities. Such work cannot be initiated until the revised HASP has been updated and approved.

## 3.0 SITE CHARACTERISTICS

### 3.1 Site Location and Description

The 700 Dexter Avenue North Property ("Property") consists of a single tax parcel (King County parcel number 224900-0285) that covers approximately 61,440 square feet (1.4 acres) of land in the South Lake Union neighborhood of Seattle, Washington. BMR-Dexter LLC currently owns the Property. The Site is located in Section 30, Township 25 North, Range 4 East, Willamette Meridian in King County, Washington. The Property is currently zoned for mixed use (SM 160/85-240) and is within the 200-foot buffer surrounding the historic shoreline of Lake Union.

The Property previously contained a building with four additions that were constructed between 1925 and 1966. The Property buildings were demolished in February and March 2013, with the majority of the Property covered by concrete building slabs or asphalt. Potable water, sewer, and waste disposal services are not currently provided to the Property.

### 3.2 Site History

Residences exclusively occupied the Property prior to construction of the first commercial building on the southern half of the Property in 1925. In 1930, a fueling facility with several underground storage tanks ("USTs") and two dispenser islands was constructed in the northwest corner of the Property. Building additions were constructed between 1947 and 1966. Four 6,000- gallon USTs containing heating oil in association with the boiler system were installed in 1947, a fuel dispenser with as many as three USTs was constructed on the northeast portion of the Property between 1947 and 1966, and a 1930-vintage gasoline service station was demolished in 1966. Commercial operations at the Property included a parking garage, an automotive repair facility, laundry operations, and dry cleaning operations. Dry cleaning was conducted on the Property as early as 1966, and washing machines operated on the western portion of the Property reportedly leaked solvents into the subsurface. The dry cleaning machines were no longer present on the Property by 1990. In 1986, a wastewater treatment facility for the commercial laundry operations, including several aboveground storage tanks (containing acids, caustics, polymers, sludge, and water) were installed. Waste material derived from the wastewater treatment facility was either directly discharged through the sewer system or conveyed into an on-Property disposal container. In the mid-1990s, commercial laundry operations ceased, the wastewater treatment system was removed, and the buildings were leased to various tenants, including several automotive repair shops, a bakery, and a car rental office.

As a result of past/current activities on the Property, the following contaminants have been identified in soil and/or groundwater:

- Petroleum hydrocarbons (gasoline-, diesel-, and oil-range); and
- Volatile organic compounds ("VOCs").

## 4.0 PERSONNEL REQUIREMENTS

### 4.1 Employee and Contractor Responsibilities

Each person is responsible for his/her own health and safety, for completing tasks in a safe manner, and for reporting any unsafe acts or conditions to his/her supervisor and the Project Manager ("PM"). All persons on site are responsible for continuous adherence to health and safety procedures during the performance of any project work. In no case may work be performed in a manner which conflicts with the intent of, or the inherent safety precautions expressed in, this HASP or the client's health and safety policies.

After due warning, persons who violate procedure and work rules may be dismissed from the site, terminated, or have their contract revoked. Blatant disregard or repeated infractions of health and safety policies are grounds for disciplinary action up to, and including, dismissal, and/or removal from the project.

All PES and subcontractor personnel are required to read and acknowledge their understanding of this HASP. Safety acknowledgement forms are included in Appendix C. All project personnel are expected to abide by the requirements of this HASP and cooperate with project management and safety representatives in ensuring a safe and healthful work site. Site personnel are required to immediately report any of the following to the Site PM or Project Scientist:

- Accidents and injuries, no matter how minor;
- Unexpected or uncontrolled release of chemical substances;
- Any sign or symptoms of chemical exposure;
- Any unsafe or malfunctioning equipment; and
- Any changes in site conditions which may affect the health and safety of project personnel.

No one is permitted on Site without prior approval of the PES Project Supervisor or Project Manager or his or her designee.

### 4.2 Specific Site Organization Structure

| **Team Member** | **Function** |
|---|---|
| Bill Haldeman | Project Manager (PES) |
| Nick Pogoncheff | Corporate Health and Safety Manager (PES) |
| Kelly Rankich | Office Health and Safety Manager (PES) |
| Karsten Springstead | Site Safety Officer (PES) |
| Chris DeBoer | Site Worker/Alternate Site Safety Officer (PES) |
| Shannon McKernan | Site Worker/Alternate Site Safety Officer (PES) |
| Russ Stolsen | Site Worker (PES) |

Duties of the Project Manager include:

- Maintain control, authority, and responsibility for health and safety on the project;
- Act as the liaison with the client regarding project health and safety to ensure adequate precautions are made for protection of PES staff;
- Support the Corporate Health and Safety Manager in developing the HASP;
- Support the Site Safety Officer in providing the required equipment and authority required to carry out the project safely; and
- Maintain and provide quality control of all health and safety documentation, including site briefing forms, HASP signature sheet, air monitoring records, accident reports, etc.

Duties of the Corporate Health and Safety Manager include:

- Develop and coordinate the HASP;
- Determine appropriate monitoring, if necessary, so that employees are not exposed to hazardous substances above established PELs or action levels per this plan;
- Communicate requirements to the PES Project Manager;
- Respond to field requests for assistance in safety and health from PES employees and the Site Safety Officer ("SSO"); and
- Provide assistance in obtaining training of site workers, hazard communication, and other assistance, as required.

Duties of the SSO include:

- Conduct daily safety briefings;
- Maintain sign in sheets for daily briefings and HASP review for PES employees and subcontractors;
- Ensure PES responsibilities for safety and health are being implemented by daily inspections;
- Implement Site Safety and Health requirements in the field;
- Monitor site conditions during work activities where hazardous environments may be present;
- Record any variances in conditions;
- Record any illness, disease, injury, or death of any person on the site;
- Communicate requirements to field personnel and subcontractors;
- Consult with the PES Corporate Health and Safety Manager and Project Manager regarding new or unanticipated site hazards;

- Perform safety record keeping; and
- Verify that medical monitoring and training have been performed.

Duties of the Site Workers include:

- Read and follow the HASP;
- Check all personal safety equipment to ensure it is in good working condition prior to entering the site;
- Immediately report any accidents/illness, spills, unsafe conditions, any unusual smells or chemical smell to the SSO;
- Incidents must be reported on a daily basis in detail for spills or accidents; and
- Immediately report any symptoms of exposure.

## 4.3 Training

### 4.3.1 Classroom Training

All personnel conducting site work involving intrusive activities where the potential exists for exposure to contaminated soils or groundwater (drilling, excavation, trench work, etc.) shall have completed 40 hours of classroom-style health and safety training and three days of on-site training, as required by OSHA 29 CFR 1910.120 and WAC 296-843. In addition, the Project Manager and Project Engineer have received an additional eight hours of supervisory training specified by the same regulations.

Forty-hour hazardous waste site trained personnel shall also be current in their annual refresher training and enrolled in the medical surveillance program which shall include the employee’s ability to wear respiratory protection devices.

Personnel performing work activities which are non-intrusive or otherwise not expected to expose them to hazardous chemicals, contaminated soils or groundwater (concrete cutting, electricians, plumbers, surveyors, etc.) are not required to hold the 40-hour hazardous waste training. They shall receive site-specific training concerning the potential hazards associated with this project site.

### 4.3.2 Field Training

An initial site-specific training session or briefing shall be conducted by the PM or SSO prior to commencement of work and/or entering the site. During this initial training session, employees shall be instructed on the following topics:

- Personnel responsibilities;
- Content and implementation of the HASP;
- Site hazards and controls;

- Site-specific hazardous procedures (i.e., intrusive activities, etc.);
- Limited access to and around intrusive work activities (i.e., electricians, plumbers, etc.);
- Medical and training requirements;
- Use of direct reading monitoring equipment;
- Levels of protection;
- Action levels for upgrading/downgrading levels of personal protective equipment (“PPE”); and
- Emergency information, including local emergency response team phone numbers, route to nearest hospital, and emergency response procedures.

In addition to the initial site briefing conducted at the commencement of the project, supplemental brief safety meetings shall be conducted by the SSO to discuss potential health and safety hazards associated with upcoming tasks, and necessary precautions to be taken.

## 4.4 Medical Surveillance

Employees assigned to duties on hazardous waste sites or that require them to wear respirators will, prior to work, be assessed by a physician to determine if they are qualified for the scheduled work. The PES Occupational Health Care Provider for hazardous waste and respiratory protection medical monitoring is:

Valley Medical Occupational Health Clinic
3600 Lind Avenue SW, Suite 170
Renton, Washington
(425) 656-5020

Prior to assignment to duties requiring the use of respirators, each employee will be evaluated by a physician. A description of the type of respirator, duties to be performed, and any other pertinent information will be provided to the physician. The examination will include, but not be limited to the following:

- A history of family, individual, and prior chemical exposures (either work or hobby). This is usually in the form of a written questionnaire;
- A "hands-on" examination by the physician;
- Spirometry testing (test of lung capacity); and
- Other tests that the examining physician feels are advised or as necessary per WAC 296-849-120 (Exposure and Medical Monitoring – benzene exposure).

A written report of findings will be made on each employee listing any restrictions. The medical status of the employees will be assessed at least annually or more often if circumstances indicate the need.

# 5.0 SITE CONTROL

## 5.1 Work Area Control

This project requires that access to the work area be controlled to protect both the worker and the public. This access control may require fences, barricades, traffic control devices, use of flaggers, caution tape, and other methods to keep the work area secure and provide a visual barrier to help keep the curious or unaware public from entering active work areas.

## 5.2 Work Zones

Site control will be maintained by establishing clearly identified work zones. These will include the exclusion zone, decontamination zone (contaminant reduction zone), and support zone, as defined below.

### 5.2.1 Exclusion Zone

Only persons with appropriate training (40-hour Hazardous Waste Operations/8-hour Refresher) and authorization from the Site Safety Officer will enter this zone. Traffic cones, barrier tapes, and warning signs will be used, as necessary, to establish the zone boundary.

### 5.2.2 Decontamination Zone (Contaminant Reduction Zone)

A decontamination zone (contaminant reduction zone) will be established just outside each temporary exclusion zone to decontaminate equipment and personnel, as discussed below. This zone will be clearly delineated from the exclusion zone and support zone using traffic cones, barrier tapes, and warning signs. The decontamination zone shall have boot, glove, and rain gear wash and rinse buckets/wading pools, brushes, and a source of additional water (hose or water buckets) for cleaning. Used wash water will be collected for removal as contaminated water. Care will be taken to prevent contact with used wash water on a daily basis. Damaged or disposable PPE will be placed in plastic garbage bags for interim storage and disposal, as appropriate.

### 5.2.3 Support Zone

A support zone will be established outside the contamination reduction area to stage clean equipment, don protective clothing, take rest breaks, rehydrate, etc. This zone will be clearly delineated from the decontamination zone and exclusion zone using the means noted above.

## 6.0 SITE HAZARD INFORMATION

The job hazard analysis for this project is attached to this Plan as Appendix B. The job hazard analysis includes more detail on specific hazards identified.

### 6.1 Chemical Hazards

The chemical hazards identified at this site include the following:

- Petroleum hydrocarbons (gasoline-, diesel-, and oil-range);
- VOCs, including benzene, toluene, ethylbenzene, and xylenes (BTEX) and tetrachloroethene (also known as perchloroethylene or "PCE"), trichloroethene ("TCE"), cis- and trans-1,2-dichloroethene ("cDCE" and "tDCE"), and vinyl chloride ("VC").; and
- Products used during ISCO injections: (ISOTECSM Catalyst Series 4260 Component-A Powder Mix, ISOTECSM Catalyst Series 4260 Chelopolychempremox-B-2, ISOTECSM Catalyst-4260 Chelopolychempremox-B-4, ISOTECSM Stabilizer 0875, Hydrogen Peroxide 20-34%, EVO, and pH buffer)

The primary routes of exposure for these contaminants are the inhalation of vapors, gases or particulate, inhalation of contaminated soil particulate, direct skin contact with contaminated media, or the accidental ingestion of contaminated soil or water. See the attached Hazardous Substance Fact sheets in Appendix D for additional information.

Table 1 identifies representative site contaminants in each chemical class potentially present that have the highest toxicity potential. The table provides maximum documented concentrations (where applicable) and DOSH Permissible Exposure Limit ("PEL") for each contaminant listed.

**Table 1**
**Maximum Concentration Encountered or Anticipated On Site**

| Identified Site Contaminants | Max. Concentration in Groundwater (ppb) | Max. Concentration in Soil (ppm) | DOSH PEL-TWA (STEL) |
|---|---|---|---|
| TPH – gasoline | 240,000 | 4,100 | 300 ppm (500 ppm) |
| TPH- diesel | 26,000 | 610 | 100 ppm (150 ppm) |
| TPH- oil | 25,000 | 770 | 100 ppm (150 ppm) |
| Benzene | 20,000 | 10 | 1 ppm (5 ppm) |
| Toluene | 22,000 | 160 | 100 ppm (150 ppm) |
| Ethylbenzene | 3,100 | 54 | 100 ppm (125 ppm) |
| Xylenes | 15,000 | 300 | 100 ppm (150 ppm) |
| PCE | 220,000 | 8,270 | 25 ppm (38 ppm) |
| TCE | 21,300 | 113 | 50 ppm (200 ppm) |
| cDCE | 13,000 | 329 | 200 ppm (250 ppm) |
| Vinyl Chloride | 7,500 | 17 | 1 ppm (5 ppm) |

*TWA = 8 hour time-weighted average*
*STEL = Short-term exposure limit*

## 6.2 Physical Hazards

The physical hazards identified at this site include the following:

- Slip/Trip/Hit Fall Hazards
- Excavation and Trenching
- Hazardous Atmospheres
- Flammable Atmospheres
- Dust/Wind
- Heavy Equipment Operations
- Facility/Traffic
- Drilling
- Utility Clearance

- Hand and Power Tools
- Noise
- Back Injury/Heavy Lifting
- Heat Stress
- Cold-Related Illnesses

The PES Safety Practices for Field Personnel is included with this plan as Appendix A. Safety procedures and guidelines for these site-specific hazards are attached to this plan in Appendix B.

### 6.3 Biological Hazards

Specific activities that involve site walkovers in highly vegetated areas may pose potential exposure to insects, plants, and bacteria. Information on these biological hazards that includes preventive measures is attached to this plan in Appendix B. No biological hazards are expected to be encountered at the Site.

## 7.0 SITE HAZARD CONTROL

The job hazard analysis for this project is attached to this Plan as Appendix B. The job hazard analysis includes more detail on specific hazard controls.

### 7.1 Administrative Controls

Avoid exposure to vapors and contaminated dust by working upwind of borings, wells, and other sources of contamination whenever possible. Avoid skin contact with contaminants by wearing specified PPE when working near contaminated soil or water. Avoid exposure via inadvertent ingestion by refraining from eating, drinking, smoking, or chewing gum while working, and by washing hands and face thoroughly before breaks and at the end of the shift.

### 7.2 Engineering Controls

If feasible, use intrinsically safe portable fans to control the concentration of volatile organic compounds in the employee's breathing zone prior to the use of respiratory protection devices. Avoid or eliminate activities that may cause generation of contaminated soil dust.

### 7.3 Personal Protective Equipment

The initial protection level for all site activities is Level D. As site activities progress, levels of PPE are subject to change or to modification. Upgrading of PPE can occur when action levels are exceeded or whenever the need arises to protect the safety and health of site personnel. Levels of PPE will not be downgraded without prior approval from the Project Health and Safety Manager or Technician.

## Table 2
## Protection Levels

| Activity | Initial Level of Protection | Equipment Requirements |
|---|---|---|
| General Site Activities outside of the exclusion zone | D | Work clothing, hardhat, steel-toed work boots, and eye protection. Wear traffic vests on site if working during vehicular traffic hours or around heavy equipment. Work gloves, if required. |
| Drilling activities | D | Protection for General Site Activities, plus wear nitrile gloves and Tyvek coveralls when the possibility exists for contact with contaminated water or soil. Use hearing protection when working near the drill rig, excavator, etc. Upgrade to Level C protection if exposure monitoring results warrant. |
| Well Installation, Development, and Abandonment | D | Protection for General Site Activities, plus wear nitrile gloves when the possibility exists for contact with contaminated water or soil. Change gloves frequently to minimize the chance for breakthrough. Use a face-shield if the chance exists for splash onto face or clothing. Upgrade to Level C protection if exposure monitoring results warrant. |
| Aquifer Testing and Injection | D | Protection for General Site Activities, plus wear nitrile gloves when the possibility exists for contact with contaminated water or soil. Change gloves frequently to minimize the chance for breakthrough. Use a face-shield if the chance exists for splash onto face or clothing. Upgrade to Level C protection if exposure monitoring results warrant. |
| Groundwater Monitoring and Sampling | D | Protection for General Site Activities, plus wear nitrile gloves when the possibility exists for contact with contaminated water. Change gloves frequently to minimize the chance for breakthrough. Use a face-shield if the chance exists for splash onto face or clothing. Upgrade to Level C protection if exposure monitoring results warrant. |

## 7.4 Decontamination

### 7.4.1 Personnel

Procedures for decontamination must be followed to prevent the spread of contamination and to eliminate the potential for chemical exposure. A decontamination station will be set up at each activity site where contaminated media may be encountered in the contamination reduction zone. Personnel are expected to perform a gross decontamination prior to leaving the exclusion zone of any of these sites. All personnel working in the exclusion zone are expected to observe decontamination procedures.

The Support Zone will contain:

- Restroom facility;
- Drinking water and cups;
- First aid kit;
- Extra gloves and chemical-resistant clothing, as required;
- Extra respirator cartridges, as required;
- Towels and wipes; and
- Eye wash.

Gross Decontamination includes:

- Wash rubber boots and remove;
- Remove coveralls and gloves;
- Spray off rain gear and rubber gloves;
- Remove respirator; and
- Wash hands and face.

Drink breaks are to be taken at the outside edge of the contamination reduction zone following decontamination.

### 7.4.2 Vehicles and Heavy Equipment

The surfaces of all heavy equipment that come into contact with contaminated soils or water will be cleaned prior to removal from site with power-washer or heavy brooms. The SSO is responsible for assuring decontamination activities are sufficient at minimizing the potential for transport of contaminants off-site.

## 8.0 AIR MONITORING

The following is the air monitoring plan for the project:

### 8.1 Volatile Organic Compounds

Exposure monitoring for volatile organic compounds shall be conducted using a photoionization detector ("PID") whenever visible sheens or product odors are present. The exposure monitoring shall be conducted in the worker's breathing zone ("BZ") every 15 minutes while odors or visible sheens exist, and readings recorded in a field notebook. Exposure monitoring for VOCs shall be performed every five minutes if PID readings approach 5 parts per million ("ppm") in the BZ.

If air concentrations of organic vapors in the worker's BZ should meet or exceed 5 ppm for a time period greater than five minutes, workers will be required to upgrade to Level C personal protective equipment, including the use of air-purifying respirators (equipped with organic vapor/HEPA cartridges), unless the non-presence of vinyl chloride/benzene is confirmed through the use of Draeger tubes.

Upgrade to Level C protection immediately if VOC concentrations exceed 10 ppm in the worker's BZ. If organic vapor concentrations drop back down below 5 ppm, the level of personal protective equipment can be downgraded to Level D protection.

If VOC concentrations in the worker's BZ exceed 25 ppm, the area must be evacuated and allowed to ventilate to less than 25 ppm in the BZ. If VOC concentrations exceed 100 ppm in the worker's BZ, the area will be evacuated.

## Table 3
## Exposure Monitoring Action Levels

| Activity | Instrument* | Action Level** | Level of Protection |
|---|---|---|---|
| General site activities, drilling, LNAPL monitoring, LNAPL recovery, and well installation / abandonment activities, aquifer testing | Use a PID to conduct exposure monitoring whenever product odors or visible sheens are present. | 5 ppm or greater in the BZ for > 5 minutes | Level C unless the non-presence of vinyl chloride or benzene is confirmed using Draeger tubes. |
| | | > 10 ppm in the BZ | C |
| | | > 25 ppm in the BZ | Evacuate area, contact Project H&S Manager, allow area to ventilate |
| | | > 100 ppm in the BZ | Evacuate area |
| Any type of hot work, or other work that could produce sparks | LEL meter or Methane Meter | LEL < 10% | Continue work |
| | | LEL 10 to 20% | Ventilate to reduce LEL and Continue work |
| | | LEL > 20% | Stop any hot work or spark producing activity, evacuate area until levels are below 10% |
| NOTE: * = monitoring instruments shall be calibrated and maintained according to manufacturers' specifications and at a minimum calibration shall occur once daily.<br>** = action levels should be based on DOSH PELs. | | | |

***The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated shall result in the evacuation of site personnel and re-evaluation by the safety officer and project manager of the hazard and the level of protection.***

## 9.0 EMERGENCY RESPONSE

Emergencies can range from minor to serious conditions. Various procedures for responding to site emergencies are listed in this section. The SSO is responsible for contacting local emergency services in emergency situations. Various individual site characteristics will determine preliminary action to be taken to assure that these emergency procedures are successfully implemented in the event of an emergency. Emergency contact information is in Appendix D of this HASP and posted in the job site office.

***In the event of an uncontrolled release of hazardous materials on the site, PES will evacuate immediately. They will not perform emergency response operations such as spill cleanup, rescue, or any other critical tasks. PES will rely on emergency responders to perform those tasks.***

### 9.1 Accident, Injury, and Illness Reporting and Investigation

PES employees are required to immediately report to their direct supervisor all occupational injuries, illnesses, accidents, and near miss incidents having the potential for injury. Any supervisor (but preferably the supervisor directly responsible for the involved employees) with first-hand knowledge of an incident is required to:

- Immediately arrange for appropriate medical attention and notify the responsible health and safety representative.

- Inform the PES Corporate Health and Safety Officer of all incidents requiring medical attention by calling 1 (800) 737-4450. Provide the following information:

- Employee name
- Name of treating medical facility and phone number
- Brief description of incident

**Injury and/or incident reports, including those involving motor vehicles, must be submitted to the appropriate health and safety representative within one business day of the incident.**

Subcontractor employees shall notify their supervisors and the associated PES Project Manager of any incidents or injuries while engaged in a PES project.

### 9.2 Emergency Procedures for Contaminated Personnel

Whenever possible, personnel should be decontaminated in the contamination reduction zone before administering first aid.

***Skin Contact*** — Remove contaminated clothing, wash immediately with water, use soap, if available.

***Inhalation*** — Remove victim from contaminated atmosphere. Remove any respiratory protection equipment. Initiate artificial respiration, if necessary. Transport to the hospital.

***Ingestion*** — Remove from contaminated atmosphere. Do not induce vomiting if victim is unconscious. Also never induce vomiting when acids, alkalis, or petroleum products are suspected. Transport to the hospital, if necessary.

## 9.3 Emergency Equipment/First Aid

The emergency equipment to be located on site either in site trailers or company vehicles include, at a minimum:

- first aid kit
- emergency eye wash
- ABC fire extinguisher
- potable water
- telephone/two-way radios.

### 9.3.1 Site Evacuation

In the event of an emergency situation such as fire, explosion, significant release of toxic materials, an air horn or other appropriate device will be sounded for approximately 10 seconds indicating the initiation of evacuation procedures. Personnel in the field will be notified through radio communications to evacuate the area. All personnel in both the restricted and non-restricted area will evacuate and assemble near the Support Zone or other safe area as identified by the SM prior to the beginning of field operations. The location shall be upwind of the site, if possible. The evacuation routes and muster points are indicated on the site plan in Figure 1 of Appendix E.

### 9.3.2 Spill and Release Contingencies

If a spill has occurred, the first step is controlling the spread of contamination if possible. The site Supervisor will immediately contact site Project Management to inform them of the spill and activate emergency spill procedures.

# FIGURES

Aerial Photo: June 27, 2016 (Google 2017)

**PES Environmental, Inc.**
Engineering & Environmental Services

**Property Location**
Former American Linen Supply
700 Dexter Avenue North
Seattle, Washington

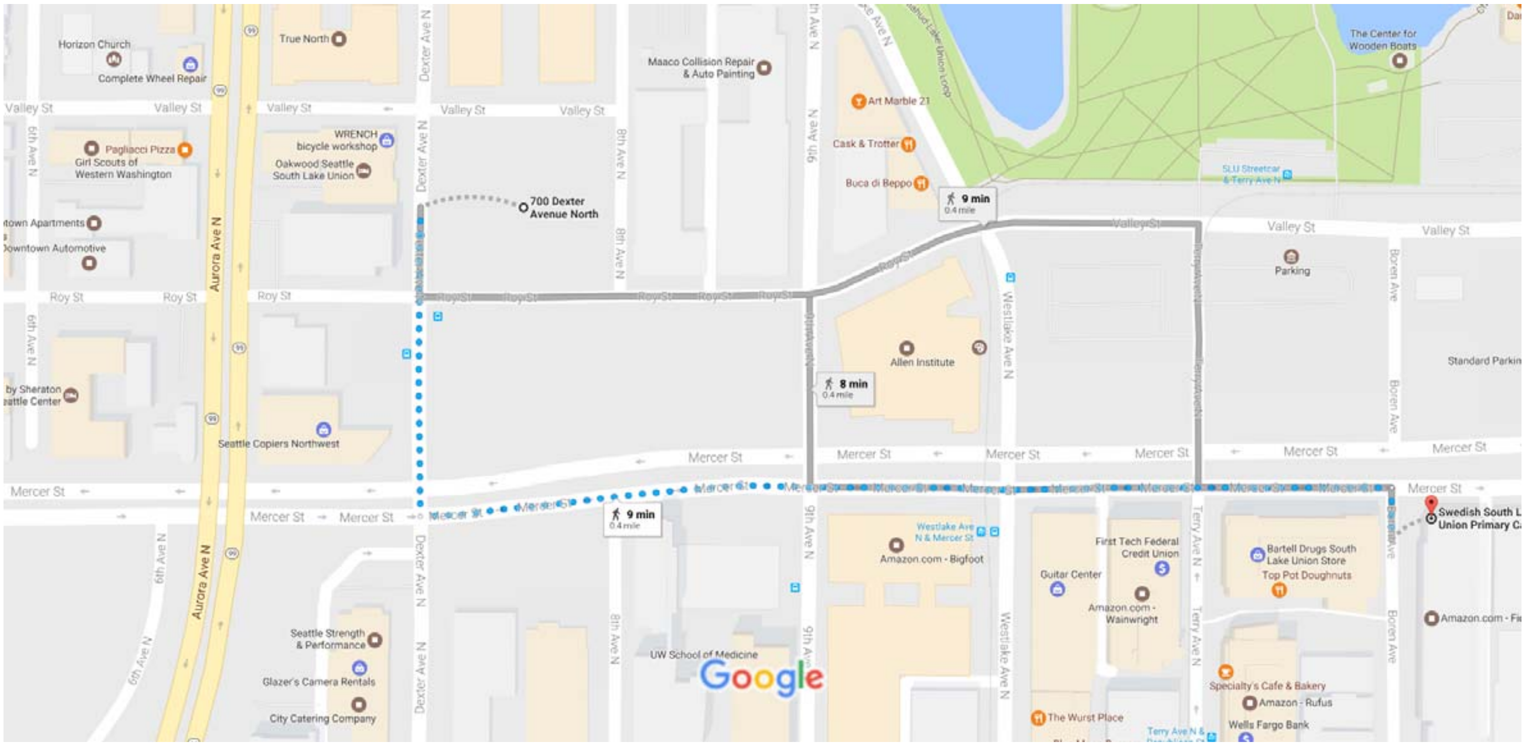
FIGURE
1

| 1412.004.02.004 | 141300102004_IAWPU_1-4 | DRAFT | 10/17 |
|---|---|---|---|
| JOB NUMBER | DRAWING NUMBER | REVIEWED BY | DATE |

Google Maps

# 700 Dexter Avenue North, Seattle, WA to Swedish South Lake Union Primary Care, 510 Boren Ave N, Seattle, WA 98109

Walk 0.4 mile, 9 min



Map data ©2017 Google 100 ft

## 700 Dexter Ave N

Seattle, WA 98109

Use caution - may involve errors or sections not suited for walking

1. Head south on Dexter Ave N toward Roy St

0.1 mi

2. Turn left onto Mercer St

0.3 mi

3. Turn right onto Boren Ave

ⓘ Destination will be on the left

85 ft

## Swedish South Lake Union Primary Care

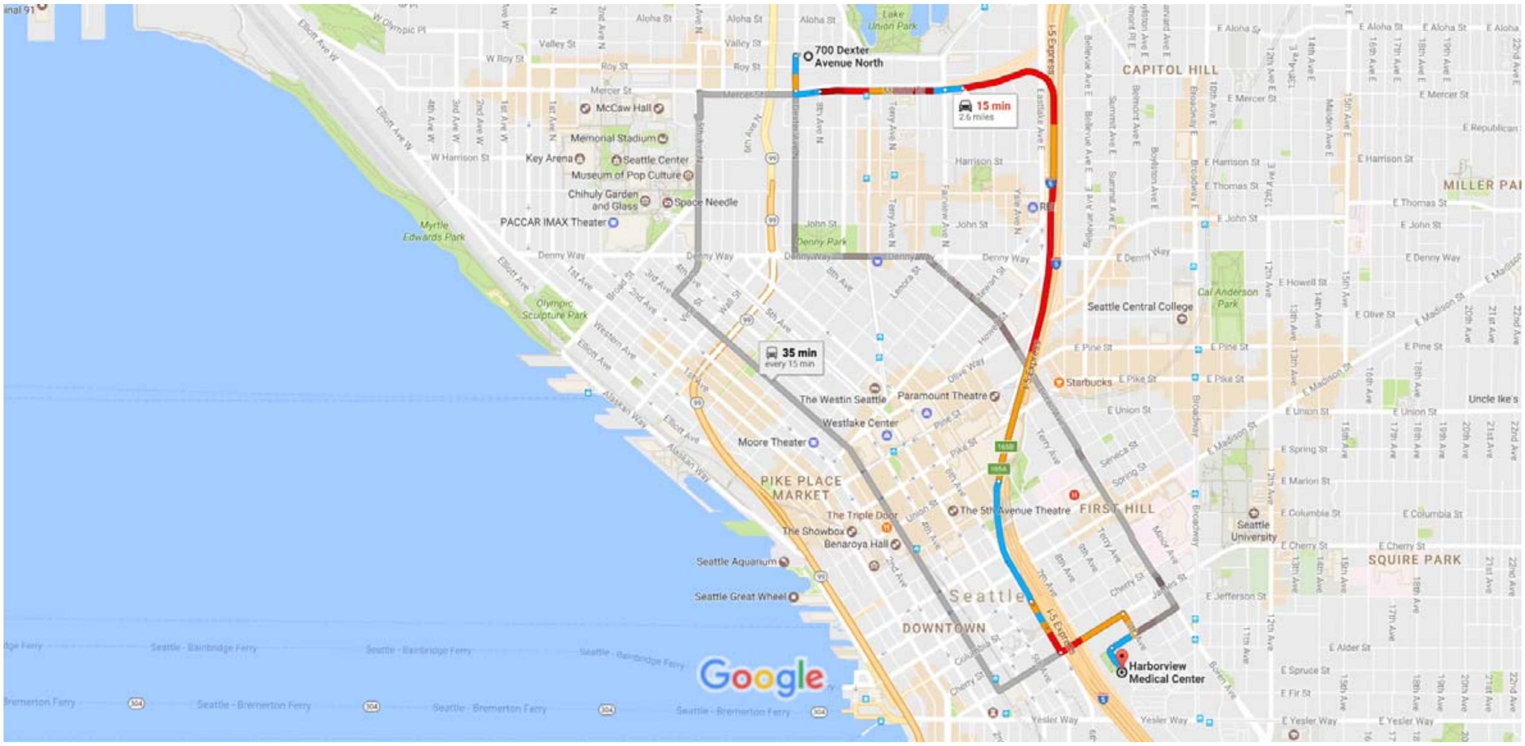
510 Boren Ave N, Seattle, WA 98109

**Figure 2**

Google Maps

# 700 Dexter Avenue North, Seattle, WA to Harborview Medical Center, Seattle, WA

Drive 2.6 miles, 15 min



Map data ©2017 Google 1000 ft

## 700 Dexter Ave N

Seattle, WA 98109

### Take Mercer St, I-5 S and Exit 165A to 9th Ave

8 min (2.4 mi)

1. Head south on Dexter Ave N toward Roy St

466 ft

2. Turn left at the 2nd cross street onto Mercer St

371 ft

3. Continue straight to stay on Mercer St

0.3 mi

4. Use the right 2 lanes to take the ramp to I-5 S

236 ft

5. Keep right at the fork, follow signs for I-5 S and merge onto I-5 S

1.3 mi

6. Use the 2nd from the right lane to take exit 165A toward James Street

0.3 mi

7. Use the left lane to merge onto 6th Ave

0.1 mi

8. Turn left onto James St

0.2 mi

### Take Jefferson St to 8th Ave

1 min (0.2 mi)

Figure 3

↱ 9. Turn right onto 9th Ave

302 ft

↱ 10. Turn right at the 1st cross street onto Jefferson St

364 ft

↑ 11. Jefferson St turns slightly left and becomes 8th Ave

ⓘ Destination will be on the right

374 ft

## Harborview Medical Center

Seattle, WA 98104

# APPENDIX A

# PES SAFETY PRACTICES FOR FIELD PERSONNEL

Field operations shall be conducted in accordance with the minimum safety practices described below required for all PES employees on all projects.

## 1.0 GENERAL SITE SAFETY

### 1.1 Safe Driving

Operators of vehicles on company business must:

- Evaluate conditions of the vehicle and observe deficiencies of the vehicle before commencing operation.
- Driver must be in possession of a valid driver's license.
- Wear seat belts/available safety restraint systems in all vehicles.
- Drive defensively, be courteous, and obey all traffic rules and regulations.
- Do not exceed posted speed limits.
- Do not pick up hitchhikers.
- Do not use cell phones while driving.
- Under no circumstances should a PES employee operate a vehicle while under the influence of intoxicating beverages, drugs, or other substances.
- Operate the vehicle at a SAFE speed in cases of inclement weather, heavy traffic, or other road hazards. Be especially aware of the hazards of black ice, particularly on bridges and overpasses.
- Remove keys and lock unattended vehicles.

All accidents involving a vehicle being operated on business, regardless of circumstances or severity, will be reported to the Project Manager within 24 hours. It is important to note that this is done not to find fault, but to analyze specific incidents for future accident prevention.

### 1.2 Facility/Traffic

Cargo/transfer terminal sites and other work sites with high traffic flow and limited visibility present a significant hazard to PES field staff. Since this is an area of extremely high risk, it is important that the following health and safety policies and procedures are followed. While visual devices are generally effective, the use of a structural barrier (such as a company vehicle) is a more sure method of protection should a vehicle driver fail to see an employee. Barriers shall be used on work sites when it is possible to do so without adversely affecting the project work or other client considerations. Employees are reminded to maintain a high degree of awareness of moving vehicles on the site. The following guidelines concerning traffic warning devices should be followed when working in traffic flow areas:

- Meet with the Facility Manger or Client Contact at the start of fieldwork to discuss equipment and personnel access to the work area;
- Obtain any facility-related emergency information, i.e., facility alarms, response phone numbers, evacuation areas, and special hazards;
- High visibility vests shall be worn by employees when working around traffic flow areas. Ensure that there is a clear line of sight between approaching traffic and the work area;

- Orange cones are typically used to direct traffic flow on roadways, but are not always appropriate as a flagging device on PES project sites. Due to the low height, a cone can be easily overlooked, especially when a motorist is backing up. Tubular markers at least 4-feet high with flags attached at the top are more visible. Alternatively, type I barricade with flagging at the top may be used. One option often used with cones is to place an object on the cones that will make noise if struck by a car; and
- When two or more PES employees are together on a site and a site-specific activity has a high risk of impact from vehicular traffic, one employee shall act as a look-out for the other employee performing the specific work activity.

## 1.3 Hazardous Waste Sites

- PES field personnel are to be thoroughly briefed on the anticipated hazards, equipment requirements, safety practices, emergency procedures, and communications methods, both initially and in daily briefings.
- At sites with known or suspected contamination, appropriate work areas for field personnel support, contaminant reduction, and exclusion will be designated and maintained.
- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increase the probability of hand-to-mouth transfer and ingestion of materials is prohibited in any area where the possibility of contamination exists.
- Hands must be thoroughly washed when leaving a contaminated or suspected contaminated area before eating, drinking, or any other activities.
- Contaminated protective equipment shall not be removed from the work area until it has been properly decontaminated or containerized on site.
- Avoid activities that may cause dust. Removal of materials from protective clothing or equipment by blowing, shaking, or any means which may disperse materials into the air is prohibited.
- All field personnel will, whenever possible, remain upwind of drilling rigs, open excavations, boreholes, etc.
- Field personnel are specifically prohibited from entering excavations, trenches, or other confined spaces deeper than 4 feet. Unattended boreholes must be properly covered or otherwise protected.

## 1.4 Respiratory Protection

- The PES Respiratory Protection Program will be followed whenever a respirator is required.
- Field personnel must use the "buddy system" when wearing any respiratory protective devices. Communications between members must be maintained at all times. Emergency communications shall be prearranged in case unexpected situations arise. Visual contact must be maintained between pairs on site, and team members should stay close enough to assist each other in the event of an emergency.
- Personnel should be cautioned to inform each other of subjective symptoms of chemical exposure such as headache, dizziness, nausea, and irritation of the respiratory tract.
- No excessive facial hair that interferes with a satisfactory fit of the facepiece-to-face seal will be allowed on personnel required to wear respiratory protective equipment.

- The selection, use, and maintenance of respiratory protective equipment shall meet the requirements of established PES procedures, recognized consensus standards (AIHA, ANSI, NIOSH), and shall comply with the requirements set forth in 29 CFR 1910.134 and WAC 296-841.

## 1.5 Back Injury Prevention

Back injuries on the job are costing employers in the U.S.A. approximately 6.5 billion annually. Eight out of ten people will suffer a back injury during their life time, either on or off the job. Many of these injuries could be prevented by adhering to the following proper lifting concepts:

- Keep the load close to the body. Arrange tasks so that the load will be close to the body and at a proper and safe height which will not require bending or stooping. Tighten stomach muscles to offset the force of the load.
- Keep the load within reach. Try to arrange tasks to eliminate handling loads below 20 inches or above 50 inches. Try to keep the lifting zone between your shoulders and the knuckles.
- Control the load size. Loads which extend beyond 16 inches in front of the body put excessive lifting stress on the body and should be handled by two people or lifting aids should be employed.
- Maintain proper alignment of body. The task should be designed so that twisting of the body is minimized or eliminated. Twisting while carrying a load increases injury potential significantly.
- Lift with your legs. Your leg muscles are the strongest in your body. Always bend your knees and use your leg muscles when you go toward the floor whether you have a load or not. Do not bend at your waist if it can be avoided.
- Balance your load if possible. An evenly balanced load is much easier and much safer to handle than an off-balance load. Grasp the object at opposite corners if possible.
- Avoid excessive weights if possible. Mechanical aids should be used for loads which are greater than those which can be handled safely by one person.
- Lift in a comfortable manner. Workers should use a lifting position that feels comfortable for them; however, they should bend their knees and keep their back as straight as possible when performing a lift. Your feet should be shoulder width apart in order to get the best footing possible.
- Lift smoothly and gradually. Quick jerking lifting motions increase sudden and abrupt stress to the back. This type of aggressive movement can affect the discs, muscles, and the ligaments. A well controlled and smooth lifting motion will reduce the likelihood of injury.
- Most importantly, think before lifting.

In addition to these lifting techniques it is also important to implement the proper carrying techniques as follows:

- Eliminate carrying where possible. If possible, conveyors, trucks, small loaders, and other mechanical equipment should be considered. Carts and dollies should be employed when surface conditions permit. Surface conditions can be altered with plywood or other materials.
- Use two-handed carries where possible. Using a two-handed carry method helps to balance the load even out the body stress.
- Keep the load close to the body. Keeping the load in close and lifting in as erect a position as possible helps to reduce the stress to the lower spine.

- Keep your arms straight. Less stress is created on the muscles and ligaments when your arms are kept straight during a carry. Contraction of the muscles will quickly increase fatigue and the possibility of an accident.
- Balance the load. A balanced load is similar to the two-handed carry. The load is evenly distributed across the body and the stress is also evenly shared.
- Avoid carrying any material on stairs. Carrying on stairs will obstruct your vision and increase the likelihood of slip and fall. The bumping of the load on your leg as you climb or descend increases the chance of an injury.
- Reduce the weight if possible. When the weight of the lifts is high look for ways to reduce the weight. Use smaller containers, put less in containers, indicate fill levels, and locate lighter containers.
- Use handles. Make the task easier by adding handles where possible. If numerous repetitions are required, it may be possible to design a handled device to accommodate a two handed carrying task.

In addition to these lifting and carrying techniques it is also important to consider pushing and pulling tasks:

- Eliminate manual pushing and pulling where possible. Look at those tasks that are repeated often to see if they can be modified or altered in a way that reduces pushing and pulling. consider mechanical aids, powered conveyors, gravity slides, and chutes.
- Reduce the necessary force. Force required is a function of weight, gravity and friction. Look for opportunities to reduce these factors. Improved bearings, larger wheels, reduced weight, improved rolling surfaces, lubrication, and improved regular maintenance are all opportunities for reducing work force and stress.
- Push load instead of pulling. Studies indicate that pushing loads rather than pulling them is the safest approach. There is less stress on muscles, joints, and ligaments. As in lifting, pushing pressure should be applied firmly, but gradually. Avoid aggressive impacts.

There are also several guidelines to follow when addressing tasks that involve shoveling operations:

- Choose correct shovel type. The shovel should be appropriate for the material and the project. Light, loose, and fluffy materials should be handled with a scoop type shovel. A smaller shovel like a spade should be used for more dense material.
- Use a long-handled shovel. A long-handled shovel should be provided to avoid stooping during shoveling activities. Take the time to obtain the correct tool for the job.
- Maintain load to 10 pounds per shovelful. The general rule of thumb for the average work situation is 10 pounds per shovel load. Work performed is a function of repetition and load. Increasing shovel loads will increase fatigue as repetitions increase and it will also increase the potential for injury.

Drum handling operations can be made safer by considering the following techniques:

- Use a drum cart where feasible. A four-wheel cart is preferred for drum handling because it is more stable, better latched, and has a better handle positioning. In addition, it is more easily tipped back and held in place when the drums are loaded.

- Do not rotate from horizontal to vertical unless nearly empty. Only empty or nearly empty drums should be rotated from horizontal to vertical. A tipster or forklift with a proper drum handling attachment is the preferred method.
- Use handling equipment for moving drums from one level to another. Whenever possible pallets, scales, and conveyors should be recessed in the floor to avoid raising drums to another level. If not, drums should be handled on a low platform or an incline adapter should be provided.
- Limit drum weight to 450 to 500 pounds. Regardless of the material involved, drums should only be filled to a maximum weight of 700 pounds. Drums over 300 pounds shall not be handled by hand. Use of mechanical equipment is required. *(Example: water = 8.6 lb per gallon x 52 gallons = 447.2 lbs)*
- Limit travel distance to 30 feet. The other general guideline regarding drum handling involves keeping drum transport to a maximum of thirty feet.

## 1.6 Slip / Trip / Hit / Fall Hazards

Slip/trip/hit and fall injuries are the most frequent of all injuries to workers. They occur for a wide variety of reasons, but can be minimized by the following prudent practices:

- Spot check the work area to identify hazards;
- Establish and utilized a pathway which is most free of slip and trip hazards;
- Beware of trip hazards such as wet floors, slippery surfaces, and uneven surfaces or terrain;
- Carry loads which you can see over;
- Keep work area clean and free of clutter, especially in storage rooms and walkways;
- Communicate hazards to on-site personnel;
- Secure all loose clothing, ties, and remove jewelry while around machinery;
- Report and/or remove hazards; and
- Keep a safe buffer zone between workers using equipment and tools.

## 2.0 CONSTRUCTION SAFETY

### 2.1 Utility Clearance

- Subsurface work shall not be performed at any location until the area has been cleared by a utility locator firm to be free of underground utilities or other obstructions.
- Elevated superstructures (e.g., drill rig, backhoe, scaffolding, ladders, cranes) shall remain a distance of 10 feet away from utility lines and 20 feet away from power lines. Distance from utility lines may be adjusted by the Project Manager or request information from the project Health & Safety Manager, depending on actual voltage of the lines.

### 2.2 Drilling Safety

The following practices shall be adhered to when working around drill rigs.

- Be aware of overhead obstructions.
- Employees working around drill rigs shall not wear any loose-fitting clothing which has the potential to caught in moving machinery.
- During freezing weather, do not touch any metal parts of the drill rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.
- Adequately cover or protect all unattended boreholes to prevent drill rig personnel or site visitors from stepping or falling into the borehole.
- Personnel shall wear steel-toed shoes, safety glasses, hearing protection and hard hats during drilling operations.
- The area shall be roped off, marked or posted, to keep the area clear of pedestrian traffic or spectators.
- All personnel should be instructed in the use of the emergency kill switch on the drill rig.

### 2.3 Heavy Equipment Operations

Working around heavy equipment can be dangerous because of the size and power of the equipment, the limited operator field of vision, and the noise levels that can be produced by the equipment. Heavy equipment to be utilized at the site may include a variety of backhoes, dozers, track loaders, and off-road trucks.

The following practices shall be followed by operators when using heavy equipment.

- Equipment shall be inspected daily by the operator to ensure that the equipment is in safe operating condition.
- No riding on vehicles or equipment except in fixed seats.
- Seat belts shall be worn at all times.
- Backup alarms, automatically activated and loud enough to be heard above background noise are required on all heavy equipment.
- Parking brakes should always be applied on parked equipment.
- Equipment should never be operated closer than 10 feet from utility lines.
- Windshields must be maintained clean and free of visual obstructions.

To ensure the safety of PES personnel in the work area, the following safety procedures regarding heavy equipment must be reviewed prior to and followed during work activities:

- Ensure that equipment operators are trained and/or experienced in the operation of the specific equipment.
- Personnel should never approach a piece of heavy equipment without the operator's acknowledgment and stoppage of work or yielding to the employee.
- Never walk under the load of a bucket or stand beside an opening truck bed.
- Maintain visual contact with the operator when in close proximity to the heavy equipment.
- Wear hearing protection while on or around heavy equipment, when normal conversation cannot be heard above work operations.
- Steel-toed shoes, safety glasses, and a hard hat shall be worn for all work conducted near heavy equipment.

## 2.4 Hand Tools

Use of hand tools may expose workers to cuts, lacerations, or puncture wounds if adequate hand protection is not worn or tools are improperly used or stored. Damaged hand tools may also expose employees to injuries from shattered tools and flying debris.

The following safe work practices apply to the use of hand tools:

- Only use a tool for its designed use.
- Do not use damaged tools.
- Driving faces of hammers, chisels, drift pins, bars, and similar tools must be inspected to eliminate mushroomed heads, broken faces and other defects.
- Tools must be returned to their proper storage place.
- Sharp tools must not be carried in pockets.
- Wood handles must be sound and securely wedged or fastened to the tool. Tape must not be used to cover defects such as cracks.
- When hand tools are being used overhead, those working or standing below must be notified.
- Always wear safety glasses to protect the eyes.
- Wear leather or other gloves if appropriate.

## 2.5 Power Tools

- All power tools must be in good condition and free of any damage.
- All power tools must be double insulated or equipped with a grounding plug. Grounding features (three-prong plugs) must not be defeated by use of adapters unless the adapter is appropriately grounded.
- All power cords and extension cords must be in good condition with undamaged insulation. Plugs and boots must also be in good condition and undamaged.
- Power tools must be unplugged whenever serviced or when not being used.

## 2.6 Noise

Excessive noise is hazardous not only for its potential to damage hearing, but also its potential to disrupt communications and instructions.

- All employees will have access to disposal ear plugs with a Noise Reduction Rating of not less than 30.
- Earplugs must be worn in any environment where workers must raise their voices to be heard while standing at a distance of 3 feet or less.
- Earplugs must be worn by any personnel working around active concrete cutting or sawing equipment.

# 3.0 WEATHER EXTREMES

## 3.1 Heat Extremes

Heat extremes at work can cause physical discomfort, loss of efficiency and attention to safety, and personal injury. Age, weight, degree of physical fitness, degree of acclimatization, metabolism, use of alcohol or drugs, and a variety of medical conditions such as hypertension all affect a person's sensitivity to heat. The type of clothing worn must be considered. Prior heat injury predisposes an individual to additional injury.

The fluid loss and dehydration resulting from physical activity puts outdoors laborers at particular risk. Certain medications predispose individuals to heat stress, such as drugs that alter sweat production (antihistamines, anti-psychotics, antidepressants) or interfere with the body's ability to regulate temperature. Persons with heart or circulatory diseases or those who are on "low salt" diets should consult with their physicians prior to working in hot environments.

It is difficult to predict just who will be affected and when, because individual susceptibility varies. In addition, environmental factors include more than the ambient air temperature. Radiant heat, air movement, conduction, and relative humidity all affect an individual's response to heat.

### 3.1.1 Heat-Related Illnesses

**Heat rash,** also known as prickly heat, may occur in hot and humid environments where sweat is not easily removed from the surface of the skin by evaporation. It can normally be prevented by resting in a cool place and allowing the skin to dry.

**Fainting** (heat syncope) may be a problem for the worker unacclimatized to a hot environment who simply stands still in the heat. Victims usually recover quickly after a brief period of lying down. Moving around, rather than standing still, will usually reduce the possibility of fainting.

**Heat cramps**, painful spasms of the muscles, are caused when workers drink large quantities of water but fail to replace their bodies' salt loss. Tired muscles, those used for performing the work, are usually the ones most susceptible to cramps. Cramps may occur during or after working hours and may be relieved by taking liquids by mouth or saline solutions intravenously for quicker relief, if medically determined to be required.

**Heat exhaustion** results from loss of fluid through sweating when a worker has failed to drink enough fluids or take in enough salt or both. The worker with heat exhaustion still sweats but experiences extreme weakness or fatigue, giddiness, nausea, or headache. The skin is clammy and moist, the complexion pale or flushed, and the body temperature is normal or slightly higher. Treatment is usually simple: the victim should rest in a cool place and drink an electrolyte solution (a beverage used by athletes to quickly restore potassium, calcium, and magnesium salts) such as Gatorade®. Severe cases involving victims who vomit or lose consciousness may require longer treatment under medical supervision.

**Heat stroke,** the most serious health problem for workers in hot environments, is caused by the failure of the body's internal mechanism to regulate its core temperature. Sweating stops, and the body can no longer rid itself of excess heat. Signs include mental confusion, delirium, loss of consciousness, convulsions or coma; a body temperature of 106 degrees F or higher; and hot dry skin which may be red, mottled, or bluish. Victims of heat stroke will die unless treated promptly. While awaiting medical help, the victim must be removed to a cool area and his or her clothing soaked with cool water. He or she should be fanned vigorously to increase cooling. Prompt first aid can prevent permanent injury to the brain and other vital organs.

### 3.1.2 Protection and Controls

The Washington State Department of Occupational Safety and Health (DOSH) regulates heat-related illness in WAC 296-62. DOSH defined HRI triggers based on the type of clothes worn, ambient temperature, and whether the work is conducted in sun or shade.

| | **Work in direct sun** | **Work in shade** |
|---|---|---|
| **Work Clothes (standard construction clothes** | 89° F | 96° F |
| **Double-layer woven clothes (coveralls over work clothes)** | 77° F | 87° F |
| **Vapor barrier (Tyvek, etc.)** | 52° F | 62° F |

At or above these trigger conditions, the provisions of the HRI rule become mandatory. The HRI includes requirements for a written procedure, water on site, and training of staff and supervisors.

**Written Procedures**
The employer must establish, implement, and maintain written procedures to reduce to the extent feasible the risks of heat-related illness which include the following elements:

- Identification and evaluation of temperature, humidity, and other environmental factors associated with heat-related illness
- Provisions to reduce to the extent feasible the risks of heat-related illness which include the following elements:
  - The provision of rest breaks as needed to reduce to the extent feasible the risks of heat-related illness
  - Encourage frequent consumption of water
  - Procedures for responding to signs or symptoms of possible heat-related illness and accessing medical aid
  - Employees are responsible for monitoring their own personal factors for heat-related illness, including ensuring they consume adequate water.

**Drinking Water**
Drinking water must be provided and made readily available in sufficient quantity to provide at least one quart per employee per hour. Employers may begin the shift with smaller quantities of drinking water if they have effective procedures for replenishment during the shift as needed to allow employees to drink one quart or more per hour.

**Training**
Training in the following topics must be provided to all employees who may be exposed to a heat-related illness hazard.

- The environmental factors that contribute to the risk of heat-related illness;
- General awareness of personal factors that may increase susceptibility to heat illness including, but not limited to, an individual's age, degree of acclimatization, medical conditions, water consumption, alcohol consumption, caffeine consumption, nicotine use, and use of prescription and nonprescription medications that affect hydration or other physiological responses to heat;
- The employer's procedures for identifying, evaluating, and controlling exposure;
- The importance of removing personal protective equipment that increases exposure to heat-related illness hazards during all breaks when feasible;
- The importance of frequent consumption of small quantities of water. One quart or more over the course of an hour may be necessary when the work environment is hot, and employees may be sweating more than usual in the performance of their duties;
- The importance of acclimatization;
- The different types of heat-related illness and the common signs and symptoms of heat-related illness;
- The importance of immediately reporting to the employer, directly or through the employee's supervisor, symptoms or signs of heat illness in themselves, or in co-workers;
- The employer's procedures for responding to symptoms of possible heat-related illness, including how emergency medical services will be provided should they become necessary; and
- The purpose and requirements of this standard.

Prior to supervising employees who are working in conditions that may present heat-related illness hazards, supervisors must have training on the following topics:

- The procedures the supervisor is to follow to implement the HRI rule;
- The procedures the supervisor is to follow when an employee exhibits signs or symptoms consistent with possible heat-related illness, including emergency response procedures;
- Procedures for moving employees to a place where they can be reached by an emergency medical service provider, if necessary; and
- How to provide clear and precise directions to the emergency medical provider who needs to find the work site.

## 3.2 Cold Extremes

Cold temperatures can also pose health hazards to site workers.  Injuries from cold extremes may be classified into two categories: local or general.

Local injuries include:

- frostnip
- frostbite
- trench foot
- chilblains
- Raynaud’s Phenomenon

General injuries include:

- hypothermia

Major factors contributing to cold injury are exposure to humidity and high winds, contact with wetness or metal, inadequate clothing, age, and general health. Allergies, vascular disease, excessive smoking or drinking, and certain drugs and medicines present physical conditions that can compound the effects of exposure to a cold environment. A cold stress guidelines table is included at the end of this section for quick reference.

Wind chill, or the cooling effect of moving air, is of critical importance when evaluating the cold exposure of site workers. The potential for frostbite and hypothermia increases greatly with combined cold temperatures and high wind speeds. Workers should inform the site superintendent, or site safety officer, if their hands, face, or feet feel numb, and workers should monitor each other for patches of pale or white skin on the face and ears.

### 3.2.1 Cold-Related Illnesses

**Frostnip** occurs when the face or extremities are exposed to a cold wind, causing the skin to turn white. Frostnip is considered a minor condition with no permanent damage, as long as the human tissue is warmed up in time. If not, the condition can progress to frostbite.

**Frostbite** is the freezing of the body tissues due to exposure to extremely low temperatures, resulting in damage to and loss of tissue. Frostbite occurs because of inadequate circulation or insulation, resulting in freezing of fluids around the cells of the body tissues. Most vulnerable parts of the body are the nose, cheeks, ears, fingers, and toes.

The freezing point of the skin is about 30° F. Frostbite can affect outer layers of skin or can include the tissues beneath. Damage can be serious, with permanent loss of movement in the affected parts, scarring, necrotic tissue, and amputation resulting.

There are three degrees of frostbite. First degree is freezing without blistering and peeling; second degree is freezing with blistering and peeling; and third degree is freezing with death of skin tissues and possibly the deeper tissues.

The following are symptoms of frostbite:

- Skin changes color to white or grayish-yellow, progresses to reddish-violet, and finally turns black as the tissue dies.
- Pain may be felt at first, but subsides.
- Blisters may appear.
- Affected part is cold and numb.

The first symptom of frostbite is usually an uncomfortable sensation of coldness, followed by numbness. Tingling, stinging, cramping and aching feelings will follow. Frostbite of the outer layer of the skin has a waxy or whitish look and is firm to the touch. Cases of deep frostbite cause severe injury. The victim is often unaware of the frostbite until someone else observes these symptoms. It is therefore important to use the “buddy system” when working in cold environments, so that symptoms of overexposure can be monitored.

**Trench foot** is swelling of the foot caused by long continuous exposure to cold without freezing, combined with persistent dampness or immersion in water. Edema (swelling), tingling, itching and severe pain occurs, followed by blistering, necrotic tissue and ulcerations.

**Chilblains** have similar symptoms as trench foot, except that other areas of the body are impacted. The cold exposure damages capillary beds in the skin, which in turn can cause redness, itching, blisters, and inflammation.

**Raynaud's Phenomenon** is the abnormal constriction of the blood vessels of the finger on exposure to cold temperatures, resulting in blanching of the fingertips. Numbness, itching, tingling, or a burning sensation may occur during related attacks. The disease is also associated with the use of vibrating hand tools in a condition sometimes called White Finger Disease. Persistent cold sensitivity, ulceration, and amputations can occur in severe cases.

**Hypothermia** is a condition of reduced body temperature. Most cases develop in air temperatures between 30-50° F, not taking wind-chill factor into consideration. Symptoms of hypothermia include personality changes, reduced mental alertness, irrationality, and uncontrollable shivering. The heartbeat slows and sometimes becomes irregular, weakening the pulse and changing blood pressure. Changes in the body chemistry cause severe shaking or rigid muscles, vague or slow speech, memory lapses, incoherence, and drowsiness. Cool skin, slow irregular breathing, low blood pressure, apparent exhaustion, and fatigue after rest may precede complete collapse.

As the core body temperature drops, the victim can become listless, confused, and make little or no effort to keep warm. Pain in the extremities can be the first warning of dangerous exposures to cold. At a core body temperature of about 85° F, serious problems develop due to significant drops in blood pressure, pulse rate and respiration.

Sedative drugs and alcohol increase the risk of hypothermia. Sedative drugs interfere with the transmission of impulses to the brain. Alcohol dilates blood vessels near the skin's surface, increasing heat loss, and lowering body temperature.

### 3.2.2 Treatment

In all cases, remove the person to a warm, dry place. If clothing is wet, remove and replace with dry clothing. Keep person warm. Rewarming of the person should be gradual to avoid stroke symptoms. Dehydration may result in cold injury due to a significant change in blood flow to the extremities. If the person is conscious and alert, warm, sweet liquids should be provided. Coffee and other caffeinated liquids should be avoided because of diuretic and circulatory effects. Extremities affected by frostbite should be gradually warmed up and returned to normal temperature. Moist compresses should be applied; begin with lukewarm compresses and slowly increase the temperature as changes in skin temperature are detected. Transport to a medical facility as soon as possible.

### 3.2.3 Prevention and Controls

To reduce adverse health effects from cold exposure, adopt the following work practices:

- Provide adequate dry insulating clothing to maintain core temperature above 98.6° F to workers if work is performed in air temperature below 40° F. Wind chill cooling rates and the cooling power of air are critical factors. The higher the wind speed and the lower the temperature in the work area, the greater the insulation value of the protective clothing required.

- If the air temperature is of 32° F or less, hands should be protected by gloves or mittens.
- If available clothing does not give adequate protection to prevent cold injury, work should be modified or suspended until adequate clothing is made available, or until weather conditions improve.
- Use heated warming shelters available nearby (e.g., on-site trailer) at regular intervals, the frequency depending on the severity of the environmental exposure. When entering the heated shelter, remove the outer layer of clothing and loosen the remainder of clothing to permit heat evaporation or change to dry work clothing.
- Provide warm, sweet drinks (e.g., hot chocolate) and soups at the work site for calorie intake and fluid volume. Limit the intake of coffee because of the diuretic and circulatory effects of caffeine.
- Include the weight and bulk of clothing in estimating the required work performance and weights to be lifted by the worker.
- Implement a buddy system in which workers are responsible for observing fellow workers for early signs and symptoms of cold stress.
- Employees that are not acclimatized should not work full-time in cold until they become accustomed to the working conditions and required protective clothing.
- Observe work and warming regimen as shown in the following table.

The following table describes the cooling power of wind on exposed flesh.  This information can be used as a guide for determining equivalent chill temperatures when the wind is present in cold environments.

## Cooling Power of Wind on Exposed Flesh Expressed as an Equivalent Temperature*

| Estimated Wind Speed (in mph) | Actual Temperature Reading ($^0$F) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 50 | 40 | 30 | 20 | 10 | 0 | -10 | -20 | -30 | -40 | -50 | -60 |
| | Equivalent Chill Temperature ($^0$F) | | | | | | | | | | | |
| 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 | -82 | -104 | -118 | -133 |
| 30 | 28 | 13 | -2 | -18 | -33 | -48 | -63 | -79 | -94 | -109 | -129 | -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**<br>In less than an hour with dry skin. Maximum danger of false sense of security. | | | | **INCREASING DANGER**<br>Danger from freezing of exposed flesh within one minute. | | | **GREAT DANGER**<br>Flesh may freeze within 30 seconds. | | | | |
| | Trench foot may occur at any point on this chart. | | | | | | | | | | | |

* Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.

The following table shows the recommended number of breaks that should be taken per hour based upon the air temperature and wind speeds encountered.  This table also lists the maximum sustained work period (in minutes) allowed when working under these conditions.

## Work/Warming Regimen*

| **Air Temperature - Sunny Sky** | | **No Noticeable Wind** | | **5 mph Wind** | | **10 mph Wind** | | **15 mph Wind** | | **20 mph Wind** | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $^{0}$C (approx.) | $^{0}$F (approx.) | Max Work Period | # of breaks | Max Work Period | # of breaks | Max Work Period | # of breaks | Max Work Period | # of breaks | Max Work Period | # of breaks |
| -26 to -28 | -15 to -19 | (Norm Breaks) 1 | | (Norm Breaks) 1 | | 75 min. | 2 | 55 min. | 3 | 40 min. | 4 |
| -29 to – 31 | -20 to -24 | (Norm Breaks) 1 | | 75 min. | 2 | 55 min. | 3 | 40 min. | 4 | 30 min. | 5 |
| -32 to – 34 | -25 to -29 | 75 min. | 2 | 55 min. | 3 | 40 min. | 4 | 30 min. | 5 | non-emergency work should cease | |
| -35 to – 37 | -30 to -34 | 55 min. | 3 | 40 min. | 4 | 30 min. | 5 | non-emergency work should cease | | non-emergency work should cease | |
| -38 to – 39 | -35 to -39 | 40 min. | 4 | 30 min. | 5 | non-emergency work should cease | | non-emergency work should cease | | non-emergency work should cease | |
| -40 to – 42 | -40 to -44 | 30 min. | 5 | non-emergency work should cease | | non-emergency work should cease | | non-emergency work should cease | | non-emergency work should cease | |
| -43 and below | -45 and below | non-emergency work should cease | | non-emergency work should cease | | non-emergency work should cease | | non-emergency work should cease | | non-emergency work should cease | |

* Developed by the American Conference of Governmental Industrial Hygienists

# APPENDIX B

## 1.0 JOB HAZARD ANALYSIS

| Work Activity | Hazard | Risk | Recommended Controls |
|---|---|---|---|
| Walking at the site | Slips, trips, and falls | High | Be aware of uneven terrain at the site, open holes, trenches. Be aware of unstable slope edges and stockpiled soils and materials. |
| Tools and equipment | Physical injury/noise | Moderate | Wear PPE equipment - hard hats, steel-toed boots, safety glasses with side shields, and hearing protection.<br>Equipment must be in good working order, be the correct tool for the task, and have required safety features (e.g., backup alarm, guards). Proper energy isolation, lock-out/tag-out, tagging and flagging must be applied when repairing tools and equipment.<br>Operators will be made aware of ground personnel in their operating range.<br>Additional precautions will be made if the lighting or visibility conditions are poor. All equipment will have backup alarms.<br>All operators are required to wear safety belts while operating equipment. |
| Soil and groundwater sampling | Contaminants | Moderate | At a minimum, Level D PPE will be worn if sampling activities are performed. |
|  | Dusty, windy conditions | Moderate | Air purifying respirators with organic vapor/HEPA cartridges will be donned when dusty, windy conditions exist and dust ingestion is likely. |
| Severe weather conditions | Poor visibility, temperature extremes, and high winds will increase the risk of physical hazards | High | The SSO will determine when work should be minimized or postponed due to weather conditions. |
| Cold/heat stress | Skin and extremities | High | The SSO will verify that personnel have proper clothing for the environment in which they are working and that drinking water is available. |

| Work Activity | Hazard | Risk | Recommended Controls |
|---|---|---|---|
| Confined spaces | Hazardous atmospheres | High | Identify confined spaces that might be located on the site. Level C work. Check that proper entry/egress is available, including backup personnel and system, lockout/tag out. All work will be performed under the direct supervision of the SSO.<br>Check for heat stress and dehydration.<br>Continuous LEL monitoring. |
| Confined spaces | Explosion | Moderate | Use only intrinsically safe electronic equipment inside confined spaces until monitoring proves safe for other types of equipment.<br>Check atmosphere with explosivity meter. Enter only if below 5% of LEL. Use air movers to maintain atmosphere below 10% of LEL. Check LEL continuously while work is being conducted in confined space. Use only intrinsically safe and explosion-proof equipment in the exclusion zone of the confined space. |
| Hot Work | Burns, explosions | High | Always test the atmosphere for explosive levels before performing hot work. Use welding gloves, jackets, and glasses. |

# APPENDIX C

## 1.0 PROJECT SAFETY ACKNOWLEDGEMENT FORMS

# SITE HEALTH and SAFETY PLAN ACKNOWLEDGMENT

I understand and agree to abide by the provisions as detailed in the PES Health and Safety Plan and this Site HASP for the activities described in the Project Work Plans. Failure to comply with these provisions may lead to disciplinary action, which may include dismissal from the work site, termination of employment or, for subcontractors, termination of the work contract.

| Printed Name | Company | Signature | Date |
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***(Make additional copies as needed.)***

## 2.0 BRIEFING SIGN-OFF FORM

The Project Manager or On-site Project Scientist shall sign this form after she/he has conducted a pre-entry briefing. Each PES, Inc. employee, and subcontractor, conducting field work shall sign this form after the pre-entry briefing is completed and prior to commencing work on site. A copy of this signed form shall be kept at the site and the original sent to the project manager for inclusion into the project file.

### Site Personnel Sign-off

☐ I have received a copy of the Site-Specific Health and Safety Plan.

☐ I have read the Plan and will comply with the provisions contained therein.

☐ I have attended a pre-entry briefing outlining the specific health and safety provisions on this site.

Name: ___________________________________________ Date: ________________

Name: ___________________________________________ Date: ________________

Name: ___________________________________________ Date: ________________

Name: ___________________________________________ Date: ________________

Name: ___________________________________________ Date: ________________

### PES ENVIRONMENTAL, INC. Project Manager

☐ A pre-entry briefing has been conducted by myself on _____________.

☐ I deferred the pre-entry briefing responsibility to the Health and Safety Officer.

Name:_______________________________________________ Date:______________

# APPENDIX D

NJ Health
New Jersey Department of Health

# Right to Know
# Hazardous Substance Fact Sheet

Common Name: **GASOLINE**

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Synonyms: Benzin; Motor Fuel; Petrol

Chemical Name: Gasoline, Natural

Date: April 2003 Revision: December 2008

CAS Number: 8006-61-9

RTK Substance Number: 0957

DOT Number: UN 1203

## Description and Use

**Gasoline** is a clear, colorless to amber-colored liquid with a petroleum odor. It is a blend of hydrocarbons used as an automotive fuel and as a solvent.

- **ODOR THRESHOLD= 0.25 ppm**
- Odor thresholds vary greatly. Do not rely on odor alone to determine potentially hazardous exposures.

## Reasons for Citation

- **Gasoline** is on the Right to Know Hazardous Substance List because it is cited by ACGIH, DOT, NIOSH, DEP, IARC and NFPA.
- This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

## FIRST AID

**Eye Contact**

- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while flushing. Seek medical attention.

**Skin Contact**

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

**Inhalation**

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

## EMERGENCY NUMBERS

**Poison Control: 1-800-222-1222**

**CHEMTREC: 1-800-424-9300**

**NJDEP Hotline: 1-877-927-6337**

**National Response Center: 1-800-424-8802**

**EMERGENCY RESPONDERS >>>> SEE BACK PAGE**

## Hazard Summary

| Hazard Rating | NJDOH | NFPA |
|---|---|---|
| HEALTH | 2 | 1 |
| FLAMMABILITY | - | 3 |
| REACTIVITY | - | 0 |

CARCINOGEN
FLAMMABLE
POISONOUS GASES ARE PRODUCED IN FIRE
CONTAINERS MAY EXPLODE IN FIRE

*Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe*

- **Gasoline** can affect you when inhaled and by passing through the skin.
- **Gasoline** should be handled as a CARCINOGEN--WITH EXTREME CAUTION.
- Contact can irritate and burn the skin and eyes with possible eye damage.
- Inhaling **Gasoline** can irritate the nose, throat and lungs.
- High exposure can cause headache, dizziness, lightheadedness, and passing out.
- Prolonged or repeated exposure can cause drying and cracking of the skin with redness.
- Repeated high exposure may affect the lungs and brain.
- **Gasoline** may damage the liver.
- **Gasoline** may contain *Lead* and *Benzene*. *For more information, consult the Right to Know Hazardous Substance Fact Sheets on BENZENE and TETRAETHYL LEAD.*
- **Gasoline** is a FLAMMABLE LIQUID and a DANGEROUS FIRE HAZARD.

## Workplace Exposure Limits

NIOSH: Recommends that exposure to occupational carcinogens be limited to the lowest feasible concentration.

ACGIH: The threshold limit value (TLV) is **300 ppm** averaged over an 8-hour workshift <u>and</u> **500 ppm** as a STEL (short-term exposure limit).

- **Gasoline** may be a CARCINOGEN in humans. There may be <u>no</u> safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

## Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

## Health Hazard Information

### Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Gasoline**:

- Contact can irritate and burn the skin and eyes with possible eye damage.
- Inhaling **Gasoline** can irritate the nose, throat and lungs causing coughing, wheezing and/or shortness of breath.
- High exposure can cause headache, nausea, weakness, dizziness, blurred vision, irregular heartbeat, poor coordination, lightheadedness, and passing out.

### Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Gasoline** and can last for months or years:

***Cancer Hazard***

- **Gasoline** may be a CARCINOGEN in humans since it has been shown to cause liver cancer in animals.
- Many scientists believe there is no safe level of exposure to a carcinogen.

***Reproductive Hazard***

- There is limited evidence that **Gasoline** may damage the developing fetus and may affect female fertility.

***Other Effects***

- Prolonged or repeated exposure can cause drying and cracking of the skin with redness.
- Repeated high exposure may affect the lungs and brain.
- **Gasoline** may damage the liver.

## Medical

### Medical Testing

If symptoms develop or overexposure is suspected, the following are recommended:

- Chest x-ray and lung function tests
- Liver function tests
- Exam of the nervous system
- EEG

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

### Mixed Exposures

- Smoking can cause heart disease, lung cancer, emphysema, and other respiratory problems. It may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.
- More than light alcohol consumption can cause liver damage. Drinking alcohol can increase the liver damage caused by **Gasoline**.

## Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Before entering a confined space where **Gasoline** may be present, check to make sure that an explosive concentration does not exist.

## Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

### Gloves and Clothing

- Avoid skin contact with **Gasoline**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend Nitrile and Viton for gloves, and Tychem® BR, LV, Responder® and TK, or the equivalent, as protective materials for clothing.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

### Eye Protection

- Wear indirect-vent, impact and splash resistant goggles when working with liquids.
- If additional protection is needed for the entire face, use in combination with a face shield. A face shield should not be used without another type of eye protection.

### Respiratory Protection

***Improper use of respirators is dangerous.*** Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **300 ppm**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

## Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- **Gasoline** is a FLAMMABLE LIQUID.
- Use dry chemical, $CO_2$, alcohol-resistant foam or other foam extinguishing agents, as water may not be effective in fighting fires.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- CONTAINERS MAY EXPLODE IN FIRE.
- Use water spray to keep fire-exposed containers cool.
- Vapors may travel to a source of ignition and flash back.
- Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source.

## Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Gasoline** is spilled or leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Absorb liquids in vermiculite, dry sand, earth, or a similar material and place into sealed containers for disposal.
- Keep **Gasoline** out of confined spaces, such as sewers, because of the possibility of an explosion.
- Use water spray to keep containers cool.
- Ventilate and wash area after clean-up is complete.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Gasoline** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

## Handling and Storage

Prior to working with **Gasoline** you should be trained on its proper handling and storage.

- **Gasoline** may react violently with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and NITRIC ACID.
- Store in tightly closed containers in a cool, well-ventilated area.
- Sources of ignition, such as smoking and open flames, are prohibited where **Gasoline** is used, handled, or stored.
- Metal containers involving the transfer of **Gasoline** should be grounded and bonded.
- Use explosion-proof electrical equipment and fittings wherever **Gasoline** is used, handled, manufactured, or stored.
- Use only non-sparking tools and equipment, especially when opening and closing containers of **Gasoline**.
- Flow or agitation may generate electrostatic charges.

## Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

**For more information, please contact:**

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

***The Right to Know Hazardous Substance Fact Sheets are not intended to be copied and sold for commercial purposes.***

## GLOSSARY

**ACGIH** is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

**Acute Exposure Guideline Levels** (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

**Boiling point** is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

**CFR** is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

**DEP** is the New Jersey Department of Environmental Protection.

**DOT** is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

**EPA** is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

**ERG** is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

**Emergency Response Planning Guideline** (ERPG) values provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

**IARC** is the International Agency for Research on Cancer, a scientific group.

**Ionization Potential** is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

**IRIS** is the Integrated Risk Information System database on human health effects that may result from exposure to various chemicals, maintained by federal EPA.

**LEL** or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

**$mg/m^3$** means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

**NFPA** is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

**NIOSH** is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

**NTP** is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

**OSHA** is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

**PEOSHA** is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

**Permeated** is the movement of chemicals through protective materials.

**ppm** means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

**Protective Action Criteria** (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

**STEL** is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

**UEL** or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

**Vapor Density** is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

NJ Health
New Jersey Department of Health

# Right to Know Hazardous Substance Fact Sheet

**Emergency Responders Quick Reference**

Common Name: **GASOLINE**

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Synonyms: Benzin; Motor Fuel; Petrol
CAS No: 8006-61-9
Molecular Formula: $C_5H_{12}$ to $C_9H_{20}$ (Mixture of hydrocarbons which vary by grade)
RTK Substance No: 0957
Description: Clear, colorless to amber-colored liquid with a petroleum odor

## HAZARD DATA

### Hazard Rating

**2 - Health**

**3 - Fire**

**0 - Reactivity**

**DOT#:** UN 1203

**ERG Guide #:** 128

**Hazard Class:** 3 (Flammable)

### Firefighting

FLAMMABLE LIQUID

Use dry chemical, $CO_2$, alcohol-resistant foam or other foam extinguishing agents, as water may not be effective in fighting fires.

POISONOUS GASES ARE PRODUCED IN FIRE.

CONTAINERS MAY EXPLODE IN FIRE.

Use water spray to keep fire-exposed containers cool.

Vapors may travel to a source of ignition and flash back.

Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source.

Flow or agitation may generate electrostatic charges.

### Reactivity

**Gasoline** may react violently with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and NITRIC ACID.

## SPILL/LEAKS

**Isolation Distance:**

Spill: 50 meters (150 feet)

Fire: 800 meters (1/2 mile)

Absorb liquids in vermiculite, dry sand, earth, or a similar material and place into sealed containers for disposal.

Keep **Gasoline** out of confined spaces, such as sewers, because of the possibility of an explosion.

Use only non-sparking tools and equipment, especially when opening and closing containers of **Gasoline**.

DO NOT wash into sewer.

**Gasoline** is harmful to aquatic organisms and is a marine pollutant.

## PHYSICAL PROPERTIES

| | |
|---|---|
| **Odor Threshold:** | 0.25 ppm |
| **Flash Point:** | -36°F (-38°C) |
| **LEL:** | 1.2% |
| **UEL:** | 7.6% |
| **Auto Ignition Temp:** | 536° to 853°F (280° to 456°C) |
| **Vapor Density:** | 3 to 4 (air = 1) |
| **Vapor Pressure:** | 38 to 300 mm Hg at 68°F (20°C) |
| **Specific Gravity:** | 0.73 (water = 1) |
| **Water Solubility:** | Insoluble |
| **Boiling Point:** | 140° to 390°F (60° to 199°C) |
| **Molecular Weight:** | 72 to 100 |

## EXPOSURE LIMITS

**ACGIH:** 300 ppm, 8-hr TWA; 500 ppm, STEL

The Protective Action Criteria values are:

PAC-1 = 500 ppm,
PAC-2 = 500 ppm
PAC-3 = 1,500 ppm

## PROTECTIVE EQUIPMENT

| | |
|---|---|
| **Gloves:** | Nitrile and Viton (>8-hr breakthrough) |
| **Coveralls:** | Tychem® BR, LV, Responder® and TK (>8-hr breakthrough) |
| **Respirator:** | >300 ppm - Supplied air or SCBA |

## HEALTH EFFECTS

| | |
|---|---|
| **Eyes:** | Irritation and burns |
| **Skin:** | Irritation and burns |
| **Inhalation:** | Nose, throat and lung irritation with coughing, wheezing and shortness of breath<br>Headache, nausea, weakness, dizziness, blurred vision, irregular heartbeat, and passing out |
| **Chronic:** | Cancer (liver) in animals |

## FIRST AID AND DECONTAMINATION

**Remove** the person from exposure.

**Flush** eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn. Seek medical attention.

**Quickly** remove contaminated clothing and wash contaminated skin with large amounts of soap and water.

**Begin** artificial respiration if breathing has stopped and CPR if necessary.

**Transfer** promptly to a medical facility

December 2008

NJ Health
New Jersey Department of Health

# Right to Know
# Hazardous Substance Fact Sheet

Common Name: **FUEL OILS (Light)**

Synonyms: #2 Heating Oil; Distillate (Light) Diesel Fuels; Diesel Oil No. 2; Fuel Oil No. 2

Chemical Name: None

Date: June 2008 Revision: June 2010

| | |
|---|---|
| CAS Number: | None |
| RTK Substance Number: | 2444 |
| DOT Number: | UN 1202 |

## Description and Use

**Fuel Oils** are a complex mixture of *Hydrocarbons* produced from distilling *Crude Oil*. They are brown to straw-colored, slightly thick liquids with a distinct *Petroleum* odor. **Fuel Oils** are used as ship, car, and train fuels, and as home heating oil.

- **ODOR THRESHOLD = 0.7 ppm**
- Odor thresholds vary greatly. Do not rely on odor alone to determine potentially hazardous exposures.

## Reasons for Citation

- **Fuel Oils** are on the Right to Know Hazardous Substance List because they are cited by ACGIH, DOT, DEP, IARC and NFPA.

SEE GLOSSARY ON PAGE 5.

## FIRST AID

**Eye Contact**

- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while rinsing.

**Skin Contact**

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

**Inhalation**

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

## EMERGENCY NUMBERS

**Poison Control: 1-800-222-1222**

**CHEMTREC: 1-800-424-9300**

**NJDEP Hotline: 1-877-927-6337**

**National Response Center: 1-800-424-8802**

**EMERGENCY RESPONDERS >>>> SEE BACK PAGE**

## Hazard Summary

| Hazard Rating | NJDOH | NFPA |
|---|---|---|
| HEALTH | - | 1 |
| FLAMMABILITY | - | 2 |
| REACTIVITY | - | 0 |

COMBUSTIBLE
POISONOUS GASES ARE PRODUCED IN FIRE
CONTAINERS MAY EXPLODE IN FIRE

*Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe*

- **Fuel Oils** can affect you when inhaled and may pass through the skin.
- Contact can irritate the skin and eyes.
- Inhaling **Fuel Oils** can irritate the nose, throat and lungs.
- **Fuel Oils** can affect the nervous system causing headache, dizziness, nausea, and loss of balance and coordination.
- **Fuel Oils** may affect the liver and kidneys.

## Workplace Exposure Limits

ACGIH: The threshold limit value (TLV) is **100 mg/m$^3$** (as *total Hydrocarbons*, *vapor* and *aerosol*) averaged over an 8-hour workshift.

- The above exposure limit is for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

## Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act and the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

## Health Hazard Information

**Acute Health Effects**

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Fuel Oils**:

- Contact can irritate the skin and eyes.
- Inhaling **Fuel Oils** can irritate the nose, throat and lungs causing coughing, wheezing and/or shortness of breath.
- **Fuel Oils** can affect the nervous system causing headache, dizziness, nausea, vomiting, blurred vision, irregular heartbeat, confusion, and loss of balance and coordination. Higher levels can cause coma and death.

**Chronic Health Effects**

The following chronic (long-term) health effects can occur at some time after exposure to **Fuel Oils** and can last for months or years:

***Cancer Hazard***

- While **Fuel Oils** have been tested, they are not classifiable as to their potential to cause cancer.

***Reproductive Hazard***

- According to the information presently available to the New Jersey Department of Health, **Fuel Oils** have not been tested for their ability to affect reproduction.

***Other Effects***

- Prolonged or repeated exposure can cause drying and cracking of the skin with redness and swelling.
- **Fuel Oils** can irritate the lungs. Repeated exposure may cause bronchitis to develop with coughing, phlegm, and/or shortness of breath. Very high exposure can lead to permanent lung damage.
- **Fuel Oils** may affect the liver and kidneys.

## Medical

**Medical Testing**

If symptoms develop or overexposure is suspected, the following are recommended:

- Chest x-ray and lung function tests
- Exam of the nervous system
- Liver and kidney function tests
- EKG

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are <u>not</u> a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

**Mixed Exposures**

- Smoking can cause heart disease, lung cancer, emphysema, and other respiratory problems. It may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.
- More than light alcohol consumption can cause liver damage. Drinking alcohol may increase the liver damage caused by **Fuel Oils**.

## Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

## Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

### Gloves and Clothing

- Avoid skin contact with **Fuel Oils**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend Nitrile, Neoprene and Viton for gloves, and Tychem® SL and Responder®; Zytron® 200, Zytron® 300; and ONESuit® TEC, or the equivalent, as protective materials for clothing.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

### Eye Protection

- Wear indirect-vent, impact and splash resistant goggles when working with liquids.
- Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

### Respiratory Protection

***Improper use of respirators is dangerous.*** Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **100 mg/m$^3$**, use a NIOSH approved respirator with an organic vapor cartridge and P100 prefilters. Increased protection is obtained from full facepiece powered-air purifying respirators.
- Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Fuel Oils (Light)**, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential exists for exposure over **1,000 mg/m$^3$**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

## Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- **Fuel Oils** are COMBUSTIBLE LIQUIDS.
- Use dry chemical, $CO_2$, water fog or foam as extinguishing agents.
- POISONOUS GASES ARE PRODUCED IN FIRE, including *Sulfur Oxides* and *Nitrogen Oxides*.
- CONTAINERS MAY EXPLODE IN FIRE.
- Use water spray to keep fire-exposed containers cool.
- Vapors may travel to a source of ignition and flash back.
- **Fuel Oils** may accumulate static electrical charge of sufficient energy to cause a fire and/or explosion.

## Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Fuel Oils** are spilled or leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers.
- Ventilate and wash area after clean-up is complete.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Fuel Oils** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

## Handling and Storage

Prior to working with **Fuel Oils** you should be trained on its proper handling and storage.

- **Fuel Oils** are not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and ALKALI METALS (such as LITHIUM, SODIUM and POTASSIUM).
- Store in tightly closed containers in a cool, well-ventilated area away from DIRECT SUNLIGHT, HEAT, and HOT METAL SURFACES.
- Sources of ignition, such as smoking and open flames, are prohibited where **Fuel Oils** are used, handled, or stored.
- When off-loading bulk **Fuel Oils** for delivery or transfer, static electricity grounding must be completed prior to discharge.
- Use only non-sparking tools and equipment, especially when opening and closing containers of **Fuel Oils**.
- **Fuel Oils** may accumulate static electrical charge of sufficient energy to cause a fire and/or explosion in the presence of flammable and/or combustible materials.

## Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

**For more information, please contact:**

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

***The Right to Know Hazardous Substance Fact Sheets are not intended to be copied and sold for commercial purposes.***

## GLOSSARY

**ACGIH** is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

**Acute Exposure Guideline Levels** (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

**Boiling point** is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

**CFR** is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

**DEP** is the New Jersey Department of Environmental Protection.

**DOT** is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

**EPA** is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

**ERG** is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

**Emergency Response Planning Guideline** (ERPG) values are intended to provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

**IARC** is the International Agency for Research on Cancer, a scientific group.

**Ionization Potential** is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

**IRIS** is the Integrated Risk Information System database maintained by federal EPA. The database contains information on human health effects that may result from exposure to various chemicals in the environment.

**LEL** or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

**$mg/m^3$** means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

**NFPA** is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

**NIOSH** is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

**NTP** is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

**OSHA** is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

**PEOSHA** is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

**Permeated** is the movement of chemicals through protective materials.

**PIH** is a DOT designation for chemicals which are Poison Inhalation Hazards.

**ppm** means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

**STEL** is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

**UEL** or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

**Vapor Density** is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

NJ Health
New Jersey Department of Health

# Right to Know Hazardous Substance Fact Sheet

Emergency Responders
Quick Reference

Common Name: **FUEL OILS (Light)**

Synonyms: #2 Heating Oil; Distillate (Light) Diesel Fuels; Fuel Oil No. 2; Diesel Oil No. 2
CAS No: None
Molecular Formula: Varies
RTK Substance No: 2444

Description: Brown to straw-colored, slightly thick liquids with a distinct *Petroleum* odor

## HAZARD DATA

### Hazard Rating

**1 - Health**

**2 - Fire**

**0 - Reactivity**

**DOT#:** UN 1202

**ERG Guide #:** 128

**Hazard Class:** 3 (Flammable)

### Firefighting

COMBUSTIBLE LIQUIDS

Use dry chemical, $CO_2$, water fog or foam as extinguishing agents.

POISONOUS GASES ARE PRODUCED IN FIRE, including *Sulfur Oxides* and *Nitrogen Oxides*.

CONTAINERS MAY EXPLODE IN FIRE.

Use water spray to keep fire-exposed containers cool.

Vapors may travel to a source of ignition and flash back.

**Fuel Oils** may accumulate static electrical charge of sufficient energy to cause a fire and/or explosion.

### Reactivity

**Fuel Oils** are not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and ALKALI METALS (such as LITHIUM, SODIUM and POTASSIUM).

## SPILL/LEAKS

**Isolation Distance:**

Small Spill: 60 meters (200 feet)

Large Spill: 330 meters (1,100 feet)

Fire: 800 meters (1/2 mile)

Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers.

When off-loading bulk **Fuel Oils** for delivery or transfer, static electricity grounding must be completed prior to discharge.

DO NOT wash into sewer.

May affect aquatic life.

## PHYSICAL PROPERTIES

| | |
|---|---|
| **Odor Threshold:** | 0.7 ppm |
| **Flash Point:** | >125°F (>52°C) |
| **LEL:** | 0.6% to 1.3% |
| **UEL:** | 4.7% to 7.5% |
| **Auto Ignition Temp:** | 351° to 624°F (177° to 329°C) |
| **Vapor Density:** | >3 (air = 1) |
| **Vapor Pressure:** | less than 1 mm Hg at 68°F (20°C) |
| **Specific Gravity:** | 0.87 to 0.95 (water = 1) |
| **Water Solubility:** | Insoluble |
| **Boiling Point:** | 340° to 676°F (171° to 358°C) |
| **Molecular Weight:** | Varies |

## EXPOSURE LIMITS

| | |
|---|---|
| **OSHA:** | None |
| **ACGIH:** | 100 $mg/m^3$, 8-hr TWA |
| **IDLH:** | None |

The Protective Action Criteria values are:

PAC-1 = 100 $mg/m^3$ PAC-2 = 500 $mg/m^3$
PAC-3 = 500 $mg/m^3$

## PROTECTIVE EQUIPMENT

| | |
|---|---|
| **Gloves:** | Nitrile, Neoprene and Viton |
| **Coveralls:** | Tychem® SL and Responder®; Zytron® 200 and Zytron® 300; and ONESuit® TEC |
| **Respirator:** | >100 $mg/m^3$ - APR with *Organic vapor cartridge* and *P100 prefilters*<br>>500 $mg/m^3$ - SCBA |

## HEALTH EFFECTS

| | |
|---|---|
| **Eyes:** | Irritation |
| **Skin:** | Irritation, drying and cracking with redness and swelling |
| **Inhalation:** | Nose, throat and lung irritation with coughing, wheezing and shortness of breath<br>Headache, dizziness, blurred vision, and loss of balance and coordination |

## FIRST AID AND DECONTAMINATION

**Remove** the person from exposure.

**Flush** eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.

**Quickly** remove contaminated clothing and wash contaminated skin with large amounts of soap and water.

**Begin** artificial respiration if breathing has stopped and CPR if necessary.

**Transfer** to a medical facility.

June 2010

# Right to Know
# Hazardous Substance Fact Sheet

NJ Health
New Jersey Department of Health

Common Name: **PETROLEUM DISTILLATES**

Synonyms: Crude Oil; Petroleum Oil
Chemical Name: Petroleum
Date: August 2011

CAS Number: 8002-05-9
RTK Substance Number: 2648
DOT Number: UN 1268

## Description and Use

**Petroleum Distillates** are dark yellow to brown or green-black liquids with a mild *gasoline* or *kerosene*-like odor. They are a complex blend of *Hydrocarbons* used in making petroleum products.

## Reasons for Citation

- **Petroleum Distillates** are on the Right to Know Hazardous Substance List because they are cited by OSHA, DOT, NIOSH and IARC.
- This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

## FIRST AID

**Eye Contact**

- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while rinsing.

**Skin Contact**

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

**Inhalation**

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

## EMERGENCY NUMBERS

**Poison Control: 1-800-222-1222**
**CHEMTREC: 1-800-424-9300**
**NJDEP Hotline: 1-877-927-6337**
**National Response Center: 1-800-424-8802**

**EMERGENCY RESPONDERS >>>> SEE LAST PAGE**

## Hazard Summary

| Hazard Rating | NJDOH | NFPA |
|---|---|---|
| HEALTH | 2 | - |
| FLAMMABILITY | 3 | - |
| REACTIVITY | 0 | - |

FLAMMABLE
POISONOUS GASES ARE PRODUCED IN FIRE
CONTAINERS MAY EXPLODE IN FIRE

*Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe*

- **Petroleum Distillates** can affect you when inhaled and may be absorbed through the skin.
- Contact can irritate and burn the skin and eyes.
- Inhaling **Petroleum Distillates** can irritate the nose, throat and lungs.
- **Petroleum Distillates** can affect the nervous system causing headache, dizziness, nausea, and loss of balance and coordination.
- **Petroleum Distillates** may affect the liver and kidneys.
- **Petroleum Distillates** are FLAMMABLE LIQUIDS and DANGEROUS FIRE HAZARDS.

## Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **3,500 ppm** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **88 ppm** averaged over a 10-hour workshift and **450 ppm**, not to be exceeded during any 15-minute work period.

## Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act and the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

## Health Hazard Information

### Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Petroleum Distillates**:

- Contact can irritate and burn the skin and eyes.
- Inhaling **Petroleum Distillates** can irritate the nose, throat and lungs causing coughing, wheezing and/or shortness of breath.
- **Petroleum Distillates** can affect the nervous system causing headache, dizziness, nausea, vomiting, blurred vision, confusion, and loss of balance and coordination. Higher levels may cause coma and death.

### Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Petroleum Distillates** and can last for months or years:

#### *Cancer Hazard*

- While **Petroleum Distillates** have been tested, they are not classifiable as to their potential to cause cancer.

#### *Reproductive Hazard*

- There is limited evidence that **Petroleum Distillates** may affect female fertility.

#### *Other Effects*

- Prolonged or repeated exposure can cause drying and cracking of the skin with redness.
- **Petroleum Distillates** can irritate the lungs. Repeated exposure may cause bronchitis to develop with coughing, phlegm, and/or shortness of breath.
- **Petroleum Distillates** may affect the liver and kidneys.

## Medical

### Medical Testing

For frequent or potentially high exposure (half the REL or greater), the following are recommended before beginning work and at regular times after that:

- Liver and kidney function tests

If symptoms develop or overexposure is suspected, the following are recommended:

- Chest x-ray and lung function tests
- Exam of the nervous system

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

### Mixed Exposures

- Smoking can cause heart disease, lung cancer, emphysema, and other respiratory problems. It may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.
- More than light alcohol consumption can cause liver damage. Drinking alcohol may increase the liver damage caused by **Petroleum Distillates**.

## Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Before entering a confined space where **Petroleum Distillates** may be present, check to make sure that an explosive concentration does not exist.

## Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

### Gloves and Clothing

- Avoid skin contact with **Petroleum Distillates**. Wear personal protective equipment made from material that can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- The recommended glove materials for *Hydrocarbons* are Silver Shield®/4H®, Viton, Viton/Butyl and Barrier®.
- The recommended protective clothing materials for *Hydrocarbons* are Tychem® BR, CSM and TK; and Trellchem® HPS and VPS, or the equivalent.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

### Eye Protection

- Wear indirect vent goggles when working with liquids that may splash, spray or mist. A face shield is also required if the liquid is severely irritating or corrosive to the skin and eyes.

### Respiratory Protection

***Improper use of respirators is dangerous.*** Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **88 ppm**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus or an emergency escape air cylinder.
- Exposure to **1,100 ppm** is immediately dangerous to life and health. If the possibility of exposure above **1,100 ppm** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

## Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- **Petroleum Distillates** are FLAMMABLE LIQUIDS.
- Use dry chemical, $CO_2$, alcohol-resistant foam or other foam extinguishing agents, as water may not be effective in fighting fires.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- CONTAINERS MAY EXPLODE IN FIRE.
- Use water spray to keep fire-exposed containers cool.
- Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source and flash back.
- Flow or agitation may generate electrostatic charges.
- **Petroleum Distillates** may form an ignitable vapor/air mixture in closed tanks or containers.

## Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Petroleum Distillates** are spilled or leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Absorb liquids in dry sand, earth, or a noncombustible material and place into sealed containers for disposal.
- Ventilate area of spill or leak.
- Keep **Petroleum Distillates** out of confined spaces, such as sewers, because of the possibility of an explosion.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Petroleum Distillates** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

## Handling and Storage

Prior to working with **Petroleum Distillates** you should be trained on its proper handling and storage.

- **Petroleum Distillates** may react violently with OXIDIZING AGENTS (such as NITROGEN TETROXIDE, PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and NITRIC ACID.
- Store in tightly closed containers in a cool, well-ventilated area.
- Sources of ignition, such as smoking and open flames, are prohibited where **Petroleum Distillates** are used, handled, or stored.
- Metal containers involving the transfer of **Petroleum Distillates** should be grounded and bonded.
- Use explosion-proof electrical equipment and fittings wherever **Petroleum Distillates** are used, handled, manufactured, or stored.
- Use only non-sparking tools and equipment, especially when opening and closing containers of **Petroleum Distillates**.
- **Petroleum Distillates** may accumulate static electricity when being filled into properly grounded containers.

## Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

**For more information, please contact:**

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

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## GLOSSARY

**ACGIH** is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

**Acute Exposure Guideline Levels** (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

**Boiling point** is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

**CFR** is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

The **critical temperature** is the temperature above which a gas cannot be liquefied, regardless of the pressure applied.

**DEP** is the New Jersey Department of Environmental Protection.

**DOT** is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

**EPA** is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

**ERG** is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

**Emergency Response Planning Guideline** (ERPG) values provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

**IARC** is the International Agency for Research on Cancer, a scientific group.

**Ionization Potential** is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

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**LEL** or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

**$mg/m^3$** means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

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**PEOSHA** is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

**Permeated** is the movement of chemicals through protective materials.

**ppm** means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

**Protective Action Criteria** (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

**STEL** is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

**UEL** or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

**Vapor Density** is the ratio of the weight of a given volume of one gas to the weight of another (usually *Air*), at the same temperature and pressure.

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

NJ Health
New Jersey Department of Health

# Right to Know Hazardous Substance Fact Sheet

Emergency Responders
Quick Reference

Common Name: **PETROLEUM DISTILLATES**

Synonyms: Crude Oil; Petroleum; Petroleum Oil
CAS No: 8002-05-9
Molecular Formula: Varies
RTK Substance No: 2648
Description: Dark yellow to brown or green-black liquids with a mild *gasoline* or *kerosene* odor

## HAZARD DATA

| Hazard Rating | Firefighting | Reactivity |
|---|---|---|
| **2 - Health**<br>**3 - Fire**<br>**0 - Reactivity**<br>**DOT#:** UN 1268<br>**ERG Guide #:** 128<br>**Hazard Class:** 3 (Flammable) | FLAMMABLE LIQUIDS<br>Use dry chemical, $CO_2$, alcohol-resistant foam or other foam extinguishing agents, as water may not be effective in fighting fires.<br>POISONOUS GASES ARE PRODUCED IN FIRE.<br>CONTAINERS MAY EXPLODE IN FIRE.<br>Use water spray to keep fire-exposed containers cool.<br>Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source and flash back.<br>Flow or agitation may generate electrostatic charges.<br>**Petroleum Distillates** may form an ignitable vapor/air mixture in closed tanks or containers. | **Petroleum Distillates** may react violently with OXIDIZING AGENTS (such as NITROGEN TETROXIDE, PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and NITRIC ACID. |

## SPILL/LEAKS

**Isolation Distance:**

Spill: 50 meters (150 feet)
Fire: 800 meters (1/2 mile)

Absorb liquids in dry sand, earth, or a noncombustible material and place into sealed containers for disposal.

Bond and ground containers when transferring **Petroleum Distillates**.

Use only non-sparking tools and equipment.

Keep **Petroleum Distillates** out of confined spaces, such as sewers, because of the possibility of an explosion.

DO NOT wash into sewer.

## PHYSICAL PROPERTIES

| | |
|---|---|
| **Odor Threshold:** | Mild *gasoline* or *kerosene*-like |
| **Flash Point:** | -40° to -86°F (-40° to -66°C) |
| **LEL:** | 1.1% |
| **UEL:** | 5.9% |
| **Vapor Pressure:** | 40 mm Hg at 68°F (20°C) (approximately) |
| **Specific Gravity:** | 0.78 to 0.97 (water = 1) |
| **Water Solubility:** | Insoluble |
| **Boiling Point:** | 86 ° to 460°F (30° to 238°C) |
| **Freezing Point:** | -99°F (-73°C) |
| **Molecular Weight:** | 98 (approximately) |

## EXPOSURE LIMITS

| | |
|---|---|
| **OSHA:** | 500 ppm, 8-hr TWA |
| **NIOSH:** | 88 ppm, 10-hr TWA; 450 ppm, Ceiling (15-minute) |
| **IDLH:** | 1,100 ppm |

**The Protective Action Criteria values are:**

PAC-1 = 87.5 ppm PAC-2 = 450 ppm
PAC-3 = 1,100 ppm

## PROTECTIVE EQUIPMENT

| | |
|---|---|
| **Gloves:** | Silver Shield®/4H®, Viton, Viton/Butyl and Barrier® (>8-hr breakthrough for *Hydrocarbons*) |
| **Coveralls:** | Tychem® BR, CSM and TK; and Trellchem® HPS and VPS (>8-hr breakthrough for *Hydrocarbons*)<br>**Use turn out gear or flash protection if ignition/fire is the greatest hazard.** |
| **Respirator:** | >88 ppm - SCBA |

## HEALTH EFFECTS

| | |
|---|---|
| **Eyes:** | Irritation and burns |
| **Skin:** | Irritation and burns |
| **Inhalation:** | Nose, throat and lung irritation, with coughing, wheezing and shortness of breath<br>Headache, dizziness, confusion and loss of balance |

## FIRST AID AND DECONTAMINATION

**Remove** the person from exposure.

**Flush** eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.

**Quickly** remove contaminated clothing and wash contaminated skin with large amounts of soap and water.

**Begin** artificial respiration if breathing has stopped and CPR if necessary.

**Transfer** promptly to a medical facility.

August 2011

NJ Health
New Jersey Department of Health

# Right to Know
# Hazardous Substance Fact Sheet

Common Name: **BENZENE**

Synonyms: Benzin; Benzol; Phenyl Hydride
Chemical Name: Benzene
Date: January 2001 Revision: October 2008

CAS Number: 71-43-2
RTK Substance Number: 0197
DOT Number: UN 1114

## Description and Use

**Benzene** is a clear, colorless liquid with a sweet *Petroleum*-like odor. It is used as a solvent and in making plastics, resins dyes and pesticides. It is also found in *Gasoline*.

- **ODOR THRESHOLD= 12 ppm**
- Odor thresholds vary greatly. Do not rely on odor alone to determine potentially hazardous exposures.

## Reasons for Citation

- **Benzene** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, NTP, DEP, IARC, IRIS, NFPA and EPA.
- This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

## FIRST AID

**Eye Contact**

- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while rinsing.

**Skin Contact**

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

**Inhalation**

- Remove the person from exposure
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

## EMERGENCY NUMBERS

**Poison Control: 1-800-222-1222**
**CHEMTREC: 1-800-424-9300**
**NJDEP Hotline: 1-877-927-6337**
**National Response Center: 1-800-424-8802**

**EMERGENCY RESPONDERS >>>> SEE BACK PAGE**

## Hazard Summary

| Hazard Rating | NJDOH | NFPA |
|---|---|---|
| HEALTH | 4 | 2 |
| FLAMMABILITY | - | 3 |
| REACTIVITY | - | 0 |

CARCINOGEN
FLAMMABLE
POISONOUS GASES ARE PRODUCED IN FIRE
CONTAINERS MAY EXPLODE IN FIRE

*Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe*

- **Benzene** can affect you when inhaled and by passing through the skin.
- **Benzene** is a CARCINOGEN and MUTAGEN. HANDLE WITH EXTREME CAUTION.
- **Benzene** can irritate the skin and eyes with drying and scaling of the skin.
- Inhaling **Benzene** can irritate the nose and throat.
- **Benzene** can cause headache, dizziness, nausea and vomiting. Convulsions and coma, or sudden death from irregular heartbeat, may follow high exposure.
- Repeated exposure can cause damage to the blood cells (aplastic anemia).
- **Benzene** is a FLAMMABLE LIQUID and a DANGEROUS FIRE HAZARD.

## Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **1 ppm** averaged over an 8-hour workshift and **5 ppm**, not to be exceeded during any 15-minute work period.

NIOSH: The recommended airborne exposure limit (REL) is **0.1 ppm** averaged over a 10-hour workshift and **1 ppm**, not to be exceeded during any 15-minute work period.

ACGIH: The threshold limit value (TLV) is **0.5 ppm** averaged over an 8-hour workshift and **2.5 ppm** as a STEL (short-term exposure limit).

- **Benzene** is a CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

## Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

## Health Hazard Information

### Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Benzene**:

- Contact can irritate the skin and eyes.
- Inhaling **Benzene** can irritate the nose and throat causing coughing and wheezing.
- **Benzene** can cause headache, dizziness, lightheadedness, nausea and vomiting. Convulsions and coma, or sudden death from irregular heartbeat, may follow high exposure.

### Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Benzene** and can last for months or years:

***Cancer Hazard***

- **Benzene** is a CARCINOGEN in humans. It has been shown to cause leukemia.
- Many scientists believe there is no safe level of exposure to a carcinogen.

**Reproductive Hazard**

- There is limited evidence that **Benzene** is a teratogen in animals. Until further testing has been done, it should be treated as a possible teratogen in humans.

***Other Effects***

- **Benzene** can cause drying and scaling of the skin.
- Repeated exposure can cause damage to the blood cells (aplastic anemia).

## Medical

### Medical Testing

Before first exposure and every 12 months thereafter, OSHA requires your employer to provide (for persons exposed to greater than **0.5 ppm** of *Benzene*) a work and medical history and exam, which shall include:

- Thorough physical examination
- Complete blood count (CBC)
- Any other tests determined necessary by the examining physician

OSHA requires your employer to provide you and your doctor with a copy of the OSHA *Benzene* Standard (29 CFR 1910.1028).

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are <u>not</u> a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

## Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Specific engineering controls are required for this chemical by OSHA. Refer to the OSHA *Benzene* Standard (29 CFR 1910.1028).
- Before entering a confined space where **Benzene** may be present, check to make sure that an explosive concentration does not exist.

## Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

### Gloves and Clothing

- Avoid skin contact with **Benzene**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend Polyvinyl Alcohol, Silver Shield®/4H®, Viton and Fluoroelastomer for gloves and Tychem® CPF 3, F, BR, LV, Responder®, and TK; Zytron® 300; and ONESuit® TEC, or the equivalent, as protective materials for *Hydrocarbons, Aromatic*.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

### Eye Protection

- Wear indirect-vent, impact and splash resistant goggles when working with liquids.
- Wear non-vented, impact resistant goggles when working with fumes, gases, or vapors.
- Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.
- Do not wear contact lenses when working with this substance.

### Respiratory Protection

***Improper use of respirators is dangerous.*** Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **0.5 ppm**, use a NIOSH approved full facepiece respirator with an organic vapor cartridge. Increased protection is obtained from full facepiece powered-air purifying respirators.
- Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Benzene**, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential exists for exposure over **5 ppm**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- Exposure to **500 ppm** is immediately dangerous to life and health. If the possibility of exposure above **500 ppm** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

## Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- **Benzene** is a FLAMMABLE LIQUID.
- Use dry chemical, $CO_2$, water spray or foam as extinguishing agents.
- Use water as fog, as spray may be ineffective and may scatter and spread fire.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- CONTAINERS MAY EXPLODE IN FIRE.
- Use water spray to reduce vapors and keep containers cool.
- Vapors may travel to a source of ignition and flash back.
- Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source.

## Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Benzene** is spilled or leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers.
- Ventilate area of spill or leak.
- Keep **Benzene** out of confined spaces, such as sewers, because of the possibility of an explosion.
- Use water spray to reduce vapors and keep containers cool.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Benzene** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

## Handling and Storage

Prior to working with **Benzene** you should be trained on its proper handling and storage.

- A regulated, marked area should be established where **Benzene** is handled, used or stored as required by the OSHA *Benzene* Standard (29 CFR 1910.1028).
- **Benzene** reacts violently or explosively with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC).
- **Benzene** ignites on contact with CHROMIC ANHYDRIDE.
- **Benzene** is not compatible with LIQUID OXYGEN, HYDROGEN, and RANEY NICKEL.
- Store in tightly closed containers in a cool, well-ventilated area away from AIR and HEAT.
- **Benzene** attacks some RUBBER, COATINGS and PLASTICS.
- Sources of ignition, such as smoking and open flames, are prohibited where **Benzene** is used, handled, or stored.
- Metal containers involving the transfer of **Benzene** should be grounded and bonded.
- Use explosion-proof electrical equipment and fittings wherever **Benzene** is used, handled, manufactured, or stored.
- Use only non-sparking tools and equipment, especially when opening and closing containers of **Benzene**.

## Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

**For more information, please contact:**

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
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**NTP** is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

**OSHA** is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

**PEOSHA** is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

**Permeated** is the movement of chemicals through protective materials.

**PIH** is a DOT designation for chemicals which are Poison Inhalation Hazards.

**ppm** means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

**STEL** is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

**UEL** or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

**Vapor Density** is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

NJ Health
New Jersey Department of Health

# Right to Know Hazardous Substance Fact Sheet

Emergency Responders
Quick Reference

Common Name: **BENZENE**

Synonyms: Benzin; Benzol; Phenyl Hydride
CAS No: 71-43-2
Molecular Formula: $C_6H_6$
RTK Substance No: 0197
Description: Clear, colorless liquid with a sweet *Petroleum*-like odor

## HAZARD DATA

### Hazard Rating

**4 - Health**
**3 - Fire**
**0 - Reactivity**

**DOT#:** UN 1114
**ERG Guide #:** 130
**Hazard Class:** 3 (Flammable)

### Firefighting

FLAMMABLE LIQUID

Use dry chemical, $CO_2$, water spray or foam as extinguishing agents.

Use water as fog, as spray may be ineffective and may scatter and spread fire.

POISONOUS GASES ARE PRODUCED IN FIRE.

CONTAINERS MAY EXPLODE IN FIRE.

Use water spray to reduce vapors and keep containers cool.

Vapors may travel to a source of ignition and flash back.

Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source.

### Reactivity

**Benzene** reacts violently or explosively with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC).

**Benzene** ignites on contact with CHROMIC ANHYDRIDE.

**Benzene** is not compatible with LIQUID OXYGEN, HYDROGEN, and RANEY NICKEL.

## SPILL/LEAKS

**Isolation Distance:**

Small Spill: 30 meters (100 feet)
Large Spill: 60 meters (200 feet)
Fire: 800 meters (1/2 mile)

Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers.

Keep **Benzene** out of confined spaces, such as sewers, because of the possibility of an explosion.

DO NOT wash into sewer.

**Benzene** is very toxic to aquatic organisms.

## PHYSICAL PROPERTIES

| | |
|---|---|
| **Odor Threshold:** | 12 ppm |
| **Flash Point:** | 12°F (-11°C) |
| **LEL:** | 1% |
| **UEL:** | 8% |
| **Auto Ignition Temp:** | 928° to 1,076°F (498° to 580°C) |
| **Vapor Density:** | 2.7 (air = 1) |
| **Vapor Pressure:** | 75 mm Hg at 68°F (20°C) |
| **Specific Gravity:** | 0.88 (water = 1) |
| **Water Solubility:** | Slightly soluble |
| **Boiling Point:** | 176°F (80°C) |
| **Freezing Point:** | 42°F (6°C) |
| **Ionization Potential:** | 9.24 eV |
| **Molecular Weight:** | 78.1 |

## EXPOSURE LIMITS

| | |
|---|---|
| **OSHA:** | 1 ppm, 8-hr TWA; 5 ppm, 15-min STEL |
| **NIOSH:** | 0.1 ppm, 10-hr TWA; 1 ppm, 15-min STEL |
| **ACGIH:** | 0.5 ppm, 8-hr TWA; 2.5 ppm, 15-min STEL |
| **IDLH:** | 500 ppm |
| | ERPG-1: 50 ppm; ERPG-2: 150 ppm |
| | EPRG-3: 1,000 ppm |

## PROTECTIVE EQUIPMENT

| | |
|---|---|
| **Gloves:** | Polyvinyl Alcohol, Silver Shield®/4H®, Viton and Fluoroelastomer (>8-hr breakthrough) |
| **Coveralls:** | Tychem® CPF 3, F, BR, LV, Responder®, and TK; Zytron® 300; and ONESuit® TEC (>8-hr breakthrough for *Hydrocarbons, Aromatic*) |
| **Respirator:** | >0.5 ppm - Supplied air or SCBA |

## HEALTH EFFECTS

| | |
|---|---|
| **Eyes:** | Irritation |
| **Skin:** | Irritation |
| **Inhalation:** | Nose and throat irritation with coughing and wheezing<br>Headache, dizziness, convulsions and coma |
| **Chronic:** | Cancer (leukemia) in humans |

## FIRST AID AND DECONTAMINATION

**Remove** the person from exposure.

**Flush** eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.

**Quickly** remove contaminated clothing and wash contaminated skin with large amounts of soap and water.

**Begin** artificial respiration if breathing has stopped and CPR if necessary.

**Transfer** promptly to a medical facility.

October 2008

# Right to Know
# Hazardous Substance Fact Sheet

Common Name: **TOLUENE**

Synonyms: Toluol; Methyl Benzene; Phenyl Methane

Chemical Name: Benzene, Methyl-

Date: August 1998 Revision: November 2007

CAS Number: 108-88-3

RTK Substance Number: 1866

DOT Number: UN 1294

## Description and Use

**Toluene** is a colorless liquid with a sweet, strong odor. It is used as a solvent, in aviation gasoline, and in making chemicals, perfumes, medicines, dyes, explosives and detergents.

- **ODOR THRESHOLD = 2.5 ppm**
- Odor thresholds vary greatly. Do not rely on odor alone to determine potentially hazardous exposures.

## Reasons for Citation

- **Toluene** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, DEP, IARC, IRIS, NFPA and EPA.
- This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

## FIRST AID

**Eye Contact**

- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while rinsing.

**Skin Contact**

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

**Inhalation**

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

## EMERGENCY NUMBERS

**Poison Control: 1-800-222-1222**
**CHEMTREC: 1-800-424-9300**
**NJDEP Hotline: 1-877-927-6337**
**National Response Center: 1-800-424-8802**

**EMERGENCY RESPONDERS >>>> SEE BACK PAGE**

## Hazard Summary

| Hazard Rating | NJDOH | NFPA |
|---|---|---|
| HEALTH | - | 2 |
| FLAMMABILITY | - | 3 |
| REACTIVITY | - | 0 |

TERATOGEN
FLAMMABLE
POISONOUS GASES ARE PRODUCED IN FIRE
CONTAINERS MAY EXPLODE IN FIRE

*Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe*

- **Toluene** can affect you when inhaled and by passing through the skin.
- **Toluene** should be handled as a TERATOGEN--WITH EXTREME CAUTION.
- **Toluene** may damage the developing fetus.
- Contact can irritate the skin and eyes.
- Inhaling **Toluene** can irritate the nose and throat.
- **Toluene** may affect the nervous system causing headache, dizziness and passing out.
- Repeated exposure may cause liver, kidney and brain damage.
- **Toluene** is FLAMMABLE LIQUID and a DANGEROUS FIRE HAZARD.

## Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **200 ppm** averaged over an 8-hour workshift,

**300 ppm** not to be exceeded during any 15-minute work period, and **500 ppm** as a 10-minute acceptable maximum peak during an 8-hr workshift.

NIOSH: The recommended airborne exposure limit (REL) is **100 ppm** averaged over a 10-hour workshift and **150 ppm**, not to be exceeded during any 15-minute work period.

ACGIH: The threshold limit value (TLV) is **20 ppm** averaged over an 8-hour workshift.

- **Toluene** may be a teratogen in humans. All contact with this chemical should be reduced to the lowest possible level.
- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

## Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

## Health Hazard Information

### Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Toluene**:

- Contact can irritate the skin and eyes.
- Inhaling **Toluene** can irritate the nose and throat causing coughing and wheezing.
- **Toluene** may affect the nervous system causing trouble concentrating, headaches and slowed reflexes. Higher levels can cause dizziness, lightheadedness and passing out.

### Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Toluene** and can last for months or years:

***Cancer Hazard***

- While **Toluene** has been tested, it is not classifiable as to its potential to cause cancer.

***Reproductive Hazard***

- **Toluene** may be a TERATOGEN in humans since it is a teratogen in animals.
- **Toluene** may damage the developing fetus.

***Other Effects***

- Prolonged or repeated exposure can cause drying and cracking of the skin with redness and a skin rash.
- Repeated exposure may cause liver, kidney and brain damage.

## Medical

### Medical Testing

For frequent or potentially high exposure (half the TLV or greater, or significant skin contact) the following is recommended before beginning work and at regular times after that:

- Urinary Hippuric acid excretion test (at the end of the shift) as an index of overexposure

If symptoms develop or overexposure is suspected, the following are recommended:

- Liver and kidney function tests
- EEG

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

### Mixed Exposures

- More than light alcohol consumption can cause liver damage. Drinking alcohol may increase the liver damage caused by **Toluene**.

## Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Before entering a confined space where **Toluene** may be present, check to make sure that an explosive concentration does not exist.

## Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

### Gloves and Clothing

- Avoid skin contact with **Toluene**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend *Viton*, *4-H®/Silver Shield®*, and *Polyvinyl Alcohol* for gloves and DuPont *Tychem® CPF-3*, *CPF-4*, *BR* and *LV*, *Responder®* and *TK*, and *Kappler Zytron® 300* and *500* as protective materials for clothing.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

### Eye Protection

- Wear indirect-vent, impact and splash resistant goggles when working with liquids.
- Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.
- Do not wear contact lenses when working with this substance.

### Respiratory Protection

***Improper use of respirators is dangerous.*** Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **20 ppm**, use a NIOSH approved full facepiece respirator with an organic vapor cartridge. Increased protection is obtained from full facepiece powered-air purifying respirators.
- Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Toluene**, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential exists for exposure over **200 ppm**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- Exposure to **500 ppm** is immediately dangerous to life and health. If the possibility of exposure above **500 ppm** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

## Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- **Toluene** is a FLAMMABLE LIQUID.
- Use dry chemical, $CO_2$, alcohol-resistant foam or other foaming agent as extinguishing agents, as water may not be effective in fighting fires.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- CONTAINERS MAY EXPLODE IN FIRE.
- Use water spray to keep fire-exposed containers cool.
- Vapors may travel to a source of ignition and flash back.
- Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source.
- Use water spray to reduce vapors.

## Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Toluene** is spilled or leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers.
- Ventilate and wash area after clean-up is complete.
- Keep **Toluene** out of confined spaces, such as sewers, because of the possibility of an explosion.
- It may be necessary to contain and dispose of **Toluene** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

## Handling and Storage

Prior to working with **Toluene** you should be trained on its proper handling and storage.

- **Toluene** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); METAL SALTS; and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC).
- Store in tightly closed containers in a cool, well-ventilated area away from COMBUSTIBLES.
- Sources of ignition, such as smoking and open flames, are prohibited where **Toluene** is used, handled, or stored.
- Metal containers involving the transfer of **Toluene** should be grounded and bonded.
- Use only non-sparking tools and equipment, especially when opening and closing containers of **Toluene**.
- **Toluene** may accumulate static electricity.

## Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

**For more information, please contact:**

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

***The Right to Know Hazardous Substance Fact Sheets are not intended to be copied and sold for commercial purposes.***

## GLOSSARY

**ACGIH** is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

**Acute Exposure Guideline Levels** (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

**Boiling point** is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

**CFR** is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

**DEP** is the New Jersey Department of Environmental Protection.

**DOT** is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

**EPA** is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

**ERG** is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

**Emergency Response Planning Guideline** (ERPG) values are intended to provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

**IARC** is the International Agency for Research on Cancer, a scientific group.

**Ionization Potential** is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

**IRIS** is the Integrated Risk Information System database maintained by federal EPA. The database contains information on human health effects that may result from exposure to various chemicals in the environment.

**LEL** or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

**$mg/m^3$** means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

**NFPA** is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

**NIOSH** is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

**NTP** is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

**OSHA** is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

**PEOSHA** is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

**Permeated** is the movement of chemicals through protective materials.

**PIH** is a DOT designation for chemicals which are Poison Inhalation Hazards.

**ppm** means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

**STEL** is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

**UEL** or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

**Vapor Density** is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

NJ Health
New Jersey Department of Health

# Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **TOLUENE**

Synonyms: Toluol; Methyl Benzene; Phenyl Methane
CAS No: 108-88-3
Molecular Formula: $C_7H_8$
RTK Substance No: 1866
Description: A colorless liquid with a sweet, strong odor

## HAZARD DATA

### Hazard Rating

**2 - Health**

**3 - Fire**

**0 - Reactivity**

**DOT#:** UN 1294

**ERG Guide #:** 130

**Hazard Class:** 3 (Flammable)

### Firefighting

**Toluene** is a FLAMMABLE LIQUID.

Use dry chemical, $CO_2$, alcohol-resistant foam or other foaming agent as extinguishing agents, as water may not be effective in fighting fires.

POISONOUS GASES ARE PRODUCED IN FIRE.

CONTAINERS MAY EXPLODE IN FIRE.

Use water spray to keep fire-exposed containers cool.

Vapors may travel to a source of ignition and flash back.

Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source.

Use water spray to reduce vapors.

### Reactivity

**Toluene** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); METAL SALTS; and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC).

**Toluene** may accumulate static electricity.

## SPILL/LEAKS

**Isolation Distance:**

Small Spill: 60 meters (200 feet)

Large Spill: 270 meters (900 feet)

Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers.

DO NOT wash into sewer. **Toluene** is toxic to aquatic organisms.

Liquid floats on water and may travel to ignition source and spread fire.

## EXPOSURE LIMITS

| | |
|---|---|
| **OSHA:** | 200 ppm, 8-hr TWA; 300 ppm, STEL; and 500 ppm, 10-min peak per 8-hr workshift |
| **NIOSH:** | 100 ppm, 10-hr TWA; 150 ppm, STEL |
| **ACGIH:** | 20 ppm, 8-hr TWA |
| **IDLH LEVEL:** | 500 ppm |

## HEALTH EFFECTS

| | |
|---|---|
| **Eyes:** | Irritation |
| **Skin:** | Irritation, drying, cracking and rash |
| **Acute:** | Nose and throat irritation with coughing and wheezing<br>Headache, dizziness and passing out |
| **Chronic:** | Cancer (Not Classifiable)<br>May be a teratogen in humans |

## PHYSICAL PROPERTIES

| | |
|---|---|
| **Odor Threshold:** | 2.5 ppm |
| **Flash Point:** | 40°F (4°C) |
| **LEL:** | 1.1% |
| **UEL:** | 7.1% |
| **Vapor Density:** | 3.1 (air = 1) |
| **Vapor Pressure:** | 21 mm Hg at 68°F (20°C) |
| **Specific Gravity:** | 0.87 (water = 1) |
| **Water Solubility:** | Very slightly soluble |
| **Boiling Point:** | 232°F (111°C) |
| **Ionization Potential:** | 8.82 eV |
| **Molecular Weight:** | 92.1 |

## PROTECTIVE EQUIPMENT

| | |
|---|---|
| **Gloves:** | Viton, 4-H®/Silver Shield® and Polyvinyl Alcohol (>4-hr breakthrough) |
| **Coveralls:** | DuPont Tychem® CPF-3, CPF-4, BR and LV, Responder®, TK and Kappler Zytron® 300 and 500 (>8-hr breakthrough) |
| **Boots:** | No information |
| **Respirator:** | >20 ppm - full facepiece APR with Organic Vapor cartridge<br>>200 ppm - Supplied air |

## FIRST AID AND DECONTAMINATION

**Remove** the person from exposure.

**Flush** eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.

**Quickly** remove contaminated clothing and wash contaminated skin with large amounts of soap and water.

**Begin** artificial respiration if breathing has stopped and CPR if necessary.

**Transfer** to a medical facility.

November 2007

New Jersey Department of Health and Senior Services

# HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **ETHYL BENZENE**

CAS Number: 100-41-4
DOT Number: UN 1175

RTK Substance number: 0851
Date: February 1996 Revision: April 2002

## HAZARD SUMMARY

- **Ethyl Benzene** can affect you when breathed in and by passing through your skin.
- **Ethyl Benzene** can irritate the eyes, nose and throat.
- Contact with **Ethyl Benzene** can irritate the skin. Prolonged exposure can causing drying, scaling and even blistering of the skin.
- Exposure to high concentration can cause you to become dizzy, lightheaded, and to pass out. Very high levels can cause trouble breathing and even death.
- High exposure may damage the liver.
- **Ethyl Benzene** is a FLAMMABLE LIQUID and a FIRE HAZARD.

## IDENTIFICATION

**Ethyl Benzene** is a colorless liquid. It is used in the production of *Styrene* and synthetic polymers, as a solvent, and as a component of automotive and aviation fuels.

## REASON FOR CITATION

- **Ethyl Benzene** is on the Hazardous Substance List because it is regulated by OSHA and cited by ACGIH, DOT, NIOSH, DEP, HHAG, NFPA and EPA.
- This chemical is on the Special Health Hazard Substance List because it is **FLAMMABLE**.
- Definitions are provided on page 5.

## HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

- Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.1020.
- If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

## WORKPLACE EXPOSURE LIMITS

OSHA: The legal airborne permissible exposure limit (PEL) is **100 ppm** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit is **100 ppm** averaged over a 10-hour workshift and **125 ppm**, not to be exceeded during any 15 minute work period.

ACGIH: The recommended airborne exposure limit is **100 ppm** averaged over an 8-hour workshift and **125 ppm** as a STEL (short-term exposure limit).

- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

## WAYS OF REDUCING EXPOSURE

- Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
- Wear protective work clothing.
- Wash thoroughly immediately after exposure to **Ethyl Benzene** and at the end of the workshift.
- Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Ethyl Benzene** to potentially exposed workers.

This Fact Sheet is a summary source of information of all potential and most severe health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

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## HEALTH HAZARD INFORMATION

### Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Ethyl Benzene**:

* **Ethyl Benzene** can irritate the eyes, nose and throat.
* Contact with **Ethyl Benzene** can irritate the skin.
* Exposure to high concentration can cause you to become dizzy, lightheaded and to pass out. Very high levels can cause trouble breathing and even death.

### Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Ethyl Benzene** and can last for months or years:

### Cancer Hazard

* There is limited evidence that **Ethyl Benzene** causes cancer in animals. It may cause cancer of the kidneys.
* Many scientists believe there is no safe level of exposure to a carcinogen.

### Reproductive Hazard

* There is limited evidence that **Ethyl Benzene** may damage the developing fetus.

### Other Long-Term Effects

* Prolonged exposure can cause drying, scaling and even blistering of the skin.
* High exposure may damage the liver.
* This chemical has not been adequately evaluated to determine whether brain or other nerve damage could occur with repeated exposure. However, many solvents and other petroleum-based chemicals have been shown to cause such damage. Effects may include reduced memory and concentration, personality changes (withdrawal, irritability), fatigue, sleep disturbances, reduced coordination, and/or effects on nerves supplying internal organs (autonomic nerves) and/or nerves to the arms and legs (weakness, "pins and needles").

## MEDICAL

### Medical Testing

If symptoms develop or overexposure is suspected, the following are recommended:

* Liver function tests.
* Evaluate for brain effects such as changes in memory, concentration, sleeping patterns and mood (especially irritability and social withdrawal), as well as headaches and fatigue. Consider evaluations of the cerebellar, autonomic and peripheral nervous systems. Positive and borderline individuals should be referred for neuropsychological testing.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under OSHA 1910.1020.

### Mixed Exposures

* Because more than light alcohol consumption can cause liver damage, drinking alcohol can increase the liver damage caused by **Ethyl Benzene**.

## WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following controls are recommended:

* Where possible, automatically pump liquid **Ethyl Benzene** from drums or other storage containers to process containers.
* Before entering a confined space where **Ethyl Benzene** may be present, check to make sure that an explosive concentration does not exist.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

* Workers whose clothing has been contaminated by **Ethyl Benzene** should change into clean clothing promptly.
* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Ethyl Benzene**.
* Eye wash fountains should be provided in the immediate work area for emergency use.

* If there is the possibility of skin exposure, emergency shower facilities should be provided.
* On skin contact with **Ethyl Benzene**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **Ethyl Benzene**, whether or not known skin contact has occurred.
* Do not eat, smoke, or drink where **Ethyl Benzene** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, applying cosmetics, smoking, or using the toilet.

## PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 1910.132 requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

### Clothing

* Avoid skin contact with **Ethyl Benzene**. Wear solvent-resistant gloves and clothing. Safety equipment suppliers/ manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.
* ACGIH recommends *Teflon* as a protective material.

### Eye Protection

* Wear indirect-vent, impact and splash resistant goggles when working with liquids.
* Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.
* Contact lenses should not be worn when working with this substance.

### Respiratory Protection

**IMPROPER USE OF RESPIRATORS IS DANGEROUS.** Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

* Where the potential exists for exposure over **100 ppm**, use a NIOSH approved full facepiece respirator with an organic vapor cartridge. Increased protection is obtained from full facepiece powered-air purifying respirators.
* If while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Ethyl Benzene**, or if while wearing particulate filters abnormal resistance to breathing is experienced, or eye irritation occurs while wearing a full facepiece respirator, leave the area immediately. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
* Be sure to consider all potential exposures in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
* Where the potential for high exposure exists, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
* Exposure to **800 ppm** is immediately dangerous to life and health. If the possibility of exposure above **800 ppm** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode.

## HANDLING AND STORAGE

* Prior to working with **Ethyl Benzene** you should be trained on its proper handling and storage.
* **Ethyl Benzene** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and NITRIC ACID.
* Store in tightly closed containers in a cool, well-ventilated area.
* Sources of ignition, such as smoking and open flames, are prohibited where **Ethyl Benzene** is used, handled, or stored.
* Metal containers involving the transfer of **Ethyl Benzene** should be grounded and bonded.
* Use only non-sparking tools and equipment, especially when opening and closing containers of **Ethyl Benzene**.

## QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?
A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?
A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?

A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?

A: Conditions which increase risk of exposure include physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?

A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

Q: Don't all chemicals cause cancer?

A: No. Most chemicals tested by scientists are not cancer-causing.

Q: Should I be concerned if a chemical causes cancer in animals?

A: Yes. Most scientists agree that a chemical that causes cancer in animals should be treated as a suspected human carcinogen unless proven otherwise.

Q: But don't they test animals using much higher levels of a chemical than people usually are exposed to?

A: Yes. That's so effects can be seen more clearly using fewer animals. But high doses alone don't cause cancer unless it's a cancer agent. In fact, a chemical that causes cancer in animals at high doses could cause cancer in humans exposed to low doses.

Q: Can men as well as women be affected by chemicals that cause reproductive system damage?

A: Yes. Some chemicals reduce potency or fertility in both men and women. Some damage sperm and eggs, possibly leading to birth defects.

Q: Who is at the greatest risk from reproductive hazards?

A: Pregnant women are at greatest risk from chemicals that harm the developing fetus. However, chemicals may affect the ability to have children, so both men and women of childbearing age are at high risk.

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The following information is available from:

New Jersey Department of Health and Senior Services
Occupational Health Service
PO Box 360
Trenton, NJ 08625-0360
(609) 984-1863
(609) 984-7407 (fax)

Web address: http://www.state.nj.us/health/eoh/odisweb/

**Industrial Hygiene Information**

Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

**Medical Evaluation**

If you think you are becoming sick because of exposure to chemicals at your workplace, you may call personnel at the Department of Health and Senior Services, Occupational Health Service, who can help you find the information you need.

**Public Presentations**

Presentations and educational programs on occupational health or the Right to Know Act can be organized for labor unions, trade associations and other groups.

**Right to Know Information Resources**

The Right to Know Infoline (609) 984-2202 can answer questions about the identity and potential health effects of chemicals, list of educational materials in occupational health, references used to prepare the Fact Sheets, preparation of the Right to Know Survey, education and training programs, labeling requirements, and general information regarding the Right to Know Act. Violations of the law should be reported to (609) 984-2202.

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## DEFINITIONS

**ACGIH** is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is assigned by the Chemical Abstracts Service to identify a specific chemical.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

**DEP** is the New Jersey Department of Environmental Protection.

**DOT** is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

**EPA** is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

**HHAG** is the Human Health Assessment Group of the federal EPA.

**IARC** is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

**$mg/m^3$** means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

**NAERG** is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

**NCI** is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

**NFPA** is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

**NIOSH** is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

**NTP** is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

**OSHA** is the Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

**PEL** is the Permissible Exposure Limit which is enforceable by the Occupational Safety and Health Administration.

**PIH** is a DOT designation for chemicals which are Poison Inhalation Hazards.

**ppm** means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

**TLV** is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

# >>>>>>>>>>>>>>>>>> EMERGENCY INFORMATION <<<<<<<<<<<<<<<<<<

Common Name: **ETHYL BENZENE**
DOT Number: **UN 1175**
NAERG Code: **129**
CAS Number: **100-41-4**

| Hazard rating | NJDHSS | NFPA |
|---|---|---|
| **FLAMMABILITY** | - | 3 |
| **REACTIVITY** | - | 0 |
| FLAMMABLE<br>POISONOUS GASES ARE PRODUCED IN FIRE<br>CONTAINERS MAY EXPLODE IN FIRE | | |

*Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe*

## FIRE HAZARDS

- **Ethyl Benzene** is a FLAMMABLE LIQUID.
- Use dry chemical, $CO_2$, alcohol or polymer foam extinguishers, as water may not be effective in fighting fires.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- CONTAINERS MAY EXPLODE IN FIRE.
- Use water spray to keep fire-exposed containers cool.
- Vapors may travel to a source of ignition and flash back.
- Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source.
- If employees are expected to fight fires, they must be trained and equipped as stated in OSHA 1910.156.

## SPILLS AND EMERGENCIES

If **Ethyl Benzene** is spilled or leaked, take the following steps:

- Evacuate persons not wearing protective equipment from area of spill or leak until clean-up is complete.
- Remove all ignition sources.
- Cover with an activated charcoal adsorbent and place in covered containers for disposal.
- Ventilate and wash area after clean-up is complete.
- Keep **Ethyl Benzene** out of a confined space, such as a sewer, because of the possibility of an explosion, unless the sewer is designed to prevent the build-up of explosive concentrations.
- It may be necessary to contain and dispose of **Ethyl Benzene** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.
- If employees are required to clean-up spills, they must be properly trained and equipped. OSHA 1910.120(q) may be applicable.

FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300
NJDEP HOTLINE: 1-877-WARN-DEP

## HANDLING AND STORAGE (See page 3)

## FIRST AID

*For POISON INFORMATION call 1-800-222-1222*

### Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids.

### Skin Contact

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

### Breathing

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

## PHYSICAL DATA

**Vapor Pressure:** 7.1 mm Hg at 68°F (20°C)
**Flash Point:** 70°F (21°C)
**Water Solubility:** Slightly soluble

## OTHER COMMONLY USED NAMES

### Chemical Name:

Benzene, Ethyl-

### Other Names:

Ethylbenzol; Phenylethane

*Not intended to be copied and sold for commercial purposes.*

NEW JERSEY DEPARTMENT OF HEALTH AND SENIOR SERVICES
**Right to Know Program**
PO Box 368, Trenton, NJ 08625-0368
(609) 984-2202

**NJ Health**
**New Jersey Department of Health**

# Right to Know
# Hazardous Substance Fact Sheet

Common Name: **XYLENES**

Synonyms: Methyl Toluene (mixed isomers); Xylol

Chemical Name: Benzene, Dimethyl-

Date: August 2006 Revision: October 2011

CAS Number: 1330-20-7

RTK Substance Number: 2014

DOT Number: UN 1307

## Description and Use

**Xylenes** are colorless liquids with a faint, sweet odor. They are used as solvents and in making paints, adhesives and other chemicals.

- **ODOR THRESHOLD = 0.07 to 40 ppm**
- Odor thresholds vary greatly. Do not rely on odor alone to determine potentially hazardous exposures.

This fact sheet can be used for:

| | |
|---|---|
| *m-Xylene* | CAS#: 108-38-3 |
| *o-Xylene* | CAS#: 95-47-6 |
| *p-Xylene* | CAS#: 106-42-3 |

## Reasons for Citation

- **Xylenes** are on the Right to Know Hazardous Substance List because they are cited by OSHA, ACGIH, DOT, NIOSH, DEP, IARC, IRIS, NFPA and EPA.

SEE GLOSSARY ON PAGE 5.

## FIRST AID

**Eye Contact**
- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while flushing. Seek medical attention.

**Skin Contact**
- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

**Inhalation**
- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

## EMERGENCY NUMBERS

**Poison Control: 1-800-222-1222**
**CHEMTREC: 1-800-424-9300**
**NJDEP Hotline: 1-877-927-6337**
**National Response Center: 1-800-424-8802**

**EMERGENCY RESPONDERS >>>> SEE LAST PAGE**

## Hazard Summary

| Hazard Rating | NJDOH | NFPA |
|---|---|---|
| HEALTH | - | 2 |
| FLAMMABILITY | - | 3 |
| REACTIVITY | - | 0 |

FLAMMABLE
POISONOUS GASES ARE PRODUCED IN FIRE
CONTAINERS MAY EXPLODE IN FIRE

*Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe*

- **Xylenes** can affect you when inhaled and by passing through the skin.
- Contact can irritate the skin and eyes. Prolonged or repeated contact can cause a skin rash, dryness and redness.
- Inhaling **Xylenes** can irritate the nose and throat causing coughing and wheezing.
- Exposure can cause headache, dizziness, lightheadedness and passing out. Repeated exposure can affect concentration, memory, vision, and muscle coordination. Higher levels can cause coma and death.
- **Xylenes** may damage the liver and kidneys.
- **Xylenes** are FLAMMABLE LIQUIDS and DANGEROUS FIRE HAZARDS.

## Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **100 ppm** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **100 ppm** averaged over a 10-hour workshift and **150 ppm**, not to be exceeded during any 15-minute work period.

ACGIH: The threshold limit value (TLV) is **100 ppm** averaged over an 8-hour workshift and **150 ppm** as a STEL (short-term exposure limit).

- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

## Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act and the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

## Health Hazard Information

### Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Xylenes**:

- Contact can irritate the skin and eyes.
- Inhaling **Xylenes** can irritate the nose and throat causing coughing and wheezing.
- Exposure can cause headache, nausea and vomiting, dizziness, lightheadedness and passing out.

### Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Xylenes** and can last for months or years:

*Cancer Hazard*

- While **Xylenes** have been tested, they are not classifiable as to their potential to cause cancer.

*Reproductive Hazard*

- **Xylenes** may damage the developing fetus.

*Other Effects*

- Repeated exposure can affect concentration, memory, vision, and muscle coordination. Higher levels can cause coma and death.
- Prolonged or repeated contact can cause a skin rash, dryness and redness.
- **Xylenes** may damage the liver and kidneys.

## Medical

### Medical Testing

For frequent or potentially high exposure (half the PEL or greater), the following are recommended before beginning work and at regular times after that:

- Liver and kidney function tests

If symptoms develop or overexposure is suspected, the following are recommended:

- Exam of the eyes and vision
- Exam of the nervous system

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

You have a legal right to request copies of your medical testing under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

### Mixed Exposures

- More than light alcohol consumption can cause liver damage. Drinking alcohol can increase the liver damage caused by **Xylenes**.

## Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Before entering a confined space where **Xylenes** may be present, check to make sure that an explosive concentration does not exist.

## Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

### Gloves and Clothing

- Avoid skin contact with **Xylenes**. Wear personal protective equipment made from material that can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- The recommended glove materials for **Xylenes** are Viton/Butyl, Polyvinyl Alcohol, Silver Shield®/4H®, Viton and Barrier®.
- The recommended protective clothing materials for **Xylenes** are Tychem® BR, CSM and TK, or the equivalent.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

### Eye Protection

- Wear indirect vent goggles when working with liquids that may splash, spray or mist. A face shield is also required if the liquid is severely irritating or corrosive to the skin and eyes.

### Respiratory Protection

***Improper use of respirators is dangerous.*** Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134). **Only NIOSH approved respirators should be used.**

- Where the potential exists for exposure over **100 ppm**, use a full facepiece respirator with an organic vapor cartridge. Increased protection is obtained from full facepiece powered-air purifying respirators.
- Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Xylenes**, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential for high exposure exists, use a supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus or an emergency escape air cylinder.
- Exposure to **900 ppm** is immediately dangerous to life and health. If the possibility of exposure above **900 ppm** exists, use a self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

## Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- **Xylenes** are FLAMMABLE LIQUIDS.
- Use dry chemical, $CO_2$, water spray or foam as extinguishing agents.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- CONTAINERS MAY EXPLODE IN FIRE.
- Use water spray to keep fire-exposed containers cool.
- Vapors are heavier than air and may travel a distance to cause a fire or explosion far from the source and flash back.
- Flow or agitation may generate electrostatic charges.
- **Xylenes** may form an ignitable vapor/air mixture in closed tanks or containers.

## Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Xylenes** are spilled or leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Absorb *liquids* in dry sand, earth, or a similar material and place into sealed containers for disposal.
- Keep **Xylenes** out of confined spaces, such as sewers, because of the possibility of an explosion.
- Ventilate area of spill or leak.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Xylenes** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

## Handling and Storage

Prior to working with **Xylenes** you should be trained on its proper handling and storage.

- **Xylenes** react with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC).
- Store in tightly closed containers in a cool, well-ventilated area.
- Sources of ignition, such as smoking and open flames, are prohibited where **Xylenes** are used, handled, or stored.
- Metal containers involving the transfer of **Xylenes** should be grounded and bonded.
- Use explosion-proof electrical equipment and fittings wherever **Xylenes** are used, handled, manufactured, or stored.
- Use only non-sparking tools and equipment, especially when opening and closing containers of **Xylenes**.

## Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

**For more information, please contact:**

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

***The Right to Know Hazardous Substance Fact Sheets are not intended to be copied and sold for commercial purposes.***

## GLOSSARY

**ACGIH** is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

**Acute Exposure Guideline Levels** (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

**Boiling point** is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

**CFR** is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

The **critical temperature** is the temperature above which a gas cannot be liquefied, regardless of the pressure applied.

**DEP** is the New Jersey Department of Environmental Protection.

**DOT** is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

**EPA** is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

**ERG** is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

**Emergency Response Planning Guideline** (ERPG) values provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

**IARC** is the International Agency for Research on Cancer, a scientific group.

**Ionization Potential** is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

**IRIS** is the Integrated Risk Information System database on human health effects that may result from exposure to various chemicals, maintained by federal EPA.

**LEL** or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

**mg/m$^3$** means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

**NFPA** is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

**NIOSH** is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

**NTP** is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

**OSHA** is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

**PEOSHA** is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

**Permeated** is the movement of chemicals through protective materials.

**ppm** means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

**Protective Action Criteria** (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

**STEL** is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

**UEL** or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

**Vapor Density** is the ratio of the weight of a given volume of one gas to the weight of another (usually *Air*), at the same temperature and pressure.

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

NJ Health
New Jersey Department of Health

# Right to Know Hazardous Substance Fact Sheet

**Emergency Responders**
**Quick Reference**

Common Name: **XYLENES**

---

Synonyms: Dimethylbenzene; Methyl Toluene (mixed isomers); Xylol
CAS No: 1330-20-7
Molecular Formula: $C_6H_4(CH_3)_2$
RTK Substance No: 2014
Description: Colorless liquids with a faint, sweet odor

## HAZARD DATA

### Hazard Rating

**2 - Health**
**3 - Fire**
**0 - Reactivity**

**DOT#:** UN 2014
**ERG Guide #:** 130
**Hazard Class:** 3 (Flammable)

### Firefighting

FLAMMABLE LIQUIDS

Use dry chemical, $CO_2$, water spray or foam as extinguishing agents.

POISONOUS GASES ARE PRODUCED IN FIRE.

CONTAINERS MAY EXPLODE IN FIRE.

Use water spray to keep fire-exposed containers cool.

Vapors are heavier than air and may travel a distance to cause a fire or explosion far from the source and flash back.

Flow or agitation may generate electrostatic charges.

**Xylenes** may form an ignitable vapor/air mixture in closed tanks or containers.

### Reactivity

**Xylenes** react with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC).

## SPILL/LEAKS

**Isolation Distance:**

Spill: 50 meters (150 feet)

Fire: 800 meters (1/2 mile)

Absorb *liquids* in dry sand, earth, or a similar material and place into sealed containers for disposal.

Ground and bond containers when transferring **Xylenes**.

Use only non-sparking tools and equipment.

Keep **Xylenes** out of confined spaces, such as sewers, because of the possibility of an explosion.

DO NOT wash into sewer.

**Xylenes** are toxic to aquatic organisms.

## PHYSICAL PROPERTIES

| | |
|---|---|
| **Odor Threshold:** | 0.07 to 40 ppm |
| **Flash Point:** | 63° to 77°F (17° to 25°C) |
| **LEL:** | 0.9 to 1.1% |
| **UEL:** | 6.7 to 7% |
| **Auto Ignition Temp:** | 867° to 984°F (464° to 529°C) |
| **Vapor Density:** | 3.7 (air = 1) |
| **Vapor Pressure:** | 7 to 9 mm Hg at 68°F (20°C) |
| **Specific Gravity:** | 0.86 (water = 1) |
| **Water Solubility:** | Insoluble |
| **Boiling Point:** | 279° to 291°F (137° to 144°C) |
| **Freezing Point:** | -53°F (-47°C) to 55.4°F (13°C) |
| **Ionization Potential:** | 8.44 to 8.56 eV |
| **Molecular Weight:** | 106.2 |

## EXPOSURE LIMITS

| | |
|---|---|
| **OSHA:** | 100 ppm, 8-hr TWA |
| **NIOSH:** | 100 ppm, 10-hr TWA; 150 ppm, STEL |
| **ACGIH:** | 100 ppm, 8-hr TWA; 150 ppm, STEL |
| **IDLH:** | 900 ppm |

The Protective Action Criteria values are:
PAC-1 = 130 ppm PAC-2 = 920 ppm PAC-3 = 2,500 ppm

## PROTECTIVE EQUIPMENT

| | |
|---|---|
| **Gloves:** | Vinton/Butyl, Polyvinyl Alcohol, Silver Shield®/4H®, Viton and Barrier® (>8-hr breakthrough) |
| **Coveralls:** | Tychem® BR, CSM and TK (>8-hr breakthrough)<br>**Use turnout gear or flash protection if ignition/fire is the greatest hazard** |
| **Respirator:** | >100 ppm - full facepiece APR with *Organic vapor cartridge*<br>>900 ppm - SCBA |

## HEALTH EFFECTS

| | |
|---|---|
| **Eyes:** | Irritation |
| **Skin:** | Irritation (skin absorbable) |
| **Inhalation:** | Nose and throat irritation with coughing and wheezing<br>Headache, dizziness, lightheadedness, and passing out |

## FIRST AID AND DECONTAMINATION

**Remove** the person from exposure.

**Flush** eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.

**Quickly** remove contaminated clothing and wash contaminated skin with large amounts of soap and water.

**Begin** artificial respiration if breathing has stopped and CPR if necessary.

**Transfer** promptly to a medical facility.

October 2011

# Right to Know
# Hazardous Substance Fact Sheet

Common Name: **TETRACHLOROETHYLENE**

Synonyms: Ethylene Tetrachloride; Perchloroethylene
Chemical Name: Ethene, Tetrachloro-
Date: March 2002 Revision: October 2011

CAS Number: 127-18-4
RTK Substance Number: 1810
DOT Number: UN 1897

## Description and Use

**Tetrachloroethylene** is a clear, colorless liquid with a sweet *Ether*-like odor. It is used as a dry cleaning solvent, heat transfer medium, degreaser, solvent, and drying agent for metals.

- **ODOR THRESHOLD = 5 to 50 ppm**
- Odor thresholds vary greatly. Do not rely on odor alone to determine potentially hazardous exposures.

## Reasons for Citation

- **Tetrachloroethylene** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, NTP, DEP, IARC, IRIS, NFPA and EPA.
- This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

## FIRST AID

**Eye Contact**

- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while rinsing.

**Skin Contact**

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

**Inhalation**

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.
- Medical observation is recommended for 24 to 48 hours after overexposure, as pulmonary edema may be delayed.

## EMERGENCY NUMBERS

**Poison Control: 1-800-222-1222**
**CHEMTREC: 1-800-424-9300**
**NJDEP Hotline: 1-877-927-6337**
**National Response Center: 1-800-424-8802**

**EMERGENCY RESPONDERS >>>> SEE LAST PAGE**

## Hazard Summary

| Hazard Rating | NJDOH | NFPA |
|---|---|---|
| HEALTH | 3 | 2 |
| FLAMMABILITY | - | 0 |
| REACTIVITY | - | 0 |
| CARCINOGEN<br>POISONOUS GASES ARE PRODUCED IN FIRE<br>DOES NOT BURN | | |

*Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe*

- **Tetrachloroethylene** can affect you when inhaled and by passing through the skin.
- **Tetrachloroethylene** should be handled as a CARCINOGEN--WITH EXTREME CAUTION.
- **Tetrachloroethylene** can cause reproductive damage.
- Contact can irritate and burn the skin and eyes. Prolonged or repeated exposure can cause drying and cracking of the skin with rash, redness and blisters.
- Exposure can irritate the eyes, nose and throat.
- Inhaling **Tetrachloroethylene** can irritate the lungs. Higher exposures may cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency.
- Exposure can cause headache, dizziness, lightheadedness, nausea, vomiting, and passing out.
- **Tetrachloroethylene** may damage the liver and kidneys and affect the nervous system and heart.

## Workplace Exposure Limits

| | |
|---|---|
| OSHA: | The legal airborne permissible exposure limit (PEL) is **100 ppm** averaged over an 8-hour workshift, **200 ppm**, not to be exceeded during any 15-minute work period, and **300 ppm** as a maximum peak for 5-minutes during any 3-hour period. |
| NIOSH: | Recommends that exposure to occupational carcinogens be limited to the lowest feasible concentration. |
| ACGIH: | The threshold limit value (TLV) is **25 ppm** averaged over an 8-hour workshift and **100 ppm** as a STEL (short-term exposure limit). |

- **Tetrachloroethylene** is a PROBABLE CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

## Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act and the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

## Health Hazard Information

**Acute Health Effects**

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Tetrachloroethylene**:

- Contact can irritate and burn the skin and eyes.
- Exposure can irritate the eyes, nose and throat.
- Inhaling **Tetrachloroethylene** can irritate the lungs causing coughing and/or shortness of breath. Higher exposures may cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.
- Exposure can cause headache, dizziness, lightheadedness, incoordination, nausea, vomiting, and passing out.

**Chronic Health Effects**

The following chronic (long-term) health effects can occur at some time after exposure to **Tetrachloroethylene** and can last for months or years:

***Cancer Hazard***

- **Tetrachloroethylene** is a PROBABLE CARCINOGEN in humans. There is evidence that it causes cancer of the liver, esophagus, bladder, and other types of cancer in humans. It has also been shown to cause cancer of the liver and leukemia in animals.
- Many scientists believe there is no safe level of exposure to a carcinogen.

***Reproductive Hazard***

- **Tetrachloroethylene** may damage the developing fetus.
- **Tetrachloroethylene** may decrease fertility in males and females and may damage the male (testes) and female (ovaries) reproductive systems in animals.
- There is limited evidence that **Tetrachloroethylene** causes spontaneous abortions.

***Other Effects***

- Prolonged or repeated exposure can cause drying and cracking of the skin with rash, redness and blisters.
- **Tetrachloroethylene** may damage the liver and kidneys and affect the nervous system and heart

## Medical

**Medical Testing**

For frequent or potentially high exposure (half the TLV or greater), the following are recommended before beginning work and at regular times after that:

- Liver and kidney function tests

If symptoms develop or overexposure is suspected, the following are recommended:

- Consider chest x-ray after acute overexposure
- Exam of the nervous system
- EKG

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

You have a legal right to request copies of your medical testing under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

**Mixed Exposures**

- Smoking can cause heart disease, lung cancer, emphysema, and other respiratory problems. It may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.
- More than light alcohol consumption can cause liver damage. Drinking alcohol can increase the liver damage caused by **Tetrachloroethylene**.

## Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Where possible, transfer **Tetrachloroethylene** from drums or other containers to process containers in an enclosed system.

## Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

### Gloves and Clothing

- Avoid skin contact with **Tetrachloroethylene**. Wear personal protective equipment made from material that can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- The recommended glove materials for **Tetrachloroethylene** are Polyvinyl Alcohol, Silver Shield®/4H®, Viton, Viton/Butyl and Barrier®.
- The recommended protective clothing materials for **Tetrachloroethylene** are Tychem® F, CPF3, BR, CSM and TK; and Trellchem® HPS and VPS, or the equivalent.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

### Eye Protection

- Wear indirect vent goggles when working with liquids that may splash, spray or mist. A face shield is also required if the liquid is severely irritating or corrosive to the skin and eyes.

### Respiratory Protection

***Improper use of respirators is dangerous.*** Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure to **Tetrachloroethylene**, use a NIOSH approved respirator with an organic vapor cartridge. More protection is provided by a full facepiece respirator than by a half-mask respirator, and even greater protection is provided by a powered-air purifying respirator.
- Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Tetrachloroethylene**, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential exists for exposure over **25 ppm**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus or an emergency escape air cylinder.
- Exposure to **150 ppm** is immediately dangerous to life and health. If the possibility of exposure above **150 ppm** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

## Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- Extinguish fire using an agent suitable for type of surrounding fire. **Tetrachloroethylene** itself does not burn.
- POISONOUS GASES ARE PRODUCED IN FIRE, including *Hydrogen Chloride* and *Phosgene*.
- Use water spray to keep fire-exposed containers cool.

## Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Tetrachloroethylene** is spilled or leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Absorb liquids in dry sand, earth, or a similar material and place into sealed containers for disposal.
- Ventilate area of spill or leak.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Tetrachloroethylene** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

## Handling and Storage

Prior to working with **Tetrachloroethylene** you should be trained on its proper handling and storage.

- **Tetrachloroethylene** reacts violently with *finely dispersed* or *finely divided* METALS (such as ALUMINUM, BARIUM, LITHIUM, BERYLLIUM and ZINC).
- **Tetrachloroethylene** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); SULFURIC ACID; NITRIC ACID; SODIUM HYDROXIDE; and POTASSIUM HYDROXIDE.
- **Tetrachloroethylene** slowly decomposes in WATER to form acids such as *Hydrogen Chloride*.
- **Tetrachloroethylene** decomposes slowly with heating, and with exposure to ultraviolet light or on contact with hot surfaces, to form toxic *Hydrogen Chloride* and *Phosgene gases*.
- Store in tightly closed containers in a cool, well-ventilated area.

## Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

**For more information, please contact:**

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

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## GLOSSARY

**ACGIH** is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

**Acute Exposure Guideline Levels** (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

**Boiling point** is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

**CFR** is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

The **critical temperature** is the temperature above which a gas cannot be liquefied, regardless of the pressure applied.

**DEP** is the New Jersey Department of Environmental Protection.

**DOT** is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

**EPA** is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

**ERG** is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

**Emergency Response Planning Guideline** (ERPG) values provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

**IARC** is the International Agency for Research on Cancer, a scientific group.

**Ionization Potential** is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

**IRIS** is the Integrated Risk Information System database on human health effects that may result from exposure to various chemicals, maintained by federal EPA.

**LEL** or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

**$mg/m^3$** means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

**NFPA** is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

**NIOSH** is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

**NTP** is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

**OSHA** is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

**PEOSHA** is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

**Permeated** is the movement of chemicals through protective materials.

**ppm** means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

**Protective Action Criteria** (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

**STEL** is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

**UEL** or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

**Vapor Density** is the ratio of the weight of a given volume of one gas to the weight of another (usually *Air*), at the same temperature and pressure.

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

NJ Health
New Jersey Department of Health

# Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **TETRACHLOROETHYLENE**

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Synonyms: Ethene, Tetrachloro-; Ethylene Tetrachloride; Perchloroethylene
CAS No: 127-18-4
Molecular Formula: $Cl_2C=CCl_2$
RTK Substance No: 1810
Description: Clear, colorless liquid with a sweet *Ether*-like odor

## HAZARD DATA

### Hazard Rating

**3 - Health**

**0 - Fire**

**0 - Reactivity**

**DOT#:** UN 1897

**ERG Guide #:** 160

**Hazard Class:** 6.1 (Toxic)

### Firefighting

Extinguish fire using an agent suitable for type of surrounding fire.

**Tetrachloroethylene** itself does not burn.

POISONOUS GASES ARE PRODUCED IN FIRE, including *Hydrogen Chloride* and *Phosgene*.

Use water spray to keep fire-exposed containers cool.

### Reactivity

**Tetrachloroethylene** reacts violently with *finely dispersed* or *finely divided* METALS (such as ALUMINUM, BARIUM, LITHIUM, BERYLLIUM and ZINC).

**Tetrachloroethylene** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); SULFURIC ACID; NITRIC ACID; SODIUM HYDROXIDE; and POTASSIUM HYDROXIDE.

**Tetrachloroethylene** slowly decomposes in WATER to form acids such as *Hydrogen Chloride*.

**Tetrachloroethylene** decomposes slowly with heating, and with exposure to ultraviolet light or on contact with hot surfaces, to form toxic *Hydrogen Chloride* and *Phosgene gases*.

## SPILL/LEAKS

**Isolation Distance:**

**Spill:** 50 meters (150 feet)

**Fire:** 800 meters (1/2 mile)

Absorb liquids in dry sand, earth, or a similar material and place into sealed containers for disposal.

DO NOT wash into sewer.

**Tetrachloroethylene** is toxic to aquatic organisms and may cause long term effects on the aquatic environment.

## EXPOSURE LIMITS

| | |
|---|---|
| **OSHA:** | 100 ppm, 8-hr TWA; 200 ppm, Ceiling; 300 ppm, Peak |
| **NIOSH:** | Lowest feasible concentration |
| **ACGIH:** | 25 ppm, 8-hr TWA; 100 ppm, STEL |
| **IDLH:** | 150 ppm |

The Protective Action Criteria values are:

PAC-1 = 35 ppm PAC-2 = 230 ppm
PAC-3 = 1,200 ppm

## HEALTH EFFECTS

| | |
|---|---|
| **Eyes:** | Irritation and burns |
| **Skin:** | Irritation and burns (skin absorbable) |
| **Inhalation:** | Nose, throat and lung irritation with coughing and severe shortness of breath (pulmonary edema)<br>Headache, dizziness, lightheadedness, and passing out |
| **Chronic:** | Cancer (liver, esophagus and bladder) |

## PHYSICAL PROPERTIES

| | |
|---|---|
| **Odor Threshold:** | 5 to 50 ppm |
| **Flash Point:** | Noncombustible |
| **Vapor Density:** | 5.8 (air = 1) |
| **Vapor Pressure:** | 14 mm Hg at 68°F (20°C) |
| **Specific Gravity:** | 1.62 (water = 1) |
| **Water Solubility:** | Very slightly soluble |
| **Boiling Point:** | 250°F (121°C) |
| **Freezing Point:** | -2°F (-19°C) |
| **Ionization Potential:** | 9.32 eV |
| **Molecular Weight:** | 165.8 |

## PROTECTIVE EQUIPMENT

| | |
|---|---|
| **Gloves:** | Polyvinyl Alcohol, Silver Shield®/4H®, Viton, Viton/Butyl and Barrier® (>8-hr breakthrough) |
| **Coveralls:** | Tychem® F, CPF3, BR and CSM; Trellchem® HPS and VPS (>8-hr breakthrough) |
| **Respirator:** | <25 ppm - full facepiece APR with *Organic vapor filters*<br>Spills or Fire - SCBA |

## FIRST AID AND DECONTAMINATION

**Remove** the person from exposure.

**Flush** eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.

**Quickly** remove contaminated clothing and wash contaminated skin with large amounts of soap and water.

**Begin** artificial respiration if breathing has stopped and CPR if necessary.

**Transfer** promptly to a medical facility.

**Medical** observation is recommended as symptoms may be delayed.

October 2011

NJ Health
New Jersey Department of Health

# Right to Know
# Hazardous Substance Fact Sheet

Common Name: **TRICHLOROETHYLENE**

Synonyms: Ethylene Trichloride; TCE; Trichloroethene
Chemical Name: Ethene, Trichloro-
Date: January 2000 Revision: December 2008

CAS Number: 79-01-6
RTK Substance Number: 1890
DOT Number: UN 1710

## Description and Use

**Trichloroethylene** is a clear, colorless liquid with a sweet odor. It is used as a degreaser for metal parts, as a solvent and fumigant, and to make other chemicals.

- **ODOR THRESHOLD = 1.4 ppm**
- Odor thresholds vary greatly. Do not rely on odor alone to determine potentially hazardous exposures.

## Reasons for Citation

- **Trichloroethylene** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, NTP, DEP, IARC, IRIS, NFPA and EPA.
- This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

## FIRST AID

**Eye Contact**
- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while flushing. Seek medical attention.

**Skin Contact**
- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water. Seek medical attention.

**Inhalation**
- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

## EMERGENCY NUMBERS

**Poison Control: 1-800-222-1222**
**CHEMTREC: 1-800-424-9300**
**NJDEP Hotline: 1-877-927-6337**
**National Response Center: 1-800-424-8802**

**EMERGENCY RESPONDERS >>>> SEE BACK PAGE**

## Hazard Summary

| Hazard Rating | NJDOH | NFPA |
|---|---|---|
| HEALTH | 3 | 2 |
| FLAMMABILITY | - | 1 |
| REACTIVITY | - | 0 |

CARCINOGEN
POISONOUS GASES ARE PRODUCED IN FIRE
CONTAINERS MAY EXPLODE IN FIRE

*Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe*

- **Trichloroethylene** can affect you when inhaled and by passing through the skin.
- **Trichloroethylene** should be handled as a CARCINOGEN--WITH EXTREME CAUTION.
- Contact can irritate and burn the skin and eyes with possible eye damage.
- Exposure can cause headache, dizziness, lightheadedness, and passing out. Very high exposure can cause irregular heartbeat, which can be fatal.
- **Trichloroethylene** may cause a skin allergy.
- Repeated exposure may cause personality changes such as depression, anxiety or irritability.
- **Trichloroethylene** may damage the liver and kidneys.

## Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **100 ppm** averaged over an 8-hour workshift, and **200 ppm**, not to be exceeded during any 15-minute work period, and **300 ppm** as a 5-minute peak in any 2-hour work period.

NIOSH: Recommends that exposure to occupational carcinogens be limited to the lowest feasible concentration.

ACGIH: The threshold limit value (TLV) is **10 ppm** averaged over an 8-hour workshift and **25 ppm** as a STEL (short-term exposure limit).

- **Trichloroethylene** is a PROBABLE CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

## Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

## Health Hazard Information

### Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Trichloroethylene**:

- Contact can irritate and burn the skin and eyes with possible eye damage.
- Exposure can cause headache, dizziness, lightheadedness, visual disturbances, nausea and vomiting, and passing out. Very high exposure can cause irregular heartbeat, which can be fatal.

### Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Trichloroethylene** and can last for months or years:

*Cancer Hazard*

- **Trichloroethylene** is a PROBABLE CARCINOGEN in humans. There is evidence that it causes liver, kidney, and lung cancer in animals.
- Many scientists believe there is no safe level of exposure to a carcinogen.

*Reproductive Hazard*

- There is limited evidence that **Trichloroethylene** is a teratogen in animals. Until further testing has been done, it should be treated as a possible teratogen in humans.
- There is limited evidence that **Trichloroethylene** may affect fertility and may damage the male reproductive system (including decreasing the sperm count) in animals.

*Other Effects*

- **Trichloroethylene** may cause a skin allergy. If allergy develops, very low future exposure can cause itching and a skin rash.
- Repeated exposure may cause personality changes such as depression, anxiety or irritability, and memory loss.
- **Trichloroethylene** may damage the liver and kidneys.

## Medical

### Medical Testing

For frequent or potentially high exposure (half the TLV or greater, or significant skin contact) the following are recommended before beginning work and at regular times after that:

- Liver and kidney function tests

If symptoms develop or overexposure is suspected, the following are recommended:

- Exam of the nervous system
- Evaluation by a qualified allergist can help diagnose skin allergy.
- Urinary *Trichloroacetic Acid* level (for repeated exposures) or blood **Trichloroethylene** levels (for acute exposure)
- Special 24-48 hour EKG (Holter monitor) to observe and record abnormal heart rhythms

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

### Mixed Exposures

- More than light alcohol consumption can cause liver damage. Drinking alcohol can increase the liver damage caused by **Trichloroethylene**.

## Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Where possible, transfer **Trichloroethylene** from drums or other containers to process containers in an enclosed system.

## Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

### Gloves and Clothing

- Avoid skin contact with **Trichloroethylene**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend Silver Shield®/4H®, Viton and Barrier® for gloves, and Tychem® F, BR, LV, Responder®, and TK; Zytron® 500; ONESuit® TEC; and Trellchem® HPS and VPS, or the equivalent, as protective materials for clothing.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

### Eye Protection

- Wear indirect-vent, impact and splash resistant goggles when working with liquids.
- Wear non-vented, impact resistant goggles when working with fumes, gases, or vapors.
- Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

### Respiratory Protection

***Improper use of respirators is dangerous.*** Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **10 ppm**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- Exposure to **1,000 ppm** is immediately dangerous to life and health. If the possibility of exposure above **1,000 ppm** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

## Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- **Trichloroethylene** may burn, but does not readily ignite.
- Use dry chemical, $CO_2$, water spray or alcohol-resistant foam as extinguishing agents.
- POISONOUS GASES ARE PRODUCED IN FIRE, including *Hydrogen Chloride* and *Phosgene*.
- CONTAINERS MAY EXPLODE IN FIRE.
- Use water spray to keep fire-exposed containers cool.
- Use water spray to reduce vapors.
- **Trichloroethylene** accumulates static charge.

## Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Trichloroethylene** is spilled or leaked, take the following steps:

- ▸ Evacuate personnel and secure and control entrance to the area.
- ▸ Eliminate all ignition sources.
- ▸ Absorb liquids in vermiculite, dry sand, earth, fly ash or cement powder and place into sealed containers for disposal.
- ▸ Use water spray to keep containers cool.
- ▸ Ventilate and wash area after clean-up is complete.
- ▸ DO NOT wash into sewer.
- ▸ It may be necessary to contain and dispose of **Trichloroethylene** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

## Handling and Storage

Prior to working with **Trichloroethylene** you should be trained on its proper handling and storage.

- ▸ **Trichloroethylene** will react explosively with *finely divided* or *powdered* BARIUM, BERYLLIUM, and MAGNESIUM.
- ▸ **Trichloroethylene** reacts with ACTIVE METALS (such as LITHIUM, SODIUM and TITANIUM) to cause flashing and sparks and will react with STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE) and EPOXIDES to form spontanously flammable *Dichloroacetylene*.
- ▸ **Trichloroethylene** is not compatible with STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); ISOCYANATES; EPICHLOROHYDRIN; ALCOHOLS; and GLYCOLS.
- ▸ Store in tightly closed containers in a cool, well-ventilated area away from COMBUSTIBLES, LIGHT and MOISTURE.
- ▸ Use only non-sparking tools and equipment, especially when opening and closing containers of **Trichloroethylene**.
- ▸ Metal containers involving the transfer of **Trichloroethylene** should be grounded and bonded as **Trichloroethylene** accumulates static charge.

## Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

**For more information, please contact:**

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

***The Right to Know Hazardous Substance Fact Sheets are not intended to be copied and sold for commercial purposes.***

## GLOSSARY

**ACGIH** is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

**Acute Exposure Guideline Levels** (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

**Boiling point** is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

**CFR** is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

**DEP** is the New Jersey Department of Environmental Protection.

**DOT** is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

**EPA** is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

**ERG** is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

**Emergency Response Planning Guideline** (ERPG) values provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

**IARC** is the International Agency for Research on Cancer, a scientific group.

**Ionization Potential** is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

**IRIS** is the Integrated Risk Information System database on human health effects that may result from exposure to various chemicals, maintained by federal EPA.

**LEL** or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

**mg/m$^3$** means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

**NFPA** is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

**NIOSH** is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

**NTP** is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

**OSHA** is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

**PEOSHA** is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

**Permeated** is the movement of chemicals through protective materials.

**ppm** means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

**Protective Action Criteria** (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

**STEL** is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

**UEL** or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

**Vapor Density** is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

NJ Health
New Jersey Department of Health

# Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **TRICHLOROETHYLENE**

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Synonyms: Ethylene Trichloride; TCE; Trichloroethene
CAS No: 79-01-6
Molecular Formula: $C_2HCl_3$
RTK Substance No: 1890
Description: Clear, colorless liquid with a sweet, *Chloroform-like* odor

## HAZARD DATA

### Hazard Rating

**3 - Health**

**1 - Fire**

**0 - Reactivity**

**DOT#:** UN 1710

**ERG Guide #:** 160

**Hazard Class:** 6.1 (Poison)

### Firefighting

**Trichloroethylene** may burn, but does not readily ignite.

Use dry chemical, $CO_2$, water spray or alcohol-resistant foam as extinguishing agents.

POISONOUS GASES ARE PRODUCED IN FIRE, including *Hydrogen Chloride* and *Phosgene*.

CONTAINERS MAY EXPLODE IN FIRE.

Use water spray to keep fire-exposed containers cool.

Use water spray to reduce vapors.

**Trichloroethylene** accumulates static charge.

### Reactivity

**Trichloroethylene** will react explosively with *finely divided* or *powdered* BARIUM, BERYLLIUM, and MAGNESIUM.

**Trichloroethylene** reacts with ACTIVE METALS (such as LITHIUM, SODIUM and TITANIUM) to cause flashing and sparks.

**Trichloroethylene** will react with STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE) and EPOXIDES to form spontanously flammable *Dichloroacetylene*.

**Trichloroethylene** is not compatible with STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); ISOCYANATES; EPICHLOROHYDRIN; ALCOHOLS; and GLYCOLS.

## SPILL/LEAKS

**Isolation Distance:**

Spill: 50 meters (150 feet)
Fire: 800 meters (1/2 mile)

Absorb liquids in vermiculite, dry sand, earth, fly ash or cement powder and place into sealed containers for disposal.

DO NOT wash into sewer.

Use only non-sparking tools and equipment, especially when opening and closing containers of **Trichloroethylene**.

Metal containers should be grounded and bonded as **Trichloroethylene** accumulates static charge.

**Trichloroethylene** is slightly toxic to aquatic life.

## PHYSICAL PROPERTIES

| | |
|---|---|
| **Odor Threshold:** | 1.4 ppm |
| **Flash Point:** | >200°F (93°C) |
| **LEL:** | 8% |
| **UEL:** | 10.5% |
| **Auto Ignition Temp:** | 788°F (420°C) |
| **Vapor Density:** | 4.5 (air = 1) |
| **Vapor Pressure:** | 58 mm Hg at 68°F (20°C) |
| **Specific Gravity:** | 1.5 (water = 1) |
| **Water Solubility:** | Slightly soluble |
| **Boiling Point:** | 189°F (87°C) |
| **Melting Point:** | -99°F (-73°C) |
| **Ionization Potential:** | 9.5 eV |
| **Molecular Weight:** | 131.4 |

## EXPOSURE LIMITS

**ACGIH:** 10 ppm, 8-hr TWA; 25 ppm, 15-min STEL
**IDLH:** 1,000 ppm

The Protective Action Criteria values are:
PAC-1 = 130 ppm
PAC-2 = 450 ppm
PAC-3 = 3,800 ppm

## PROTECTIVE EQUIPMENT

| | |
|---|---|
| **Gloves:** | Silver Shield®/4H®, Viton and Barrier® (>8-hr breakthrough) |
| **Coveralls:** | Tychem® F, BR, LV, Responder®, and TK; Zytron® 500; ONESuit® TEC; and Trellchem® HPS and VPS (>8-hr breakthrough) |
| **Respirator:** | >10 ppm - Supplied air or SCBA |

## HEALTH EFFECTS

| | |
|---|---|
| **Eyes:** | Irritation and burns |
| **Skin:** | Irritation and burns |
| **Inhalation:** | Headache, dizziness, lightheadedness, visual disturbances, nausea and vomiting, and passing out |
| **Chronic:** | Cancer (liver, kidney, and lung) in animals |

## FIRST AID AND DECONTAMINATION

**Remove** the person from exposure.

**Flush** eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn. Seek medical attention.

**Quickly** remove contaminated clothing and wash contaminated skin with large amounts of soap and water. Seek medical attention.

**Begin** artificial respiration if breathing has stopped and CPR if necessary.

**Transfer** promptly to a medical facility.

December 2008

New Jersey Department of Health and Senior Services

# HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **1,2-DICHLOROETHYLENE**

CAS Number: 540-59-0
DOT Number: UN 1150

RTK Substance number: 0653
Date: September 1996 Revision: July 2002

## HAZARD SUMMARY

- **1,2-Dichloroethylene** can affect you when breathed in.
- **1,2-Dichloroethylene** can irritate the skin causing a rash or burning feeling on contact.
- **1,2-Dichloroethylene** can irritate the eyes on contact.
- Breathing **1,2-Dichloroethylene** can irritate the nose, throat and lungs.
- Exposure to a high concentration can cause you to become dizzy, lightheaded and to pass out.
- Repeated exposure may affect the liver and kidneys.
- **1,2-Dichloroethylene** is a FLAMMABLE and REACTIVE chemical and a FIRE and EXPLOSION HAZARD.

## IDENTIFICATION

**1,2-Dichloroethylene** is a colorless liquid with an *Ether*-like odor. It is used as a solvent for organic materials.

## REASON FOR CITATION

- **1,2-Dichloroethylene** is on the Hazardous Substance List because it is regulated by OSHA and cited by ACGIH, DOT, NIOSH, DEP, NFPA and EPA.
- This chemical is on the Special Health Hazard Substance List because it is **FLAMMABLE** and **REACTIVE**.
- Definitions are provided on page 5.

## HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

- Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.1020.
- If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

## WORKPLACE EXPOSURE LIMITS

| | |
|---|---|
| OSHA: | The legal airborne permissible exposure limit (PEL) is **200 ppm** averaged over an 8-hour workshift. |
| NIOSH: | The recommended airborne exposure limit is **200 ppm** averaged over a 10-hour workshift. |
| ACGIH: | The recommended airborne exposure limit is **200 ppm** averaged over an 8-hour workshift. |

## WAYS OF REDUCING EXPOSURE

- Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
- Wear protective work clothing.
- Wash thoroughly immediately after exposure to **1,2-Dichloroethylene** and at the end of the workshift.
- Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **1,2-Dichloroethylene** to potentially exposed workers.

This Fact Sheet is a summary source of information of all potential and most severe health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

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## HEALTH HAZARD INFORMATION

### Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **1,2-Dichloroethylene**:

* **1,2-Dichloroethylene** can irritate the skin causing a rash or burning feeling on contact.
* **1,2-Dichloroethylene** can irritate the eyes on contact.
* Breathing **1,2-Dichloroethylene** can irritate the nose, throat and lungs.
* Exposure to a high concentration can cause you to become dizzy, lightheaded and to pass out.

### Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **1,2-Dichloroethylene** and can last for months or years:

### Cancer Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **1,2-Dichloroethylene** has not been tested for its ability to cause cancer in animals.

### Reproductive Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **1,2-Dichloroethylene** has not been tested for its ability to affect reproduction.

### Other Long-Term Effects

* Repeated exposure may affect the liver and kidneys.

## MEDICAL

### Medical Testing

If symptoms develop or overexposure is suspected, the following are recommended:

* Liver and kidney function tests.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under OSHA 1910.1020.

### Mixed Exposures

* Because more than light alcohol consumption can cause liver damage, drinking alcohol may increase the liver damage caused by **1,2-Dichloroethylene**.

## WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following controls are recommended:

* Where possible, automatically pump liquid **1,2-Dichloroethylene** from drums or other storage containers to process containers.
* Before entering a confined space where **1,2-Dichloroethylene** may be present, check to make sure that an explosive concentration does not exist.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

* Workers whose clothing has been contaminated by **1,2-Dichloroethylene** should change into clean clothing promptly.
* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **1,2-Dichloroethylene**.
* Eye wash fountains should be provided in the immediate work area for emergency use.
* If there is the possibility of skin exposure, emergency shower facilities should be provided.
* On skin contact with **1,2-Dichloroethylene**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **1,2-Dichloroethylene**, whether or not known skin contact has occurred.
* Do not eat, smoke, or drink where **1,2-Dichloroethylene** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, applying cosmetics, smoking, or using the toilet.

## PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 1910.132 requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

### Clothing

* Avoid skin contact with **1,2-Dichloroethylene**. Wear solvent-resistant gloves and clothing. Safety equipment suppliers/ manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

### Eye Protection

* Wear indirect-vent, impact and splash resistant goggles when working with liquids.
* Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.
* Contact lenses should not be worn when working with this substance.

### Respiratory Protection

**IMPROPER USE OF RESPIRATORS IS DANGEROUS.** Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

* Where the potential exists for exposure over **200 ppm**, use a NIOSH approved full facepiece respirator with an organic vapor cartridge. Increased protection is obtained from full facepiece powered-air purifying respirators.
* If while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **1,2-Dichloroethylene**, or if while wearing particulate filters abnormal resistance to breathing is experienced, or eye irritation occurs while wearing a full facepiece respirator, leave the area immediately. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
* Be sure to consider all potential exposures in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
* Where the potential for high exposure exists, use a MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
* Exposure to **1,000 ppm** is immediately dangerous to life and health. If the possibility of exposure above **1,000 ppm** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode.

## HANDLING AND STORAGE

* Prior to working with **1,2-Dichloroethylene** you should be trained on its proper handling and storage.
* **1,2-Dichloroethylene** forms explosive hazards with METAL and METAL ALLOYS (such as POTASSIUM, LITHIUM, MAGNESIUM, ALUMINUM DUSTS, COPPER and COPPER ALLOYS).
* Mixtures with NITRIC ACID can be detonated by HEAT, IMPACT or FRICTION.
* **1,2-Dichloroethylene** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); DIFLUOROMETHYLENE DIHYPOFLUORITE; and NITROGEN TETRAOXIDE.
* Store in tightly closed containers in a cool, well-ventilated area away from AIR, LIGHT and MOISTURE as **1,2-Dichloroethylene** will decompose to form *Hydrogen Chloride*.
* Sources of ignition, such as smoking and open flames, are prohibited where **1,2-Dichloroethylene** is used, handled, or stored.
* Metal containers involving the transfer of **1,2-Dichloroethylene** should be grounded and bonded.
* Use only non-sparking tools and equipment, especially when opening and closing containers of **1,2-Dichloroethylene**.
* Wherever **1,2-Dichloroethylene** is used, handled, manufactured, or stored, use explosion-proof electrical equipment and fittings.

## QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?
A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?
A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?

A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?

A: Conditions which increase risk of exposure include physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?

A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

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The following information is available from:

New Jersey Department of Health and Senior Services
Occupational Health Service
PO Box 360
Trenton, NJ 08625-0360
(609) 984-1863
(609) 984-7407 (fax)

Web address: http://www.state.nj.us/health/eoh/odisweb/

**Industrial Hygiene Information**

Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

**Medical Evaluation**

If you think you are becoming sick because of exposure to chemicals at your workplace, you may call personnel at the Department of Health and Senior Services, Occupational Health Service, who can help you find the information you need.

**Public Presentations**

Presentations and educational programs on occupational health or the Right to Know Act can be organized for labor unions, trade associations and other groups.

**Right to Know Information Resources**

The Right to Know Infoline (609) 984-2202 can answer questions about the identity and potential health effects of chemicals, list of educational materials in occupational health, references used to prepare the Fact Sheets, preparation of the Right to Know Survey, education and training programs, labeling requirements, and general information regarding the Right to Know Act. Violations of the law should be reported to (609) 984-2202.

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## DEFINITIONS

**ACGIH** is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is assigned by the Chemical Abstracts Service to identify a specific chemical.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

**DEP** is the New Jersey Department of Environmental Protection.

**DOT** is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

**EPA** is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

**HHAG** is the Human Health Assessment Group of the federal EPA.

**IARC** is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

**mg/m$^3$** means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

**NAERG** is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

**NCI** is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

**NFPA** is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

**NIOSH** is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

**NTP** is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

**OSHA** is the Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

**PEL** is the Permissible Exposure Limit which is enforceable by the Occupational Safety and Health Administration.

**PIH** is a DOT designation for chemicals which are Poison Inhalation Hazards.

**ppm** means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

**TLV** is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

## >>>>>>>>>>>>>>>>>> EMERGENCY INFORMATION <<<<<<<<<<<<<<<<<

Common Name: **1,2-DICHLOROETHYLENE**
DOT Number: **UN 1150**
NAERG Code: **130P**
CAS Number: **540-59-0**

| Hazard rating | NJDHSS | NFPA |
|---|---|---|
| **FLAMMABILITY** | - | 3 |
| **REACTIVITY** | - | 2 |
| FLAMMABLE AND REACTIVE<br>POISONOUS GASES ARE PRODUCED IN FIRE<br>CONTAINERS MAY EXPLODE IN FIRE | | |

*Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe*

## FIRE HAZARDS

- **1,2-Dichloroethylene** is a FLAMMABLE LIQUID.
- Use dry chemical, $CO_2$, or foam extinguishers as water may not be effective in fighting fires.
- POISONOUS GASES ARE PRODUCED IN FIRE, including *Hydrogen Chloride* and *Phosgene*.
- CONTAINERS MAY EXPLODE IN FIRE.
- Use water spray to keep fire-exposed containers cool.
- Vapors may travel to a source of ignition and flash back.
- Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source.
- If employees are expected to fight fires, they must be trained and equipped as stated in OSHA 1910.156.

## SPILLS AND EMERGENCIES

If **1,2-Dichloroethylene** is spilled or leaked, take the following steps:

- Evacuate persons not wearing protective equipment from area of spill or leak until clean-up is complete.
- Remove all ignition sources.
- Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers.
- Ventilate and wash area after clean-up is complete.
- Keep **1,2-Dichloroethylene** out of a confined space, such as a sewer, because of the possibility of an explosion, unless the sewer is designed to prevent the build-up of explosive concentrations.
- It may be necessary to contain and dispose of **1,2-Dichloroethylene** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.
- If employees are required to clean-up spills, they must be properly trained and equipped. OSHA 1910.120(q) may be applicable.

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FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300
NJDEP HOTLINE: 1-877-WARN-DEP

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## HANDLING AND STORAGE (See page 3)

## FIRST AID

*For POISON INFORMATION call 1-800-222-1222*

### Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids.

### Skin Contact

- Remove contaminated clothing. Wash contaminated skin with soap and water.

### Breathing

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

## PHYSICAL DATA

**Vapor Pressure:** 180-265 mm Hg at 68°F (20°C)
**Flash Point:** 36°F (2°C)
**Water Solubility:** Very slightly soluble

## OTHER COMMONLY USED NAMES

### Chemical Name:

Ethene, 1,2-Dichloro-

### Other Names:

Acetylene Dichloride; trans-Dichloroethylene; sym-Dichloroethylene

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*Not intended to be copied and sold for commercial purposes.*

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NEW JERSEY DEPARTMENT OF HEALTH AND SENIOR SERVICES
**Right to Know Program**
PO Box 368, Trenton, NJ 08625-0368
(609) 984-2202

**NJ Health**
New Jersey Department of Health

# Right to Know
# Hazardous Substance Fact Sheet

Common Name: **VINYL CHLORIDE**

Synonyms: Chloroethylene; Monochloroethylene; VCM
Chemical Name: Ethene, Chloro-
Date: June 2001 Revision: November 2010

CAS Number: 75-01-4
RTK Substance Number: 2001
DOT Number: UN 1086

## Description and Use

**Vinyl Chloride** is a colorless gas, with a sweet odor at high concentrations, that is usually handled as a liquid under pressure. It is used to make *Polyvinyl Chloride* for pipes, wire, and cable coatings, and in furniture, automobiles, and adhesives.

- **ODOR THRESHOLD = >3,000 ppm**
- Odor thresholds vary greatly. Do not rely on odor alone to determine potentially hazardous exposures.

## Reasons for Citation

- **Vinyl Chloride** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, NTP, DEP, IARC, IRIS, NFPA and EPA.
- This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

## FIRST AID

**Eye Contact**

- Immediately flush with large amounts of water for at least 30 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while flushing. Seek medical attention.

**Skin Contact**

- Immerse affected part in warm water. Seek medical attention.

**Inhalation**

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

## EMERGENCY NUMBERS

**Poison Control: 1-800-222-1222**
**CHEMTREC: 1-800-424-9300**
**NJDEP Hotline: 1-877-927-6337**
**National Response Center: 1-800-424-8802**

**EMERGENCY RESPONDERS >>>> SEE LAST PAGE**

## Hazard Summary

| Hazard Rating | NJDOH | NFPA |
|---|---|---|
| HEALTH | 4 | 2 |
| FLAMMABILITY | 4 | 4 |
| REACTIVITY | 2 | 2 |
| CARCINOGEN<br>FLAMMABLE AND REACTIVE<br>POISONOUS GASES ARE PRODUCED IN FIRE<br>CONTAINERS MAY EXPLODE IN FIRE | | |

*Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe*

- **Vinyl Chloride** can affect you when inhaled.
- **Vinyl Chloride** is a CARCINOGEN and MUTAGEN. HANDLE WITH EXTREME CAUTION.
- **Vinyl Chloride** can cause reproductive damage.
- Exposure to **Vinyl Chloride** can severely irritate and burn the skin and eyes with possible eye damage. Contact with the *liquid or gas* can cause frostbite.
- Inhaling **Vinyl Chloride** can irritate the nose, throat and lungs.
- **Vinyl Chloride** can cause headache, nausea, vomiting, dizziness, fatigue, weakness and confusion. Higher levels can cause lightheadedness and passing out.
- Prolonged or repeated exposure can damage the liver, nervous system and lungs.
- Repeated exposure can damage the skin (scleroderma), bones (acro-osteolysis) and blood vessels in the hands (Raynaud's Syndrome).
- **Vinyl Chloride** is FLAMMABLE and REACTIVE and a DANGEROUS FIRE and EXPLOSION HAZARD.
- EXPLOSIVE POLYMERIZATION may occur at elevated temperatures if **Vinyl Chloride** is not inhibited.

## Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **1 ppm** averaged over an 8-hour workshift and **5 ppm**, not to be exceeded during any 15-minute work period.

NIOSH: Recommends that exposure to occupational carcinogens be limited to the lowest feasible concentration.

ACGIH: The threshold limit value (TLV) is **1 ppm** averaged over an 8-hour workshift.

- **Vinyl Chloride** is a CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.

## Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act and the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

## Health Hazard Information

### Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Vinyl Chloride**:

- Exposure to **Vinyl Chloride** can severely irritate and burn the skin and eyes with possible eye damage. Contact with the *liquid or gas* can cause frostbite.
- Inhaling **Vinyl Chloride** can irritate the nose, throat and lungs causing coughing, wheezing and/or shortness of breath.
- **Vinyl Chloride** can cause headache, nausea, vomiting, dizziness, fatigue, weakness and confusion. Higher levels can cause lightheadedness and passing out.

### Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Vinyl Chloride** and can last for months or years:

***Cancer Hazard***

- **Vinyl Chloride** is a CARCINOGEN in humans. It has been shown to cause liver, brain, lung, and other types of cancer.
- Many scientists believe there is no safe level of exposure to a carcinogen.

***Reproductive Hazard***

- **Vinyl Chloride** may damage the developing fetus.
- There is limited evidence that **Vinyl Chloride** is a teratogen in animals. Until further testing has been done, it should be treated as a possible teratogen in humans.
- There is limited evidence that **Vinyl Chloride** may damage the male reproductive system (including decreasing the sperm count) and may affect male fertility.
- An excess of spontaneous abortions has been reported among spouses of workers who had been exposed to **Vinyl Chloride**.

***Other Effects***

- Prolonged or repeated exposure can damage the liver, nervous system and lungs.
- Repeated exposure can cause a disease called "scleroderma." This causes the skin to become very smooth, tight and shiny. It causes the bones of the fingers to erode (acro-osteolysis), and damages the blood vessels in the hands or feet (Raynaud's syndrome). This causes the fingers or toes to turn numb, pale or blue, with even mild cold exposure.

## Medical

### Medical Testing

Before first exposure and every 12 months thereafter, OSHA requires your employer to provide (for persons exposed to **0.5 ppm** of **Vinyl Chloride**) a work and medical history and exam which shall include:

- Liver function tests
- Chest x-ray and lung function tests

If symptoms develop or overexposure is suspected, the following are recommended:

- Exam of the nervous system
- Exam of the skin

OSHA requires your employer to provide you and your doctor with a copy of the OSHA **Vinyl Chloride** Standard (29 CFR 1910.1017).

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

### Mixed Exposures

- More than light alcohol consumption can cause liver damage. Drinking alcohol may increase the liver damage caused by **Vinyl Chloride**.

## Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Specific actions are required for this chemical by OSHA. Refer to the OSHA **Vinyl Chloride** Standard (29 CFR 1910.1017).
- Before entering a confined space where **Vinyl Chloride** may be present, check to make sure that an explosive concentration does not exist.
- Transfer **Vinyl Chloride** from cylinders or other containers to process containers in an enclosed system.

## Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

### Gloves and Clothing

- Avoid skin contact with **Vinyl Chloride**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- The recommended glove materials for **Vinyl Chloride** are Viton, Viton/Butyl, Silver Shield®/4H® and Barrier®.
- The recommended protective clothing materials for **Vinyl Chloride** are Tychem® BR, CSM and TK; and Trellchem® HPS and VPS or the equivalent.
- Where exposure to cold equipment, vapors, or liquid may occur, employees should be provided with *insulated* gloves and special clothing designed to prevent the freezing of body tissues.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

### Eye Protection

- Wear non-vented, impact resistant goggles when working with fumes, gases, or vapors.
- Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.
- Do not wear contact lenses when working with this substance.

### Respiratory Protection

***Improper use of respirators is dangerous.*** Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **1 ppm**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus or an emergency escape air cylinder.
- DO NOT USE CHEMICAL CARTRIDGE OR CANISTER RESPIRATORS.

## Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- **Vinyl Chloride** is a FLAMMABLE AND REACTIVE GAS that can EXPLOSIVELY POLYMERIZE if not inhibited.
- DO NOT attempt to extinguish fire unless flow can be stopped. Shut off supply or let burn.
- Use dry chemical or $CO_2$ for small fires.
- POISONOUS GASES ARE PRODUCED IN FIRE, including *Hydrogen Chloride* and *Phosgene*.
- CONTAINERS MAY EXPLODE IN FIRE.
- Use water spray to reduce vapors and to keep containers cool.
- Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source or flash back.
- Flow or agitation may generate electrostatic charges.
- **Vinyl Chloride** may form an ignitable vapor/air mixture in closed tanks or containers.

## Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Vinyl Chloride** is leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate ignition sources.
- Ventilate area of leak to disperse the gas.
- Stop flow of gas. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair leak or allow cylinder to empty.
- Absorb liquids in dry sand, earth, or a similar material and place into sealed containers for disposal.
- Turn leaking cylinder with leak up to prevent escape of gas in liquid state.
- Ventilate area of spill or leak.
- Keep **Vinyl Chloride** out of confined spaces, such as sewers, because of the possibility of an explosion.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Vinyl Chloride** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

## Handling and Storage

Prior to working with **Vinyl Chloride** you should be trained on its proper handling and storage.

- A regulated, marked area should be established where **Vinyl Chloride** is handled, used or stored as required by the OSHA **Vinyl Chloride** Standard (29 CFR 1910.1017).
- **Vinyl Chloride** can polymerize rapidly or explosively when exposed to elevated temperatures (over 125°F (52°C)), or when exposed to AIR or LIGHT in the presence of a CATALYST.
- **Vinyl Chloride** reacts violently with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).
- **Vinyl Chloride** is not compatible with WATER; METALS (such as COPPER, ALUMINUM, IRON and STEEL); METAL CARBIDES; and METAL ALLOYS as fires and/or explosions may occur.
- *Phenol* should be used as an inhibitor to prevent violent polymerization of **Vinyl Chloride**.
- Store in tightly closed containers in a cool, well-ventilated area away from MOISTURE, HEAT SOURCES and METALS.
- Sources of ignition, such as smoking and open flames, are prohibited where **Vinyl Chloride** is used, handled, or stored.
- Metal containers involving the transfer of **Vinyl Chloride** should be grounded and bonded.
- Use explosion-proof electrical equipment and fittings wherever **Vinyl Chloride** is used, handled, manufactured, or stored.
- Use only non-sparking tools and equipment, especially when opening and closing containers of **Vinyl Chloride**.
- **Vinyl Chloride** may accumulate static electricity.

## Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

**For more information, please contact:**

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

***The Right to Know Hazardous Substance Fact Sheets are not intended to be copied and sold for commercial purposes.***

### GLOSSARY

**ACGIH** is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

**Acute Exposure Guideline Levels** (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

**Boiling point** is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

**CFR** is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

The **critical temperature** is the temperature above which a gas cannot be liquefied, regardless of the pressure applied.

**DEP** is the New Jersey Department of Environmental Protection.

**DOT** is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

**EPA** is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

**ERG** is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

**Emergency Response Planning Guideline** (ERPG) values provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

**IARC** is the International Agency for Research on Cancer, a scientific group.

**Ionization Potential** is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

**IRIS** is the Integrated Risk Information System database on human health effects that may result from exposure to various chemicals, maintained by federal EPA.

**LEL** or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

**$mg/m^3$** means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

**NFPA** is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

**NIOSH** is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

**NTP** is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

**OSHA** is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

**PEOSHA** is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

**Permeated** is the movement of chemicals through protective materials.

**ppm** means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

**Protective Action Criteria** (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

**STEL** is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

**UEL** or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

**Vapor Density** is the ratio of the weight of a given volume of one gas to the weight of another (usually *Air*), at the same temperature and pressure.

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

NJ Health
New Jersey Department of Health

# Right to Know Hazardous Substance Fact Sheet

**Emergency Responders Quick Reference**

Common Name: **VINYL CHLORIDE**

---

Synonyms: Chloroethylene; Monochloroethylene; VCM
CAS No: 75-01-4
Molecular Formula: $CH_2 = CHCl$
RTK Substance No: 2001

Description: Colorless gas, with a sweet odor at high concentrations, that is usually handled as a liquid under pressure

## HAZARD DATA

### Hazard Rating

**4 - Health**

**4 - Fire**

**2 - Reactivity**

**DOT#:** UN 1086

**ERG Guide #:** 116P

**Hazard Class:** 2.1
(Flammable Gas)

### Firefighting

FLAMMABLE AND REACTIVE GAS that can EXPLOSIVELY POLYMERIZE if not inhibited.

DO NOT attempt to extinguish fire unless flow can be stopped. Shut off supply or let burn.

Use dry chemical or $CO_2$ for small fires.

POISONOUS GASES ARE PRODUCED IN FIRE, including *Hydrogen Chloride* and *Phosgene*.

CONTAINERS MAY EXPLODE IN FIRE.

Use water spray to reduce vapors and to keep containers cool.

Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source or flash back.

Flow or agitation may generate electrostatic charges.

**Vinyl Chloride** may form an ignitable vapor/air mixture in closed tanks or containers.

### Reactivity

**Vinyl Chloride** can polymerize rapidly or explosively when exposed to elevated temperatures (over 125°F (52°C)), or when exposed to AIR or LIGHT in the presence of a CATALYST.

**Vinyl Chloride** reacts violently with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).

**Vinyl Chloride** is not compatible with WATER; METALS (such as COPPER, ALUMINUM, IRON and STEEL); METAL CARBIDES; and METAL ALLOYS as fires and/or explosions may occur.

*Phenol* should be used as an inhibitor to prevent violent polymerization of **Vinyl Chloride**.

**Vinyl Chloride** may accumulate static electricity.

## SPILL/LEAKS

**Isolation Distance:**

Spill: 100 meters (330 feet)

Fire: 800 meters (1/2 mile)

Stop flow of gas. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair leak or allow cylinder to empty.

Absorb liquids in dry sand, earth, or a similar material and place into sealed containers for disposal.

Keep **Vinyl Chloride** out of confined spaces, such as sewers, because of the possibility of an explosion.

Turn leaking cylinder with leak up to prevent escape of gas in liquid state.

Use nonsparkling tools and ground and bond containers when transferring **Vinyl Chloride**.

**Vinyl Chloride** is hazardous to the environment.

## PHYSICAL PROPERTIES

| | |
|---|---|
| **Odor Threshold:** | >3,000 ppm |
| **Flash Point:** | -108°F (-78°C) |
| **LEL:** | 3.6% |
| **UEL:** | 33% |
| **Auto Ignition Temp:** | 882°F (472°C) |
| **Vapor Density:** | 2.2 (air = 1) |
| **Vapor Pressure:** | 2,524 mm Hg at 68°F (20°C) |
| **Specific Gravity:** | 0.9 (water = 1) |
| **Water Solubility:** | Very slightly soluble |
| **Boiling Point:** | 17°F (-8.3°C) |
| **Freezing Point:** | -245° to -256°F (-154° to -160°C) |
| **Ionization Potential:** | 9.99 eV |
| **Critical Temperature:** | 306° to 317.3°F (152° to 158.5°C) |
| **Molecular Weight:** | 62.5 |

## EXPOSURE LIMITS

**OSHA:** 1 ppm, 8-hr TWA; 5 ppm, Ceiling
**NIOSH:** Lowest feasible concentration
**ACGIH:** 1 ppm, 8-hr TWA

The Protective Action Criteria values are:
PAC-1 = 250 ppm PAC-2 = 1,200 ppm
PAC-3 = 4,800 ppm

## PROTECTIVE EQUIPMENT

| | |
|---|---|
| **Gloves:** | Insulated Viton, Viton/Butyl, Silver Shield®/4H® and Barrier® (>8-hr breakthrough) |
| **Coveralls:** | Tychem® BR, CSM and TK; Trellchem HPS and VPS (8-hr breakthrough)<br>>10% of the LEL wear flash protection or turnout gear |
| **Respirator:** | SCBA |

## HEALTH EFFECTS

| | |
|---|---|
| **Eyes:** | Irritation and burns, contact with *liquid* or *gas* may cause frostbite |
| **Skin:** | Irritation and burns, contact with *liquid* or *gas* may cause frostbite |
| **Inhalation:** | Nose, throat and lung irritation with coughing, wheezing and shortness of breath<br>Headache, dizziness, lightheadedness and passing out |
| **Chronic:** | Cancer (liver, brain, and lung) in humans |

## FIRST AID AND DECONTAMINATION

**Remove** the person from exposure.

**Flush** eyes with large amounts of water for at least 30 minutes. Remove contact lenses if worn. Seek medical attention.

**Immerse** affected part in warm water. Seek medical attention.

**Begin** artificial respiration if breathing has stopped and CPR if necessary.

**Transfer** promptly to a medical facility.

# Univar USA Inc Safety Data Sheet

3075 Highland Pkwy, Ste 200, Downers Grove, IL 60515
(425) 889 3400

Emergency Assistance

For emergency assistance involving chemicals call
Chemtrec - (800) 424-9300

Univar
3075 Highland Pkwy STE 200
Downers Grove, IL 60515
425-889-3400

# SAFETY DATA SHEET

## 1. Identification

**Product identifier:** - HYDROGEN PEROXIDE 20-34%

**Other means of identification**

**SDS number:** 000100000012

**Recommended use and restriction on use**

**Recommended use:** Reserved for industrial and professional use.

**Restrictions on use:** Not known.

**Emergency telephone number:For emergency assistance Involving chemicals**

**call CHEMTREC day or night at: 1-800-424-9300. CHEMTREC INTERNATIONAL Tel# 703-527-3887**

## 2. Hazard(s) identification

**Hazard Classification**

**Physical Hazards**

| | |
|---|---|
| Oxidizing liquids | Category 2 |

**Health Hazards**

| | |
|---|---|
| Acute toxicity (Oral) | Category 4 |
| Skin Corrosion/Irritation | Category 2 |
| Serious Eye Damage/Eye Irritation | Category 2A |

**Label Elements**

**Hazard Symbol**

| | |
|---|---|
| **Signal Word** | Danger |
| **Hazard Statement** | Causes serious eye damage.<br>Harmful if swallowed.<br>Harmful if inhaled.<br>May cause irritation to the respiratory system.<br>Causes skin irritation.<br>May intensify fire; oxidizer. |
| **Precautionary Statements** | |
| **Prevention** | Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Keep away from clothing and other combustible materials. Wear protective gloves/protective clothing/eye protection/face protection. Wash thoroughly after handling. Do not eat, drink or smoke when using this product. |
| **Response** | If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention. IF ON SKIN: Wash with plenty of water. If skin irritation occurs: Get medical advice/attention. IF SWALLOWED: Call a POISON CENTER/doctor/ if you feel unwell. Rinse mouth. Take off contaminated clothing. |
| **Storage** | Store in a closed container. Keep container tightly closed. Store in a well-ventilated place. Store in a dry place. Store away from other materials. |
| **Disposal** | Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal. |

**Other hazards which do not result in GHS classification** None.

## 3. Composition/information on ingredients

**Substances**

| Chemical Identity | Common name and synonyms | CAS number | Content in percent (%)* |
|---|---|---|---|
| Hydrogen peroxide ($H_2O_2$) | | 7722-84-1 | >=20 - <=34% |
| Water | | 7732-18-5 | >=66 - <=80% |

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

## 4. First-aid measures

| | |
|---|---|
| **Ingestion:** | Do NOT induce vomiting. Never give liquid to an unconscious person. Get medical attention immediately. Do NOT induce vomiting. Never give liquid to an unconscious person. Get medical attention immediately. Rinse mouth thoroughly. |
| **Inhalation:** | Move to fresh air. If breathing is difficult, give oxygen. Perform artificial respiration if breathing has stopped. Move to fresh air. If breathing is difficult, give oxygen. Perform artificial respiration if breathing has stopped. Get medical attention immediately. |
| **Skin Contact:** | Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Remove contaminated clothing and wash the skin thoroughly with soap and water after work. |
| **Eye contact:** | If in eyes, hold eyes open, flood with water for at least 15 minutes and see a doctor. If in eyes, hold eyes open, flood with water for at least 15 minutes and see a doctor. Get medical attention immediately. Rinse immediately with plenty of water. |

**Most important symptoms/effects, acute and delayed**

**Symptoms:** No data available.

**Indication of immediate medical attention and special treatment needed**

| | |
|---|---|
| **Treatment:** | No data available. |

## 5. Fire-fighting measures

| | |
|---|---|
| **General Fire Hazards:** | No data available. |

**Suitable (and unsuitable) extinguishing media**

| | |
|---|---|
| **Suitable extinguishing media:** | Use: Water Spray or Fog. Use: Water Spray or Fog. Use fire-extinguishing media appropriate for surrounding materials. |
| **Unsuitable extinguishing media:** | No data available. |
| **Specific hazards arising from the chemical:** | Strong oxidizer. Heat may cause the containers to explode. Oxidizer. Not combustible. Reaction with combustible materials, ammonium salts, or foreign substances may increase the fire hazard. Thermally unstable. Decomposes at fire temperature and is self-sustaining even if heat source is removed. Closed containers may rupture violently when heated. |

**Special protective equipment and precautions for firefighters**

| | |
|---|---|
| **Special fire fighting procedures:** | No data available. |
| **Special protective equipment for fire-fighters:** | Use water spray to keep fire-exposed containers cool. |

## 6. Accidental release measures

| | |
|---|---|
| **Personal precautions, protective equipment and emergency procedures:** | Use personal protective equipment. Keep unauthorized personnel away. Use personal protective equipment. Avoid breathing mist. |
| **Methods and material for containment and cleaning up:** | Absorb spillage with non-combustible, absorbent material. Dike for later disposal. Absorb spillage with non-combustible, absorbent material. Dike for later disposal. |

## 7. Handling and storage

| | |
|---|---|
| **Precautions for safe handling:** | Use personal protective equipment as required. Wash thoroughly after handling. Use only with adequate ventilation. Wash contaminated clothing before reuse. Use personal protective equipment as required. Wash thoroughly after handling. Use only with adequate ventilation. Wash contaminated clothing before reuse. |
| **Conditions for safe storage, including any incompatibilities:** | Keep container tightly closed. Keep containers closed when not in use. Store in a cool, dry place with adequate ventilation. Keep away from incompatible materials, open flames, and high temperatures. Protect from light, including direct sunrays. |

## 8. Exposure controls/personal protection

**Control Parameters**

**Occupational Exposure Limits**

| **Chemical Identity** | **type** | **Exposure Limit Values** | | **Source** |
|---|---|---|---|---|
| Hydrogen peroxide (H2O2) | TWA | 1 ppm | 1.4 mg/m3 | US. Tennessee. OELs. Occupational Exposure Limits, Table Z1A (06 2008) |
| | ST ESL | | 14 µg/m3 | US. Texas. Effects Screening Levels (Texas Commission on Environmental Quality) (02 2013) |
| | ST ESL | | 10 ppb | US. Texas. Effects Screening Levels (Texas Commission on Environmental Quality) (02 2013) |
| | AN ESL | | 1.4 µg/m3 | US. Texas. Effects Screening Levels (Texas Commission on Environmental Quality) (02 2013) |
| | AN ESL | | 1 ppb | US. Texas. Effects Screening Levels (Texas Commission on Environmental Quality) (02 2013) |
| Hydrogen peroxide (H2O2) - as H2O2 | TWA PEL | 1 ppm | 1.4 mg/m3 | US. California Code of Regulations, Title 8, Section 5155. Airborne Contaminants (02 2012) |
| Hydrogen peroxide (H2O2) | TWA | 1 ppm | | US. ACGIH Threshold Limit Values (03 2013) |
| | REL | 1 ppm | 1.4 mg/m3 | US. NIOSH: Pocket Guide to Chemical Hazards (2010) |
| | PEL | 1 ppm | 1.4 | US. OSHA Table Z-1 Limits for Air |

| | | | |
|---|---|---|---|
| | | mg/m3 | Contaminants (29 CFR 1910.1000) (02 2006) |
| | TWA | 1 ppm 1.4 mg/m3 | US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989) |

| Chemical Identity | type | Exposure Limit Values | Source |
|---|---|---|---|
| Hydrogen peroxide (H2O2) | TWA | 1 ppm 1.4 mg/m3 | US. Tennessee. OELs. Occupational Exposure Limits, Table Z1A (06 2008) |
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| | REL | 1 ppm 1.4 mg/m3 | US. NIOSH: Pocket Guide to Chemical Hazards (2010) |
| | PEL | 1 ppm 1.4 mg/m3 | US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006) |
| | TWA | 1 ppm 1.4 mg/m3 | US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989) |

**Appropriate Engineering Controls** No data available.

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

| | |
|---|---|
| **General information:** | Use personal protective equipment as required. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing to remove contaminants. Discard contaminated footwear that cannot be cleaned. Practice good housekeeping. Do not eat, drink or smoke when using the product. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing to remove contaminants. Discard contaminated footwear that cannot be cleaned. |
| **Eye/face protection:** | Wear tight-fitting goggles or face shield. |
| **Skin Protection** | |
| **Hand Protection:** | Use suitable protective gloves if risk of skin contact. |
| **Other:** | Wear suitable protective clothing as protection against splashing or contamination. |
| **Respiratory Protection:** | In the United States of America, if respirators are used, a program should be instituted to assure compliance with OSHA Standard 63 FR 1152, January 8, 1998. Seek advice from supervisor on the company's respiratory protection standards. If ventilation is insufficient, suitable respiratory protection must be provided. |
| **Hygiene measures:** | No data available. |

## 9. Physical and chemical properties

| | |
|---|---|
| **Physical state:** | liquid liquid |
| **Form:** | Clear Liquid |
| **Color:** | Colorless |
| **Odor:** | Odorless |
| **Odor threshold:** | No data available. |
| **pH:** | 3.7 3.7 |
| **Melting point/freezing point:** | -33 - -15 °C -33 - -15 °C |
| **Initial boiling point and boiling range:** | 100 - 176 °C 100 - 176 °C |
| **Flash Point:** | Does not flash |
| **Evaporation rate:** | > 1 |
| **Flammability (solid, gas):** | No data available. |
| **Upper/lower limit on flammability or explosive limits** | |
| **Flammability limit - upper (%):** | No data available. |

| | |
|---|---|
| **Flammability limit - lower (%):** | No data available. |
| **Explosive limit - upper (%):** | No data available. |
| **Explosive limit - lower (%):** | No data available. |
| **Vapor pressure:** | 30.664 hPa |
| **Vapor density:** | No data available. |
| **Relative density:** | 1.13 |
| **Solubility(ies)** | |
| **Solubility in water:** | No data available. |
| **Solubility (other):** | No data available. |
| **Partition coefficient (n-octanol/water):** | 1.5 |
| **Auto-ignition temperature:** | No data available. |
| **Decomposition temperature:** | No data available. |
| **Viscosity:** | No data available. |

## 10. Stability and reactivity

| | |
|---|---|
| **Reactivity:** | No data available. |
| **Chemical Stability:** | No data available. |
| **Possibility of hazardous reactions:** | No data available. |
| **Conditions to avoid:** | No data available. |
| **Incompatible Materials:** | Strong oxidizer - avoid contact with reducing agents. |
| **Hazardous Decomposition Products:** | No data available. |

## 11. Toxicological information

**Symptoms related to the physical, chemical and toxicological characteristics**

| | |
|---|---|
| **Ingestion:** | No data available. |
| **Inhalation:** | No data available. |
| **Skin Contact:** | No data available. |
| **Eye contact:** | No data available. |

**Information on toxicological effects**

**Acute toxicity (list all possible routes of exposure)**

**Oral**

| | |
|---|---|
| **Product:** | ATEmix (): 1,026 mg/kg<br>ATEmix (): 1,026 mg/kg |

**Dermal**

| | |
|---|---|
| **Product:** | Not classified for acute toxicity based on available data. |

**Inhalation**

| | |
|---|---|
| **Product:** | LC 50 (Rat, 4 h): >= 0.17 mg/l |

**Repeated dose toxicity**

| | |
|---|---|
| **Product:** | No data available. |

**Skin Corrosion/Irritation**

| | |
|---|---|
| **Product:** | No data available. |

**Serious Eye Damage/Eye Irritation**

| | |
|---|---|
| **Product:** | No data available. |

**Respiratory or Skin Sensitization**

| | |
|---|---|
| **Product:** | No data available. |

**Carcinogenicity**

| | |
|---|---|
| **Product:** | No data available. |

**IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:**
No carcinogenic components identified

**US. National Toxicology Program (NTP) Report on Carcinogens:**
No carcinogenic components identified
**US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):**
No carcinogenic components identified

**Germ Cell Mutagenicity**

**In vitro**

| | |
|---|---|
| **Product:** | No data available. |

**In vivo**

| | |
|---|---|
| **Product:** | No data available. |

**Reproductive toxicity**

| | |
|---|---|
| **Product:** | No data available. |

**Specific Target Organ Toxicity - Single Exposure**

| | |
|---|---|
| **Product:** | No data available. |

**Specific Target Organ Toxicity - Repeated Exposure**

| | |
|---|---|
| **Product:** | No data available. |

**Aspiration Hazard**

| | |
|---|---|
| **Product:** | No data available. |
| **Other effects:** | No data available. |

## 12. Ecological information

**Ecotoxicity:**

**Acute hazards to the aquatic environment:**

**Fish**

| | |
|---|---|
| **Product:** | No data available. |
| **Specified substance(s):** | |
| Hydrogen peroxide (H2O2) | LC 50 (Chameleon goby (Tridentiger trigonocephalus), 24 h): 155 mg/l Mortality LC 50 (Jack Mackerel (Trachurus japonicus), 24 h): 89 mg/l Mortality |

**Aquatic Invertebrates**

| | |
|---|---|
| **Product:** | No data available. |

**Chronic hazards to the aquatic environment:**

**Fish**

| | |
|---|---|
| **Product:** | No data available. |

**Aquatic Invertebrates**

| | |
|---|---|
| **Product:** | No data available. |

**Toxicity to Aquatic Plants**

| | |
|---|---|
| **Product:** | No data available. |

**Persistence and Degradability**

**Biodegradation**

| | |
|---|---|
| **Product:** | No data available. |

**BOD/COD Ratio**

| | |
|---|---|
| **Product:** | No data available. |

**Bioaccumulative Potential**

**Bioconcentration Factor (BCF)**

| | |
|---|---|
| **Product:** | No data available. |

**Partition Coefficient n-octanol / water (log Kow)**

| | |
|---|---|
| **Product:** | Log Kow: 1.5 |
| **Mobility in Soil:** | No data available. |

**Known or predicted distribution to environmental compartments**

| | |
|---|---|
| Hydrogen peroxide | No data available. |
| Water | No data available. |

**Known or predicted distribution to environmental compartments**

| | |
|---|---|
| Water | No data available. |

**Known or predicted distribution to environmental compartments**

| | |
|---|---|
| Hydrogen peroxide | No data available. |

**Known or predicted distribution to environmental compartments**

| | |
|---|---|
| Water | No data available. |

## 13. Disposal considerations

| | |
|---|---|
| **Disposal instructions:** | Dispose of waste and residues in accordance with local authority requirements. Since emptied containers retain product residue, follow label warnings even after container is emptied. |
| **Contaminated Packaging:** | No data available. |

## 14. Transport information

**DOT**

| | |
|---|---|
| UN Number: | UN 2014 |
| UN Proper Shipping Name: | Hydrogen peroxide, aqueous solutions |
| Transport Hazard Class(es) | |
| Class: | 5.1 |
| Label(s): | 5.1, 8 |
| Packing Group: | II |
| Marine Pollutant: | Not regulated. |
| Special precautions for user: | – |

**IMDG**

| | |
|---|---|
| UN Number: | UN 2014 |
| UN Proper Shipping Name: | Hydrogen peroxide, aqueous solution |
| Transport Hazard Class(es) | |
| Class: | 5.1 |
| Label(s): | 5.1, 8 |
| EmS No.: | F-H, S-Q |
| Packing Group: | II |
| Marine Pollutant: | Not regulated. |
| Special precautions for user: | – |

**IATA**

| | |
|---|---|
| UN Number: | UN 2014 |
| Proper Shipping Name: | Hydrogen peroxide, aqueous solution |
| Transport Hazard Class(es): | |
| Class: | 5.1 |
| Label(s): | 5.1, 8 |
| Packing Group: | II |
| Environmental Hazards | Not regulated. |
| Special precautions for user: | – |
| Other information | |

| | |
|---|---|
| Passenger and cargo aircraft: | Allowed. |
| Cargo aircraft only: | Allowed. |

## 15. Regulatory information

**US Federal RegulationsUS. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)**

None present or none present in regulated quantities.

None present or none present in regulated quantities.

**CERCLA Hazardous Substance List (40 CFR 302.4):**

None present or none present in regulated quantities.

None present or none present in regulated quantities.

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

**Hazard categories**

Not listed.

**SARA 302 Extremely Hazardous Substance**

| Chemical Identity | RQ | Threshold Planning Quantity |
|---|---|---|
| Hydrogen peroxide (H2O2) | 1000 lbs. | 1000 lbs. |
| **Chemical Identity** | **RQ** | **Threshold Planning Quantity** |
| Hydrogen peroxide (H2O2) | 1000 lbs. | 1000 lbs. |

**SARA 304 Emergency Release Notification**

| Chemical Identity | RQ |
|---|---|
| Hydrogen peroxide (H2O2) | |
| **Chemical Identity** | **RQ** |
| Hydrogen peroxide (H2O2) | |

**SARA 311/312 Hazardous Chemical**

| Chemical Identity | Threshold Planning Quantity |
|---|---|
| **Chemical Identity** | **Threshold Planning Quantity** |
| Hydrogen peroxide (H2O2) | 500lbs |
| Hydrogen peroxide (H2O2) | 500lbs |

**SARA 313 (TRI Reporting)**

None present or none present in regulated quantities.

None present or none present in regulated quantities.

**Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3)**

None present or none present in regulated quantities.

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

None present or none present in regulated quantities.

## US State Regulations

### US. California Proposition 65

No ingredient regulated by CA Prop 65 present.

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

| | |
|---|---|
| Hydrogen peroxide (H2O2) | Listed |
| Hydrogen peroxide (H2O2) | Listed |

### US. Massachusetts RTK - Substance List

| | |
|---|---|
| Hydrogen peroxide (H2O2) | Listed |
| Hydrogen peroxide (H2O2) | Listed |

### US. Pennsylvania RTK - Hazardous Substances

| | |
|---|---|
| Hydrogen peroxide (H2O2) | Listed |
| Hydrogen peroxide (H2O2) | Listed |

### US. Rhode Island RTK

| | |
|---|---|
| Hydrogen peroxide (H2O2) | Listed |
| Hydrogen peroxide (H2O2) | Listed |

| | |
|---|---|
| **Inventory Status:**Australia AICS: | On or in compliance with the inventory |
| Canada DSL Inventory List: | On or in compliance with the inventory |
| EU EINECS List: | On or in compliance with the inventory |
| EU ELINCS List: | On or in compliance with the inventory |
| Japan (ENCS) List: | On or in compliance with the inventory |
| China Inv. Existing Chemical Substances: | On or in compliance with the inventory |
| Philippines PICCS: | On or in compliance with the inventory |
| US TSCA Inventory: | On or in compliance with the inventory |
| New Zealand Inventory of Chemicals: | On or in compliance with the inventory |

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

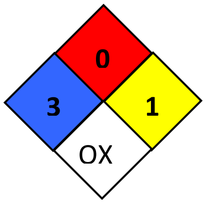
**HMIS Hazard ID**

| | | |
|---|---|---|
| Health | * | 3 |
| Flammability | | 0 |
| Physical Hazards | | 1 |
| PERSONAL PROTECTION | | B |

B - Safety Glasses & Gloves

Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe; RNP - Rating not possible; *Chronic health effect

**NFPA Hazard ID**



🟥 Flammability
🟦 Health
🟨 Reactivity
☐ Special hazard.

Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe; RNP - Rating not possible
OX: Oxidizing agent

| | |
|---|---|
| **Issue Date:** | 10/12/2016 |
| **Revision Date:** | No data available. |
| **Version #:** | 1.4 |
| **Further Information:** | No data available. |

# Univar USA Inc Safety Data Sheet

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For Additional Information contact SDS Coordinator during business hours, Pacific time: (425) 889-3400

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Do not use ingredient information and/or ingredient percentages in this SDS as a product specification. For product specification information refer to a product specification sheet and/or a certificate of analysis. These can be obtained from your local Univar sales office.

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This information relates only to the product designated herein, and does not relate to its use in combination with any other material or in any other process

# SAFETY DATA SHEET

## SECTION 1 – IDENTIFICATION OF MATERIAL AND SUPPLIER

**Product Name:** ISOTEC$^{SM}$ Catalyst Series 4260 Component-A Powder Mix
**Recommended Use:** Environmental Remediation
**Uses advised against:** No information available
**Details of the supplier of the safety data sheet:**

| | |
|---|---|
| **Supplier Name:** | ISOTEC Remediation Technologies LLC |
| **Supplier Address:** | 11 Princess Rd, Suite A Lawrenceville, NJ 08648, USA |
| **EMERGENCY TELEPHONE NUMBER(S):** | **(609) 275-8500 (USA)** |

| | |
|---|---|
| **C.A.S. CHEMICAL NAME:** | - |
| **SYNONYMS:** | Iron Catalyst |
| **CHEMICAL FAMILY:** | Not Applicable |
| **EMPIRICAL FORMULA:** | MIXT (Proprietary) |
| **INTENDED USE:** | Catalyst |

## SECTION 2 – HAZARDS IDENTIFICATION

**Classification**

| | |
|---|---|
| Acute Toxicity, Oral | Category 4 |
| Skin irritation | Category 2 |
| Eye Irritation | Category 2A |

**Signal Word**
Warning

**Hazard Statement**
Harmful if swallowed
Causes skin irritation
Causes serious eye irritation

**Appearance/Odor:** Light green powder with metallic odor.
**Precautionary statement(s):** Wash skin thoroughly after handling. Do not eat, drink, or smoke when using this product. Wear protective gloves, eye protection/face protection.
**IF SWALLOWED:** Call a POISON CENTER or doctor/ physician if you feel unwell. Rinse mouth.
**IF ON SKIN:** Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse.

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
**Hazards not otherwise classified (HNOC):** None
Specific treatment (see section 4 for more information).

*Applicable properties are relevant to the mixture as a whole when certain proprietary ingredients present at their highest concentrations. Please note that the effects are normally lower for a typical mixture with smaller concentrations of these ingredients present.*

## SECTION 3 – COMPOSITION/ INFORMATION ON INGREDIENTS

| Components | CAS Number | Proportion | Risk Phrases |
|---|---|---|---|
| Iron Compound | - | >60% | - |

## SECTION 4 – FIRST AID MEASURES

**EYE CONTACT:** Hold eyelids apart and immediately flush eyes with plenty of water for at least 15 minutes. Call a physician if irritations persist.
**SKIN CONTACT:** Wash affected area immediately with soap and water.
**INHALATION:** In case of inhalation or suspected inhalation, move patient at once to fresh air and call a physician. Keep patient absolutely quiet. If breathing has stopped or is labored, give assisted respiration (e.g., mouth-to-mouth). Supplemental oxygen may be indicated.
**INGESTION:** If swallowed, call a physician immediately. Induce vomiting or remove stomach contents by gastric suction only as directed by medical personnel. Wash mouth with plenty of water. Never give anything by mouth to an unconscious person.

**Most important symptoms and effects, both acute and delayed:** The most important known symptoms and effects are described in the labeling (see Section 2.2) and/or in Section 11.
**Indication of any immediate medical attention and special treatment needed:** No data available.

## SECTION 5 – FIRE FIGHTING MEASURES

**CHARACTERISTICS:**

| | |
|---|---|
| Flash Point | No Data Available |
| Upper Explosive Limit (UEL) | No Data Available |
| Lower Explosive Limit (LEL) | No Data Available |
| Autoignition Temperature | No Data Available |
| Flash Point Method(s) | No Data Available |
| Unusual Fire & Explosion Hazards | No Data Available |
| Fire Hazard Classification (OSHA/NFPA) | No Data Available |

**EXTINGUISHING MEDIA:** In case of fire, flood with water.

**SPECIAL FIRE FIGHTING PROCEDURES:** Firefighters should wear butyl rubber boots, gloves, body suit and self-containing breathing apparatus. Use water spray to cool all affected containers. Avoid skin contact. Contain runoff water in dikes. Prevent stream contamination. Expended liquids from fire fighting should be diverted to an active sanitary sewer line.

**UNUSUAL FIRE AND EXPLOSION HAZARDS:** May emit sulfur oxide vapors under burning conditions. See Section 6 for hazardous combustion products.

**Hazchem Code:** Not applicable

## SECTION 6 – ACCIDENTAL RELEASE MEASURES

**CLEAN-UP PROCEDURES:** Sweep up and repackage or place in receptacle for future disposal.

**OTHER EMERGENCY ADVICE:** Avoid eye and skin contact. Wear protective clothing including gloves, safety goggles, breathing mask and coveralls when handling. Stored materials should be placed in a dry and reasonably temperature area, preferably below 24$^{o}$C.

**WASTE DISPOSAL:** Remove to properly designated landfill. Observe all federal, state and local environmental regulations.

**ENVIRONMENTAL EFFECTS:** Data not yet available

## SECTION 7 – HANDLING AND STORAGE

**Precautions for safe handling:** Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed. For precautions see Section 2.

**Conditions for safe storage:** Keep container tightly closed in a dry and well-ventilated place. Air Sensitive. Hygroscopic. Store in original container. Isolate from strong oxidizers.

**Specific end use(s):** Apart from the uses mentioned in Section 1 no other specific uses are stipulated.

## SECTION 8 – PERSONAL PROTECTION/ EXPOSURE CONTROLS

**EYE PROTECTION:** Splash proof goggles or safety glasses.
**HAND PROTECTION:** Impermeable gloves made of Nitrile or rubber.
**RESPIRATORY PROTECTION:** Wear appropriate full-face respirator with HEPA cartridges for protection against excessive particulate matter/ dust
**PROTECTIVE CLOTHING:** Long sleeved clothing (e.g. cotton coveralls or Tyvek). Do not wear short trousers
**ENGINEERING CONTROLS:** Avoid drafts that may disperse material beyond the work area. Use light water spray for dust suppression
**WORK AND HYGIENIC PRACTICES:** Provide readily accessible eye wash stations. Wash at the end of each work shift and before eating, smoking or using the toilet

## SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

| | |
|---|---|
| **Physical Properties:** | |
| PHYSICAL FORM | Powder |
| COLOR | Light Green |
| ODOR | Metallic |
| **TYPICAL PHYSICAL DATA:** | |
| pH (10% aqueous) | 3.5-3.9 |
| VAPOR PRESSURE (mm Hg) | 0 |
| VAPOR DENSITY (Air = 1) | Not Applicable |
| BOILING POINT | Decomposition at 300°C |
| FREEZING/MELTING POINT | Not Applicable |
| SOLUBILITY IN WATER | 57% by weight @ 158°C |
| SPECIFIC GRAVITY (Water = 1) | 1.899 @ 14°/ 8°C |
| EVAPORATION RATE (Butylacetate = 1) | Non Volatile |
| VISCOSITY (CPS) | Not Evaluated |

## SECTION 10 – STABILITY AND REACTIVITY

**Reactivity**: No data available.
**Chemical Stability**: Stable under recommended storage conditions.
**Possibility of Hazardous Reactions**: No data available.
**Hazardous: Polymerization**: No data available.
**Conditions to Avoid**: No data available.
**Incompatible Materials**: Strong oxidizing agents.
**Hazardous Decomposition Products**: Other decomposition products – no data available.

## SECTION 11 –TOXICOLOGICAL INFORMATION

**Information on likely routes of exposure**

**Product Information:**

Inhalation: No data available
Eye Contact: No data available
Skin Contact: No data available
Ingestion: Harmful if swallowed

**Component Information:**

Symptoms: No data available

**Delayed and immediate effects as well as chronic effects from short & long-term exposure:**

Sensitization: No data available
Mutagenic effects: No data available

Carcinogenicity: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC
STOT-single exposure: No data available.
STOT-repeated exposure: No data available.
Chronic toxicity: No data available.
Target organ exposure: No data available.
Aspiration hazard: No data available

**Numerical measure of toxicity product information**

The following values are calculated based on Section 3 of the GHS document: No data available.

## SECTION 12 – ECOLOGICAL INFORMATION

**Ecotoxicity:** No data available
**Persistence and degradability**: No data available
**Bioaccumulation:** No data available
**Other adverse effects:** No data available
**Mobility in soil:** No data available

## SECTION 13 – DISPOSAL CONSIDERATIONS

**Waste treatment methods**

**Disposal methods:** Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

**Contaminated packaging:** Dispose of as unused product

## SECTION 14 – TRANSPORTATION INFORMATION

| | |
|---|---|
| **UN No.:** | Not Regulated |
| **DOT SHIPPING NAME:** | Not Regulated |
| **IMO SHIPPING NAME:** | Not Regulated as dangerous goods |
| **LATA SHIPPING NAME:** | Not Regulated as dangerous goods |
| I**MDG:** | Not dangerous goods |
| **IATA:** | Not dangerous goods |
| **ADG Code:** | Not dangerous goods |

## SECTION 15 – REGULATORY INFORMATION

**Federal and State Regulations:** No products were found.
**Other Classifications:**
**WHMIS (Canada):** Not controlled under WHMIS (Canada).
**DSCL (EEC):** R36/38- Irritating to eyes and skin. S2- Keep out of the reach of children. S46- If swallowed, seek medical advice immediately
**HMIS (U.S.A.):** Health Hazard: 2, Fire Hazard: 0, Reactivity: 0, Personal Protection: E
**National Fire Protection Association (U.S.A.):** Health: 2, Flammability: 0, Reactivity: 0, Specific hazard:0
**Protective Equipment:** Nitrile gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Splash goggles/safety glasses.

## SECTION 16 – OTHER INFORMATION

The information set forth above is based upon information, which ISOTEC Remediation Technologies, LLC. believes to be accurate. No warranty, express or implied, is intended. The information is provided solely for your information and consideration and ISOTEC Remediation Technologies, LLC. assumes no legal responsibility for use or reliance thereon.

Issuing Date: NEW

Revision Date: June 2016-Rev. 3

# SAFETY DATA SHEET

## SECTION 1 – IDENTIFICATION OF MATERIAL AND SUPPLIER

**Product Name:** ISOTEC$^{SM}$ Catalyst Series 4260 Chelopolychempremox-B-2
**Recommended Use:** Environmental Remediation
**Uses advised against:** No information available
**Details of the supplier of the safety data sheet:**

| | |
|---|---|
| **Supplier Name:** | ISOTEC Remediation Technologies LLC |
| **Supplier Address:** | 11 Princess Rd, Suite A Lawrenceville, NJ 08648, USA |

**EMERGENCY TELEPHONE NUMBER(S):** **(609) 275-8500 (USA)**

| | |
|---|---|
| **C.A.S. CHEMICAL NAME:** | - |
| **SYNONYMS:** | Chelating agent |
| **CHEMICAL FAMILY:** | Not Applicable |
| **EMPIRICAL FORMULA:** | MIXT (Proprietary) |
| **INTENDED USE:** | Catalyst |

## SECTION 2 – HAZARDS IDENTIFICATION

**Appearance/Odor:** White powder, odorless.
**Precautionary statement(s):** Wash skin thoroughly after handling. Do not eat, drink, or smoke when using this product. Wear protective gloves/eye protection/face protection.
**IF SWALLOWED:** Call a POISON CENTER or doctor/ physician if you feel unwell.
**IF ON SKIN:** Wash with plenty of soap and water.
**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
**Hazards not otherwise classified (HNOC):** None
Specific treatment (see section 4 for more information).

*Applicable properties are relevant to the mixture as a whole when certain proprietary ingredients present at their highest concentrations. Please note that the effects are normally lower for a typical mixture with smaller concentrations of these ingredients present.*

## SECTION 3 – COMPOSITION/ INFORMATION ON INGREDIENTS

| Components | CAS Number | Proportion | Risk Phrases |
|---|---|---|---|
| Amino poly carboxylic acid | - | >60% | - |

## SECTION 4 – FIRST AID MEASURES

**EYE CONTACT:** Hold eyelids apart and immediately flush eyes with plenty of water for at least 15 minutes. Call a physician if irritations persist.
**SKIN CONTACT:** Wash affected area immediately with soap and water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse.
**INHALATION:** In case of inhalation or suspected inhalation, move patient at once to fresh air and call a physician. Keep patient absolutely quiet. If breathing has stopped or is labored, give assisted respiration (e.g., mouth-to-mouth). Supplemental oxygen may be indicated.
**INGESTION:** If swallowed, give several glasses of water. If vomiting occurs, keep head below hips to reduce risk of aspiration. Give fluids again. Seek medical attention if health effects occur. Never give anything by mouth to an unconscious person.
**Most important symptoms and effects, both acute and delayed:** The most important known symptoms and effects are described in the labeling (see Section 2.2) and/or in Section 11.
**Indication of any immediate medical attention and special treatment needed:** No data available.

## SECTION 5 – FIRE FIGHTING MEASURES

**CHARACTERISTICS:**

| | |
|---|---|
| Flash Point | No Data Available |
| Upper Explosive Limit (UEL) | Not Applicable |
| Lower Explosive Limit (LEL) | Not Applicable |
| Autoignition Temperature | Not Applicable |
| Flash Point Method(s) | No Data Available |
| Unusual Fire & Explosion Hazards | No Data Available |
| Fire Hazard Classification (OSHA/NFPA) | No Data Available |

**EXTINGUISHING MEDIA:** Use water spray, alcohol-resistant foam, dry chemical or Polyvalent foam. ABC powder. Carbon dioxide.
**SPECIAL FIRE FIGHTING PROCEDURES:** Firefighters should wear butyl rubber boots, gloves, body suit and self-containing breathing apparatus. Use water spray to cool all affected

containers. Avoid skin contact. Contain runoff water in dikes. Prevent stream contamination. Expended liquids from fire fighting should be diverted to an active sanitary sewer line.
**UNUSUAL FIRE AND EXPLOSION HAZARDS:** May emit Carbon oxides, nitrogen oxides(NOX), Sodium oxides.
**Hazcchem Code:** Not applicable

## SECTION 6 – ACCIDENTAL RELEASE MEASURES

**CLEAN-UP PROCEDURES:** Sweep up and repackage or place in receptacle for future disposal.
**OTHER EMERGENCY ADVICE:** Avoid eye and skin contact. Wear protective clothing including gloves, safety goggles, breathing mask and coveralls when handling. Stored materials should be placed in a dry and reasonably temperature area, preferably below 24°C.
**WASTE DISPOSAL:** Remove to properly designated landfill. Observe all federal, state and local environmental regulations.
**ENVIRONMENTAL EFFECTS:** Data not yet available

## SECTION 7 – HANDLING AND STORAGE

**Precautions for safe handling:** Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed. For precautions see Section 2.
**Conditions for safe storage:** Keep container tightly closed in a dry and well-ventilated place. Isolate from strong oxidizing agents. Do not store in metal containers.
**Specific end use(s):** Apart from the uses mentioned in Section 1 no other specific uses are stipulated.

## SECTION 8 – PERSONAL PROTECTION/ EXPOSURE CONTROLS

**EYE PROTECTION:** Splash proof goggles or safety glasses.
**HAND PROTECTION:** Impermeable gloves made of Nitrile or rubber.
**RESPIRATORY PROTECTION:** Wear appropriate full-face respirator with HEPA cartridges for protection against excessive particulate matter/ dust
**PROTECTIVE CLOTHING:** Long sleeved clothing (e.g. cotton coveralls or Tyvek). Do not wear short trousers
**ENGINEERING CONTROLS:** Avoid drafts that may disperse material beyond the work area. Use light water spray for dust suppression
**WORK AND HYGIENIC PRACTICES:** Provide readily accessible eye wash stations. Wash at the end of each work shift and before eating, smoking or using the toilet

## SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

| | |
|---|---|
| **Physical Properties:** | |
| PHYSICAL FORM | Powder |
| COLOR | White |
| ODOR | None |
| **TYPICAL PHYSICAL DATA:** | |
| pH (10% aqueous) | 4.0-5.0 |
| VAPOR PRESSURE (mm Hg) | 0 |
| VAPOR DENSITY (Air = 1) | Not Applicable |
| BOILING POINT | Not Applicable |
| FREEZING/MELTING POINT | Not Applicable |
| SOLUBILITY IN WATER | 10g/100g @ 25°C |
| SPECIFIC GRAVITY (Water = 1) | Not Evaluated |
| EVAPORATION RATE (Butylacetate = 1) | Non Volatile |
| VISCOSITY (CPS) | Not Evaluated |

## SECTION 10 – STABILITY AND REACTIVITY

**Reactivity**: No data available.
**Chemical Stability**: Stable under recommended storage conditions.
**Possibility of Hazardous Reactions**: No data available.
**Hazardous: Polymerization**: No data available.
**Conditions to Avoid**: No data available.
**Incompatible Materials**: Strong oxidizing agents.
**Hazardous Decomposition Products**: Other decomposition products – no data available.

## SECTION 11 –TOXICOLOGICAL INFORMATION

<u>**Information on likely routes of exposure**</u>

| | |
|---|---|
| **Product Information:** | |
| Inhalation: | No data available |
| Eye Contact: | No data available |
| Skin Contact: | No data available |
| Ingestion: | Harmful if swallowed |
| **Component Information:** | |
| Symptoms: | No data available |

**Delayed and immediate effects as well as chronic effects from short & long-term exposure:**

| | |
|---|---|
| Sensitization: | No data available |
| Mutagenic effects: | No data available |

| | |
|---|---|
| Carcinogenicity: | No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC |
| STOT-single exposure: | No data available. |
| STOT-repeated exposure: | No data available. |
| Chronic toxicity: | No data available. |
| Target organ exposure: | No data available. |
| Aspiration hazard: | No data available |

**Numerical measure of toxicity product information**

The following values are calculated based on Section 3 of the GHS document: No data available.

## SECTION 12 – ECOLOGICAL INFORMATION

| | |
|---|---|
| **Ecotoxicity:** | No data available |
| **Persistence and degradability**: | No data available |
| **Bioaccumulation:** | No data available |
| **Other adverse effects:** | No data available |
| **Mobility in soil:** | No data available |

## SECTION 13 – DISPOSAL CONSIDERATIONS

**Waste treatment methods**

**Disposal methods:** Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

**Contaminated packaging:** Dispose of as unused product

## SECTION 14 – TRANSPORTATION INFORMATION

| | |
|---|---|
| **UN No.:** | Not Regulated |
| **DOT SHIPPING NAME:** | Not Regulated |
| **IMO SHIPPING NAME:** | Not Regulated as dangerous goods |
| **LATA SHIPPING NAME:** | Not Regulated as dangerous goods |
| I**MDG:** | Not dangerous goods |
| **IATA:** | Not dangerous goods |
| **ADG Code:** | Not dangerous goods |

## SECTION 15 – REGULATORY INFORMATION

**Federal and State Regulations:** No products were found.
**Other Regulations:** This product does not contain any products considered hazardous under the federal OSHA HazCom.Standard 29 CFR 1.910.1200
**Other Classifications:**
**WHMIS (Canada):** Not controlled under WHMIS (Canada).
**DSCL (EEC):** R36/38- Irritating to eyes and skin. S2- Keep out of the reach of children. S46- If swallowed, seek medical advice immediately.
**HMIS (U.S.A.):** Health Hazard: 0, Fire Hazard: 0, Reactivity: 0, Personal Protection: E
**National Fire Protection Association (U.S.A.):** Health: 0, Flammability: 0, Reactivity: 0, Specific hazard: 0
**Protective Equipment:** Nitrile gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Splash goggles/safety glasses.

## SECTION 16 – OTHER INFORMATION

The information set forth above is based upon information, which ISOTEC Remediation Technologies, LLC. believes to be accurate. No warranty, express or implied, is intended. The information is provided solely for your information and consideration and ISOTEC Remediation Technologies, LLC. assumes no legal responsibility for use or reliance thereon.

Issuing Date: NEW

Revision Date: June 2016. Rev 4.

# SAFETY DATA SHEET

## SECTION 1 – IDENTIFICATION OF MATERIAL AND SUPPLIER

**Product Name**: ISOTEC$^{SM}$ Catalyst-4260 Chelopolychempremox-B-4
**Recommended Use**: Environmental Remediation
**Uses advised against**: No information available
**Details of the supplier of the safety data sheet:**

| | |
|---|---|
| **Supplier Name:** | ISOTEC Remediation Technologies LLC |
| **Supplier Address:** | 11 Princess Rd, Suite A Lawrenceville, NJ 08648, USA |
| **EMERGENCY TELEPHONE NUMBER(S):** | **(609) 275-8500 (USA)** |
| **C.A.S. CHEMICAL NAME:** | - |
| **SYNONYMS:** | Chelating agent |
| **CHEMICAL FAMILY:** | Not Applicable |
| **EMPIRICAL FORMULA:** | MIXT (Proprietary) |
| **INTENDED USE:** | Catalyst |

## SECTION 2 – HAZARDS IDENTIFICATION

**Appearance/Odor:** White powder, odorless.
**Precautionary statement(s):** Wash skin thoroughly after handling. Do not eat, drink, or smoke when using this product. Wear protective gloves/eye protection/face protection.
**IF SWALLOWED:** Call a POISON CENTER or doctor/ physician if you feel unwell.
**IF ON SKIN:** Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse.
**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
**Hazards not otherwise classified (HNOC):** None
Specific treatment (see section 4 for more information).

*Applicable properties are relevant to the mixture as a whole when certain proprietary ingredients present at their highest concentrations. Please note that the effects are normally lower for a typical mixture with smaller concentrations of these ingredients present.*

## SECTION 3 – COMPOSITION/ INFORMATION ON INGREDIENTS

| Components | CAS Number | Proportion | Risk Phrases |
|---|---|---|---|
| Amino poly carboxylate | - | >60% | - |

## SECTION 4 – FIRST AID MEASURES

**EYE CONTACT:** Hold eyelids apart and immediately flush eyes with plenty of water for at least 15 minutes. Call a physician if irritations persist.
**SKIN CONTACT:** Wash affected area immediately with soap and water.
**INHALATION:** In case of inhalation or suspected inhalation, move patient at once to fresh air and call a physician. Keep patient absolutely quiet. If breathing has stopped or is labored, give assisted respiration (e.g., mouth-to-mouth). Supplemental oxygen may be indicated.
**INGESTION:** If swallowed, call a physician immediately. Induce vomiting or remove stomach contents by gastric suction only as directed by medical personnel. Wash mouth with plenty of water. Never give anything by mouth to an unconscious person.

**Most important symptoms and effects, both acute and delayed:** The most important known symptoms and effects are described in the labeling (see Section 2.2) and/or in Section 11.
**Indication of any immediate medical attention and special treatment needed:** No data available.

## SECTION 5 – FIRE FIGHTING MEASURES

**CHARACTERISTICS:**

| | |
|---|---|
| Flash Point | No Data Available |
| Upper Explosive Limit (UEL) | Not Applicable |
| Lower Explosive Limit (LEL) | Not Applicable |
| Autoignition Temperature | Not Applicable |
| Flash Point Method(s) | No Data Available |
| Unusual Fire & Explosion Hazards | No Data Available |
| Fire Hazard Classification (OSHA/NFPA) | No Data Available |

**EXTINGUISHING MEDIA:** In case of fire, flood with water.
**SPECIAL FIRE FIGHTING PROCEDURES:** Firefighters should wear butyl rubber boots, gloves, body suit and self-containing breathing apparatus. Use water spray to cool all affected containers. Avoid skin contact. Contain runoff water in dikes. Prevent stream contamination. Expended liquids from fire fighting should be diverted to an active sanitary sewer line.

**UNUSUAL FIRE AND EXPLOSION HAZARDS:** May emit oxides of carbon and nitrogen under burning conditions.
**Hazcchem Code:** Not applicable

## SECTION 6 – ACCIDENTAL RELEASE MEASURES

**CLEAN-UP PROCEDURES:** Sweep up and repackage or place in receptacle for future disposal.
**OTHER EMERGENCY ADVICE:** Avoid eye and skin contact. Wear protective clothing including gloves, safety goggles, breathing mask and coveralls when handling. Stored materials should be placed in a dry and reasonably temperature area, preferably below 24°C.
**WASTE DISPOSAL:** Remove to properly designated landfill. Observe all federal, state and local environmental regulations.
**ENVIRONMENTAL EFFECTS:** Data not yet available

## SECTION 7 – HANDLING AND STORAGE

**Precautions for safe handling:** Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed. For precautions see Section 2.
**Conditions for safe storage:** Keep container tightly closed in a dry and well-ventilated place. Isolate from strong oxidizers.
**Specific end use(s):** Apart from the uses mentioned in Section 1 no other specific uses are stipulated.

## SECTION 8 – PERSONAL PROTECTION/ EXPOSURE CONTROLS

**EYE PROTECTION:** Splash proof goggles or safety glasses.
**HAND PROTECTION:** Impermeable gloves made of Nitrile or rubber.
**RESPIRATORY PROTECTION:** Wear appropriate full-face respirator with HEPA cartridges for protection against excessive particulate matter/ dust
**PROTECTIVE CLOTHING:** Long sleeved clothing (e.g. cotton coveralls or Tyvek). Do not wear short trousers
**ENGINEERING CONTROLS:** Avoid drafts that may disperse material beyond the work area. Use light water spray for dust suppression
**WORK AND HYGIENIC PRACTICES:** Provide readily accessible eye wash stations. Wash at the end of each work shift and before eating, smoking or using the toilet

## SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

**Physical Properties:**

| | |
|---|---|
| PHYSICAL FORM | Powder |
| COLOR | White |
| ODOR | None |
| **TYPICAL PHYSICAL DATA:** | |
| pH (10% aqueous) | ~11 |
| VAPOR PRESSURE (mm Hg) | Non-Volatile |
| VAPOR DENSITY (Air = 1) | Non-Volatile |
| BOILING POINT | Not Applicable |
| FREEZING/MELTING POINT | ~300°C |
| SOLUBILITY IN WATER | Soluble |
| SPECIFIC GRAVITY (Water = 1) | Not Evaluated |
| EVAPORATION RATE (Butylacetate = 1) | Non Volatile |
| VISCOSITY (CPS) | Not Evaluated |

## SECTION 10 – STABILITY AND REACTIVITY

**Reactivity**: No data available.
**Chemical Stability**: Stable
**Possibility of Hazardous Reactions**: No data available.
**Hazardous: Polymerization**: Will not occur
**Conditions to Avoid**: No data available.
**Incompatible Materials**: Strong oxidizing agents.
**Hazardous Decomposition Products**: Other decomposition products – no data available. In the event of a fire see Section 5

## SECTION 11 –TOXICOLOGICAL INFORMATION

**<u>Information on likely routes of exposure</u>**

**Product Information:**

| | |
|---|---|
| Inhalation: | No data available |
| Eye Contact: | No data available |
| Skin Contact: | No data available |
| Ingestion: | Harmful if swallowed |

**Component Information:**

| | |
|---|---|
| Symptoms: | No data available |

**Delayed and immediate effects as well as chronic effects from short & long-term exposure:**

| | |
|---|---|
| Sensitization: | No data available |
| Mutagenic effects: | No data available |
| Carcinogenicity: | No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible |

|  |  |
|---|---|
|  | or confirmed human carcinogen by IARC |
| STOT-single exposure: | No data available. |
| STOT-repeated exposure: | No data available. |
| Chronic toxicity: | No data available. |
| Target organ exposure: | No data available. |
| Aspiration hazard: | No data available |

**Numerical measure of toxicity product information**

The following values are calculated based on Section 3 of the GHS document: No data available.

## SECTION 12 – ECOLOGICAL INFORMATION

|  |  |
|---|---|
| **Ecotoxicity:** | No data available |
| **Persistence and degradability**: | No data available |
| **Bioaccumulation:** | No data available |
| **Other adverse effects:** | No data available |
| **Mobility in soil:** | No data available |

## SECTION 13 – DISPOSAL CONSIDERATIONS

**Waste treatment methods**

**Disposal methods:** Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

**Contaminated packaging:** Dispose of as unused product

## SECTION 14 – TRANSPORTATION INFORMATION

|  |  |
|---|---|
| **UN No.:** | Not Regulated |
| **DOT SHIPPING NAME:** | Not Regulated |
| **IMO SHIPPING NAME:** | Not Regulated as dangerous goods |
| **LATA SHIPPING NAME:** | Not Regulated as dangerous goods |
| I**MDG:** | Not dangerous goods |
| **IATA:** | Not dangerous goods |
| **ADG Code:** | Not dangerous goods |

## SECTION 15 – REGULATORY INFORMATION

**Federal and State Regulations:** No products were found.
**Other Regulations:** This product does not contain any products considered hazardous under the federal OSHA HazCom.Standard 29 CFR 1.910.1200
**Other Classifications:**
**WHMIS (Canada):** Not controlled under WHMIS (Canada).
**DSCL (EEC):** R36/38- Irritating to eyes and skin. S2- Keep out of the reach of children. S46- If swallowed, seek medical advice immediately.
**HMIS (U.S.A.):** Health Hazard: 0, Fire Hazard: 0, Reactivity: 0, Personal Protection: E
**National Fire Protection Association (U.S.A.):** Health: 0, Flammability: 0, Reactivity: 0, Specific hazard:
**Protective Equipment:** Nitrile gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Splash goggles/safety glasses.

## SECTION 16 – OTHER INFORMATION

The information set forth above is based upon information, which ISOTEC Remediation Technologies, LLC. believes to be accurate. No warranty, express or implied, is intended. The information is provided solely for your information and consideration and ISOTEC Remediation Technologies, LLC. assumes no legal responsibility for use or reliance thereon.

Issuing Date: NEW

Revision Date: June 2016-Rev. 5.

# SAFETY DATA SHEET

## SECTION 1 – IDENTIFICATION OF MATERIAL AND SUPPLIER

**Product Name**: ISOTEC$^{SM}$ Stabilizer 0875
**Recommended Use**: Environmental Remediation
**Uses advised against**: No information available
**Details of the supplier of the safety data sheet:**

| | |
|---|---|
| **Supplier Name:** | ISOTEC Remediation Technologies LLC |
| **Supplier Address:** | 11 Princess Rd, Suite A Lawrenceville, NJ 08648, USA |
| **EMERGENCY TELEPHONE NUMBER(S):** | **(609) 275-8500 (USA)** |
| **C.A.S. CHEMICAL NAME:** | Mixture |
| **SYNONYMS:** | None |
| **CHEMICAL FAMILY:** | Not Applicable |
| **EMPIRICAL FORMULA:** | MIXT (Proprietary) |
| **INTENDED USE:** | Stabilizing Agent |

## SECTION 2 – HAZARDS IDENTIFICATION

**Appearance/Odor:** White powder, odorless.
**Precautionary statement(s):** Wash skin thoroughly after handling. Do not eat, drink, or smoke when using this product. Wear protective gloves/eye protection/face protection.
**IF SWALLOWED:** Call a POISON CENTER or doctor/ physician if you feel unwell.
**IF ON SKIN:** Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse.
**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
**Hazards not otherwise classified (HNOC):** None
Specific treatment (see section 4 for more information).

*Applicable properties are relevant to the mixture as a whole when certain proprietary ingredients present at their highest concentrations. Please note that the effects are normally lower for a typical mixture with smaller concentrations of these ingredients present.*

## SECTION 3 – COMPOSITION/ INFORMATION ON INGREDIENTS

| Components | CAS Number | Proportion | Risk Phrases |
|---|---|---|---|
| Inorganic phosphates | - | >60% | - |

## SECTION 4 – FIRST AID MEASURES

**EYE CONTACT:** Hold eyelids apart and immediately flush eyes with plenty of water for at least 15 minutes. Call a physician if irritations persist.
**SKIN CONTACT:** Wash affected area immediately with soap and water.
**INHALATION:** In case of inhalation or suspected inhalation, move patient at once to fresh air and call a physician. Keep patient absolutely quiet. If breathing has stopped or is labored, give assisted respiration (e.g., mouth-to-mouth). Supplemental oxygen may be indicated.
**INGESTION:** Rinse mouth and dilute stomach contents with water, or preferably with milk if available. Large doses may cause nausea, vomiting and diarrhea. Systematic oral toxicity is extremely rare and has consisted of acidosis and hypocalcemic tetany.

**Most important symptoms and effects, both acute and delayed:** The most important known symptoms and effects are described in the labeling (see Section 2.2) and/or in Section 11.
**Indication of any immediate medical attention and special treatment needed:** No data available.

## SECTION 5 – FIRE FIGHTING MEASURES

**CHARACTERISTICS:**

| | |
|---|---|
| Flash Point | No Data Available |
| Upper Explosive Limit (UEL) | Not Applicable |
| Lower Explosive Limit (LEL) | Not Applicable |
| Autoignition Temperature | Not Applicable |
| Flash Point Method(s) | No Data Available |
| Unusual Fire & Explosion Hazards | No Data Available |
| Fire Hazard Classification (OSHA/NFPA) | No Data Available |

**EXTINGUISHING MEDIA:** Product is noncombustible.
**SPECIAL FIRE FIGHTING PROCEDURES** Not Applicable
**UNUSUAL FIRE AND EXPLOSION HAZARDS** None.
**Hazchem Code:** Not applicable

## SECTION 6 – ACCIDENTAL RELEASE MEASURES

**CLEAN-UP PROCEDURES:** Sweep up and repackage or place in receptacle for future disposal.
**OTHER EMERGENCY ADVICE:** Avoid eye and skin contact. Wear protective clothing including gloves, safety goggles, breathing mask and coveralls when handling. Stored materials should be placed in a dry and reasonably temperature area, preferably below 24$^{o}$C.
**WASTE DISPOSAL:** Remove to properly designated landfill. Observe all federal, state and local environmental regulations.
**ENVIRONMENTAL EFFECTS:** Aquatic Toxicity.

## SECTION 7 – HANDLING AND STORAGE

**Precautions for safe handling:** Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed. For precautions see Section 2.
**Conditions for safe storage:** Keep container tightly closed in a dry and well-ventilated place. Hygroscopic.
**Specific end use(s):** Apart from the uses mentioned in Section 1 no other specific uses are stipulated.

## SECTION 8 – PERSONAL PROTECTION/ EXPOSURE CONTROLS

**EYE PROTECTION:** Splash proof goggles or safety glasses.
**HAND PROTECTION:** Impermeable gloves made of Nitrile or rubber.
**RESPIRATORY PROTECTION:** Wear appropriate full-face respirator with HEPA cartridges for protection against excessive particulate matter/ dust
**PROTECTIVE CLOTHING:** Long sleeved clothing (e.g. cotton coveralls or Tyvek). Do not wear short trousers
**ENGINEERING CONTROLS:** Avoid drafts that may disperse material beyond the work area. Use light water spray for dust suppression
**WORK AND HYGIENIC PRACTICES:** Provide readily accessible eye wash stations. Wash at the end of each work shift and before eating, smoking or using the toilet

## SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

| | |
|---|---|
| **Physical Properties:** | |
| PHYSICAL FORM | Powder |
| COLOR | White |
| ODOR | None |
| **TYPICAL PHYSICAL DATA:** | |
| pH (10% aqueous) | 4.6 |
| VAPOR PRESSURE (mm Hg) | Non volatile |
| VAPOR DENSITY (Air = 1) | Non volatile |
| BOILING POINT | Not applicable |
| FREEZING/MELTING POINT | 253° C |
| SOLUBILITY IN WATER | 20% by weight @ 25°C |
| SPECIFIC GRAVITY (Water = 1) | 1.2 |
| EVAPORATION RATE (Butylacetate = 1) | Non volatile |
| VISCOSITY (CPS) | No data available |

## SECTION 10 – STABILITY AND REACTIVITY

**Reactivity**: No data available.
**Chemical Stability**: Stable under recommended storage conditions.
**Possibility of Hazardous Reactions**: No data available.
**Hazardous: Polymerization**: None.
**Conditions to Avoid**: No data available.
**Incompatible Materials**: None.
**Hazardous Decomposition Products**: Other decomposition products – no data available. In the event of a fire see Section 5.

## SECTION 11 –TOXICOLOGICAL INFORMATION

**<u>Information on likely routes of exposure</u>**

| | |
|---|---|
| **Product Information:** | |
| Inhalation: | No data available |
| Eye Contact: | No data available |
| Skin Contact: | No data available |
| Ingestion: | Harmful if swallowed |
| **Component Information:** | |
| Symptoms: | No data available |

**Delayed and immediate effects as well as chronic effects from short & long-term exposure:**

| | |
|---|---|
| Sensitization: | No data available |

| | |
|---|---|
| Mutagenic effects: | No data available |
| Carcinogenicity: | This product does not contain any substances that are considered by OSHA, NTP, IARC or ACGIH to be "probable" or suspected" human carcinogens. |
| STOT-single exposure: | No data available. |
| STOT-repeated exposure: | No data available. |
| Chronic toxicity: | No data available. |
| Target organ exposure: | No data available. |
| Aspiration hazard: | No data available |

**Numerical measure of toxicity product information**

The following values are calculated based on Section 3 of the GHS document: No data available.

## SECTION 12 – ECOLOGICAL INFORMATION

| | |
|---|---|
| **Ecotoxicity:** | No data available |
| **Persistence and degradability**: | No data available |
| **Bioaccumulation:** | No data available |
| **Other adverse effects:** | No data available |
| **Mobility in soil:** | No data available |

## SECTION 13 – DISPOSAL CONSIDERATIONS

**Waste treatment methods**

**Disposal methods:** This product does not present a danger or hazard for disposal. Except for Food applications, salvage and return to container, process or recycle for other uses. May be disposed of in a properly designated landfill if needed.

**Contaminated packaging:** Dispose of as unused product

## SECTION 14 – TRANSPORTATION INFORMATION

| | |
|---|---|
| **UN No.:** | Not Regulated |
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**HMIS (U.S.A.):** Health Hazard: 0, Fire Hazard: 0, Reactivity: 0, Personal Protection: E
**National Fire Protection Association (U.S.A.):** Health: 1, Flammability: 0, Reactivity: 0, Specific hazard:
**Protective Equipment:** Nitrile gloves. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Splash goggles/safety glasses.

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Issuing Date: NEW

Revision Date: June 2016-Rev.5.

# APPENDIX E

## 1.0 EMERGENCY RESPONSE RESOURCES

| **EMERGENCY INFORMATION** | | |
|---|---|---|
| **Contact** | **Phone Number** | **Hospital Directions** |
| Local Police | 911 | **Hospital Directions and Route Maps on last page.** |
| Fire Department | 911 | |
| Ambulance | 911 | |
| Local Hospital: Harborview Medical Center | (206) 744-3000 | |
| Site Health and Safety Officer:<br>Karsten Springstead<br>Cell | <br><br>206-914-0308 | **Emergency Response**<br>**-----*Call for Aid FIRST*------**<br>**PES Environmental, Inc.**<br>**1215 Fourth Avenue, Suite 1350**<br>**Seattle, WA**<br>• Call PES office, inform them of emergency<br>• Meet emergency responder at the entrance<br>• Contact Project Manager |
| PES H&S Officer:<br>Kelly Rankich<br>Work<br>Cell | <br><br>(206) 529-3980<br>(206) 303-7915 | |
| Project Manager:<br>Bill Haldeman<br>Work<br>Cell | <br><br>(206) 529-3980<br>(425) 922-0254 | INCIDENT REPORTING<br>For any incidents involving medical attention, please provide:<br>• Employee name<br>• Name of treating facility and phone number<br>• Description of incident<br>• Follow the instructions on the medical forms.<br>• Supervisor complete the Supervisor's Employee Injury Report |
| Client:<br>John Moshy<br>Work<br>Cell | <br><br>(858) 485-9840<br>(858) 829-7709 | |