

# **PHASE II AND PRE-DESIGN INVESTIGATION WORK PLAN**

**Parcel A-3**

**FORMER ROD AND WIRE MILL AREA**

**SPARROWS POINT TERMINAL**

**SPARROWS POINT, MARYLAND**

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**Final – September 17, 2015**



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## 1 Introduction

EnviroAnalytics Group (EAG) has prepared the following Work Plan to complete a Phase II Site Investigation and a Remedial Design Investigation on a portion of the Sparrows Point Terminal, LLC property where the Rod and Wire Mill was once located. This portion of the site is approximately 67 acres and has been designated as Area A, Parcel A-3, as shown on **Figure 1** (Site).

This Phase II Site Investigation and Pre-Design Investigation Work Plan provides for the collection of 1) Phase II Investigation data for the Rod and Wire Mill Area to support characterization of current soil and groundwater conditions in conjunction with environmental responses for the site consistent with the Maryland Voluntary Cleanup Program Phase II investigative process and 2) data necessary to evaluate potential corrective measures for the Rod and Wire Mill Area. The intent of the data collection activities is to provide additional soil and groundwater data and proof-of-concept information to support corrective measures work that will ultimately result a final remedy for the Rod and Wire Mill Area that complies with the requirements of the Resource Conservation and Recovery Act (RCRA) and the Maryland Voluntary Cleanup Program (VCP).

The remainder of this introduction provides a brief description of the Site, a discussion of the regulatory authority for the environmental responses at the Site, a review of the basis for the scope of work specified in this work plan, a description of the existing IM, and an outline for the remainder of the work plan.

### 1.1 Site Description

From the late 1800's until 2012, the production and manufacturing of steel was conducted at Sparrows Point. Iron and steel production operations and processes at Sparrows Point included raw material handling, coke production, sinter production, iron production, steel production, and semi-finished and finished product preparation. In 1970, Sparrows Point was the largest steel facility in the United States, producing hot and cold rolled sheets, coated materials, pipes, plates, and rod and wire. The steelmaking operations at the Facility ceased in fall 2012.

The Rod and Wire Mill Area is located in the northwestern portion of the Site, and is the location of the former mills that produced rods and wire products from the 1940's to the early 1980's. The area is bounded to the west by Riverside Drive and Bear Creek, to the north by Bethlehem Boulevard and Interstate 695, and to the east by the former Pipe Mill Area, which is currently being investigated as Parcel A-1. All manufacturing activities at the Rod and Wire Mill Area ceased operation in the early 1980's with subsequent demolition of all structures between 1994 and 2000, based on historical aerial photos. Current ground cover includes slag aggregate that was placed in conjunction with the

demolition program. The Rod and Wire Mill Area includes approximately 67 acres of the Site located as shown on **Figure 1**.

Manufacturing activities at the Rod and Wire Mill included leaching of zinc ore and a subsequent treatment process to remove cadmium impurities. These activities resulted in zinc and cadmium contaminated soil and groundwater. The leaching process was implemented in large tanks located inside the north end of the former Rod and Wire Mill building. In the 1950's through the early 1970's, the acidic leach residue was stored in the Northwest Pond until about 1959 when filters were installed to dewater the residues. Dewatered sludge generated from this process was temporarily stored on the ground outside the north end of the mill in the Former Sludge Bin Storage Area as shown on **Figure 2**. Filtrate from the dewatering process was recycled to the wire plating process. Excess filtrate was discharged to the East Pond until 1971, after which it was sent to the HCWWTP for treatment. These operations ended in the early 1980's when the Rod and Wire Mill was shut down. Locations of former mill operations are shown in plan view on **Figure 2**.

Historically, as part of a series of site investigations conducted by the then owner, Bethlehem Steel Corporation, there were various Solid Waste Management Units (SWMUs) identified in the vicinity of the Rod and Wire Mill area during the mid-1980s and on through the early 1990s. Specifically, there were 8 SWMUs identified in the January 1998 "Description of Current Conditions Report – Bethlehem Steel Corporation – Sparrows Point" report (DCC report), Section 3.3.4, prepared by Rust Environment:

SWMU 27:	Sludge Bin Storage Area
SWMU 28:	Northwest Pond
SWMU 29:	East Pond
SWMU 30:	Rod Mill Equalization Tanks (2)
SWMU 38:	Cadmium Treatment Trenches
SWMU 39:	Rod Mill Scale Pits (2)
SWMU 44:	Rod Mill Cooling Tower
SWMU 45:	Rod Mill Trenches/Sumps

As part of the Phase I Environmental Site Assessment conducted by Weaver Boos Consultants, LLC, in May 2014, the SWMUs were updated from the DCC report; there were six Recognized Environmental Conditions (RECs) identified in the Rod and Wire Mill Area as still requiring further investigation for a permanent remediation measure. The location of the RECs are shown on **Figure 3** and further described as follows:

New REC	Former SMWU/AOC	Area Name	Explanation
6A	27	Rod Mill Remediation Area	Continuing interim measures (IM) are in place for cadmium/zinc impacted groundwater as per the Consent Decree. During the site visit the existing IM remediation system was observed. Based on this information, the potential for a material release which may impact the environment is present.
6B	28	[Filled] Northwest Pond	Continuing interim measures are in place for cadmium/zinc impacted groundwater as per the Consent Decree. During the site visit the existing IM remediation system was observed. Based on our review of historical source information and experience, the Northwest Pond may have potentially contained hazardous substances and/or petroleum products which may have resulted in a release to the environment.
6C	29	[Filled] East Pond	Continuing interim measures are in place for cadmium/zinc impacted groundwater as per the Consent Decree. During the site visit the existing IM remediation system was observed. Based on this information, the potential for a material release which may impact the environment is present.
6D	45	Rod Mill Trenches/Sumps	The DCC Report recommended further action was needed for this item which were identified as piping designed to transport process wastewater. Based on our review of historical source information and experience, the trenches/sumps may have potentially contained hazardous substances and/or petroleum products which may have resulted in a release to the environment.
6E	X	Unknown Aboveground Tank	The DCC Report recommended further action was needed for this item. Based on our review of historical source information and experience, the tank may have contained hazardous substances and/or petroleum products which may have resulted in a release to the environment.

## 1.2 Regulatory Authority

Environmental responses for the former Rod and Wire Mill Area and for the Site in general, are being implemented pursuant to the following:

- Multimedia Consent Decree between Bethlehem Steel Corporation, the United States Environmental Protection Agency, and the Maryland Department of the Environment (effective October 8, 1997); this Consent Decree has been modified in accordance with a stipulated order entered into by Sparrows Point LLC and the respective agencies effective July 28, 2014
- Administrative Consent Order (ACO) between Sparrows Point Terminal, LLC and the Maryland Department of the Environment (effective September 12, 2014);

- Settlement Agreement and Covenant Not to Sue (SA) between Sparrows Point Terminal, LLC and the United States Environmental Protection Agency (effective November 25, 2014).

The Rod and Wire Mill Area has been included in Area A for the Site and has been designated for investigation, remediation, and/or development on a priority basis as defined in the ACO. To delineate Area A in accordance with the ACO, Sparrows Point Terminal, LLC submitted a VCP application for Area A on September 10, 2014.

The Multi-Media Consent Decree (Decree) for the Sparrows Point facility dealt with many issues associated with ongoing iron-making, steel-making, coking, byproduct, plating, and finishing operations. To the extent that these operations are no longer conducted, and the associated facilities no longer exist, many specific requirements of the Decree are no longer applicable and have been removed in accordance with the stipulated order implementing modifications to the Decree. The aforementioned ACO and SA incorporate the relevant aspects of the Decree by reference.

### 1.3 Work Plan Basis

Regulatory obligations for investigation, remediation, pathway exclusion, and closure of applicable areas of the Site are addressed within the ACO and EPA Agreement. Regulatory obligations and closure will be conducted in accordance with the terms of the Regulatory Agreements, which include obtaining a No Further Action letter and Certificate of Completion under MDE's Voluntary Cleanup Program and an EPA Certificate of Completeness after the BSC Consent Decree Areas proceed through RCRA's Statement of Basis process upon which a Final Decision and Response to Documents is rendered.

This work plan has also been developed in view of the conceptual approach for site cleanup as specified in a Site Conceptual Cleanup Plan (SCCP) dated August 29, 2014. Furthermore, a project scoping meeting was held with the USEPA and MDE on November 19, 2014. Comments, observations, and suggestions offered by USEPA and MDE representatives during the project scoping meeting have been considered and incorporated during preparation of this work plan.

Contaminants of concern include primarily cadmium and zinc affecting surface soil, subsurface soil, and groundwater. The primary exposure pathways for the Rod and Wire Mill Area include potential exposure to surface soil and the potential discharge of groundwater to surface water of Bear Creek. Groundwater flow is currently being controlled by the operation of the Interim Measure IM system that is more fully described in the following section. This IM system has reversed the natural groundwater flow direction away from Bear Creek through the use of recovery wells. Groundwater, when the pump and treat system is not operating, has been shown to flow west-southwesterly across the impacted areas towards Bear Creek adjacent to the former Rod and Wire Mill. Potential risks may be present for this exposure pathway from direct toxicity of dissolved metals to benthic organisms, accumulation in food webs, surface water aquatic life, and human health. Response actions will be implemented to mitigate this exposure and utilize groundwater compliance concentrations derived from risk assessment work to

be completed based in part on surface water quality standards (WQS) for cadmium and zinc. Corrective actions will be completed to control sources and mitigate impacts and eliminate the requirement to operate and maintain existing interim measures (i.e. the pump and treat system).

Remediation will focus on the mitigation of future exposure pathways from contaminated soil and groundwater as follows:

#### Soil

- Prevent potential future direct exposure to contaminated surface soil
- Mitigate future leaching to groundwater

#### Groundwater

- Mitigate potential for non-point source discharge of groundwater above acceptable risk-based concentrations and eliminate need for ongoing interim measure currently consisting of pumping and treatment of groundwater in this area.

### 1.4 Description of Interim Measures

Historical operations in the Rod and Wire Mill Area resulted in releases of cadmium and zinc to soil and groundwater. In 1986, a soil and groundwater remediation program was initiated to address groundwater exhibiting elevated levels of cadmium and zinc, and residual soil contamination in the Sludge Bin Storage Area. Remediation initially consisted of a soil-flushing program and associated pumping and treatment of groundwater from shallow and intermediate wells. The groundwater pumping was discontinued and the treatment plant dismantled in 1999 to support a demolition project at the Rod and Wire Mill allowing for reassessment of the interim measure. BSC submitted a Work Plan to re-establish Interim Measures in July 2000; the Work Plan was approved by the Agencies in November 2000. Re-establishment of the Interim Measure included an institutional control for soil, upgrades to the monitoring well network, construction of two recovery wells, installation of a transmission pipeline to the HCWWTP, and evaluation of pump test data, groundwater flow characteristics, and review of the system's effectiveness.

The pumping and treatment of groundwater resumed in September 2001 and currently continues. At present, known dissolved cadmium and zinc plumes exist in the sandy subsurface from approximately 20 to 30 feet below ground surface (bgs). The average depth to water is approximately 3 to 5 feet bgs, and the sandy substrate exists down to approximately 50 to 60 feet bgs. There is currently no indication that significant dissolved phase concentrations are deeper than 30 ft. bgs.

Interim Measures (IMs) are currently underway at the former Rod and Wire Mill Area as described below:

- Institutional controls for soils have been established to provide a "Restricted Work Area" to control the exposure of onsite workers to soils in the Former Sludge Bin Storage Area.



- A groundwater monitoring network has been installed including the use of 31 wells for monitoring the performance of the groundwater pump and treat system. This monitoring network is used to collect water level and groundwater quality data.
- A groundwater pump and treat system is operated and maintained consisting of two intermediate depth zone recovery wells (RW10-PZM020 and RW15-PZM020) that operate at a rate of between 5.0 and 12.0 gallons per minute (gpm). The expected normal operating rate for the treatment plant was set at a combined rate of 8.0 to 12.0 gpm with a maximum design flow of 25 gpm. Recovered groundwater is transported via a pipeline to the Humphreys Creek Wastewater Treatment Plant (HCWWTP) for subsequent treatment and discharge in accordance with the NPDES permit requirements for the Facility.
- The 2013 and 2014 system operation stats are as follows:

	2013	2014
<b>Annual Avg Flowrate, gpm</b>	4.8 gpm	9.4 gpm
<b>Annual Avg Flowrate, gpd</b>	6955 gpd	13,573 gpd
<b>Total Annual Flow, gpyear</b>	2.54 million	4.95 million
<b>Avg Flowrate, RW10</b>	1.88 gpm	4.48 gpm
<b>Avg Flowrate, RW15</b>	2.96 gpm	4.95 gpm
<b>Avg Cd Conc's, RW10</b>	11.75 ppm	9.83 ppm
<b>Avg Cd Conc's, RW15</b>	1.0 ppm	1.08 ppm
<b>Avg Zn Conc's, RW10</b>	373 ppm	526 ppm
<b>Avg Zn Conc's, RW15</b>	44 ppm	34.9 ppm
<b>Total Mass Removed, Cd</b>	113 lbs	216 lbs
<b>Total Mass Removed, Zn</b>	3646 lbs	11,090 lbs

The increase in mass removal of cadmium and zinc in 2014 as compared to 2013 is due to the increase in the volume of water pumped from both wells in 2014.

## 1.5 Work Plan Outline

This document provides a plan for data collection efforts to further delineate the known source areas for cadmium and zinc impacts, investigate the presence of other potential contaminants, collect water quality data, and complete a hydraulic study with and without pumping conditions. Characterization of the area is required to support design planning for efforts to remediate the existing contamination posing a risk to human health and/or the environment. In addition, and to that end, this document also provides planned work that will include bench scale studies and treatability studies being considered for the purpose of evaluating various remedial options which might be applied at the Rod and Wire Mill Area.

## 2 Work Plan Objectives

The objectives of the Phase II and Pre-Design investigation consist of:

- Provide an overall investigation of the Rod and Wire Mill Area, and particularly the identified RECS, sufficient to meet the site characterization requirements of the Maryland VCP;
- Provide a focused investigation to characterize the nature and extent of contamination in the Rod & Wire Area to support risk assessment and an evaluation of remedial options for this area of known contamination.

The former operations in the Rod and Wire Mill Area represent potential releases to the environment. The objective of the Phase II investigation of these areas is to determine presence or absence of releases associated with identified RECs and former operations areas. In addition, it is planned to provide reasonable spatial coverage of samples screening the remainder of the former Rod and Wire Mill Area for potential contamination.

The Rod & Wire Area is the site of an on-going Interim Measure. The objective of the Pre-Design investigation is to provide sufficient data to allow for assessment and development of remedial objectives, and to adequately define the nature and extent of the known contamination to support the evaluation of potential remedial measures to develop a final Response Action Plan (RAP) that could eliminate the need for the on-going Interim Measure.

### 3 Scope of Work

The scope of work for the former Rod and Wire Mill Area as presented herein is supplemented by additional project planning documents. Specifically, a task-specific Health and Safety Plan (HASP) and a Site Wide Quality Assurance Project Plan (QAPP) have been prepared for the scope of work. The HASP complies with the requirements of the Occupational Safety and Health Administration regulation 1910.120. All field personnel assigned for work at the Site have been trained in accordance with the Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response standard (29 CFR 1910.120) and other applicable OSHA training standards. All field staff will be experienced in hazardous waste site work, use of personal protective equipment (PPE), and emergency response procedures.

#### 3.1 Phase II Site Investigation

Several areas in and around the buildings and facilities in the former Rod and Wire Mill area may have been historical sources of environmental contamination. These areas were identified as targets for sampling through a careful review of historical documents. When a sampling target was identified, a boring was placed at or next to its location using GIS software (ArcMap Version 10.3). The first sampling targets to be identified were Recognized Environmental Conditions (RECs) located within the Site boundaries, as shown on the REC Location Map provided in the Phase I Environmental Site Assessment (ESA) prepared by Weaver Boos Consultants dated May 19, 2014. The following RECs were identified: Rod Mill Remediation Area (REC 6A and SWMU 27), Northwest Pond (REC 6B and SWMU 28), East Pond (REC 6C and SWMU 29), Rod Mill Trenches/Sumps (REC 6D and SWMU 45) and Unknown Aboveground Storage Tank (REC 6E and AOC X). Additional Findings (non-RECs) from the Phase I ESA which were identified as Potential Environmental Concerns were also reviewed and targeted as applicable.

Following the identification and evaluation of all RECs at the Site, SWMUs and Areas of Concern (AOCs) were identified from the DCC report. Additional Findings, SWMUs and AOCs that were identified include: Rod Mill Remediation Area (REC 6A and SWMU 27), Northwest Pond (REC 6B and SWMU 28), East Pond (REC 6C and SWMU 29), Rod Mill Trenches/Sumps (REC 6D and SWMU 45) and Unknown Aboveground Storage Tank (REC 6E and AOC X).

Following the identification of all SWMUs and AOCs, three (3) sets of historical site drawings were reviewed to identify additional sampling targets. These site drawings included the 5000 Set (Plant Arrangement), the 5100 Set (Plant Index) and the 5500 Set (Plant Sewer Lines). Sampling target locations were identified if the historical site drawings depicted industrial activities or a specific feature at a location that may have been a source of environmental contamination that impacted the Site. Based on this criterion, sampling targets identified at the Site include: paint room, oil storage areas, truck repair areas, various pits, furnaces, cooling towers, water treatment areas, acid tanks, dye room, compressor rooms, pump houses, bearing shop, millwright shop, roll shop, maintenance shop, fuel

storage, electroplating area, lead room, leach plant, galvanizing line, battery storage area, rail activities, stelmor lines and bethanizing plant . The number of proposed borings that targeted a specific feature is directly related to the size and likely historical presence of materials that could have impacted the Site. The full list of sampling targets, along with the specific rationale for each point, is provided in **Table 1**.

Once all sampling targets were identified, additional samples locations were added to fill in areas with insufficient coverage (large spatial gaps between proposed borings) within the Site. The density of soil borings was maintained above the requirements set forth in **Worksheet 17 – Sampling Design and Rationale**. Excluding the electric sub-station (<3 acres) in the northeast corner of the site, Parcel A3 contained approximately 59.1 acres without engineered barriers, and 5.2 acres with engineered barriers (roads/parking). In accordance with the relevant sampling density requirements, a minimum of 30 soil bores were required in the area without engineered barriers, and a minimum of 3 soil bores were required in the parking sections (or 5 soil bores including the sub-station). **Figure 2** and **Figure 3** show the proposed borings and the Site boundary overlain on the relevant figures and drawings from the historical documents. **Figure 5** shows the proposed locations for all groundwater sampling.

The proposed locations for soil and groundwater sampling are shown on **Figure 2** and **Figure 5**. **Table 1** contains specific details on each sampling location, the proposed sample intervals and media, sampling methods, various parameters and analyses planned per location, and the purpose/rationale for the sampling at each location. The Phase II Investigation scope of work has been designed to include the following tasks:

- Provide an overall investigation of the former Rod and Wire Mill Area
- Meet site characterization requirements of the Administrative Consent Order
- Investigate specific identified RECs
- Investigate Potential Environmental Concerns associated with former operations
- Provide overall area coverage
- Assess the presence or absence of significant impacts in soil and groundwater
- Include 61 test borings
  - Surface soil and intermediate soil horizon sampling intervals
  - TCL (Target Compound List)-VOCs, TCL-SVOCs, TAL (Target Analyte List) Metals, Cobalt, Cyanide, Oil and Grease (O&G)Hexavalent Chromium and PCBs (surface soil only) for soil
  - Shallow groundwater samples will be collected at 10 boring locations
  - TCL-VOCs, TCL-SVOCs, TAL Metals, Cobalt, Cyanide, O&G and Hexavalent Chromium for groundwater
- Sampling and analysis of ten existing shallow and intermediate groundwater monitoring wells (TCL-VOCs, TCL-SVOCs, TAL Metals, Cobalt, Cyanide, O&G and Hexavalent Chromium)

### 3.1.1 Sampling Plan

This Work Plan presents the methods and protocols to be used to complete the site characterization. These methods and procedures follow the MDE-VCP guidelines. Information regarding the project organization, field activities and sampling methods, sampling equipment, sample handling and management procedures, the laboratory analytical methods and selected laboratory, quality control and

quality assurance procedures, investigation-derived waste (IDW) management methods, reporting requirements are described in detail in the Quality Assurance Project Plan (QAPP) that has been developed to support the investigation and remediation of the Sparrows Point Terminal Site (Sparrows Point Terminal Quality Assurance Project Plan-Revision 2, ARM Group Inc., September 2015).

The proposed schedule of this investigation is contained in this work plan, Section 6. All site characterization activities will be conducted under the site-specific health and safety plan (HASP); which is provided as **Appendix A**.

### 3.1.2 Soil Borings

Soil samples will be collected according to procedures referenced in the **Quality Assurance Project Plan (QAPP) Worksheet 21—Field SOPs** (Standard Operating Procedures) and **Appendix A** of the QAPP.

Regarding soil sampling depth, a shallow sample will be collected from the 0 to 1 foot depth interval, and a deeper sample be collected from the 4 to 5 foot depth interval. One additional set of samples will also be collected from the 9 to 10 foot depth interval; if groundwater has not been encountered however, these samples will be held by the laboratory pending the analysis of the 0 to 1 and 4 to 5 foot depth interval samples. If the PID or other field observations indicate contamination to exist at a depth greater than 5 feet bgs but less than 9 feet bgs, and is above the water table, the sample from the deeper 4-5 foot interval may be shifted to the depth interval indicated by the PID response. It should be noted that no soil samples will be collected from a depth that is below the water table. RW-071-SB through RW-075-SB will only include manually collected shallow soil samples, due to accessibility concerns for utility locating and boring equipment.

After soil sampling has been concluded at a location, all down-hole soil sampling equipment will be decontaminated according to procedures referenced in the QAPP **Worksheet 21—Field SOPs** and **Appendix A** of the QAPP, **SOP No. 16 – Equipment Decontamination**. The decontamination procedures that will be used during the course of this investigation include **Decontamination Area** (Section 3.1 of the SOP), **Decontamination of Sampling Equipment** (Section 3.5), **Decontamination of Groundwater Sampling Pumps** (Section 3.6), **Decontamination of Measurement Devices & Monitoring Equipment** (Section 3.7), **Decontamination of Subsurface Drilling Equipment** (Section 3.8), and **Document and Record Keeping** (Section 5).

All soil samples will be analyzed for TCL-VOCs, TCL-SVOCs, TAL Metals, cobalt, hexavalent chromium, oil & grease, and cyanide. Additionally, the shallow soil samples collected across the Site from the 0-1 foot bgs interval will also be analyzed for PCBs. Soil samples that are collected in association with the oil storage area, truck repair shop, maintenance shop, roll shop, fuel shop and oil room will also be analyzed for TPH-GRO and TPH-DRO. Analytical methods, sample containers, preservatives, and holding times for the sample analyses are listed in the QAPP **Worksheet 19 & 30—Sample Containers, Preservation, and Holding Times**. The anticipated laboratory reporting limits are provided in the QAPP **Worksheet 15 – Project Action Limits and Laboratory Specific Detection/Quantitation Limits**.

### 3.1.3 Groundwater Sampling

Groundwater samples will be collected according to procedures referenced in the QAPP **Worksheet 21—Field SOPs** and **Appendix A** of the QAPP. Soil boring locations where piezometers will be installed include: RW-002-SB, RW-006-SB, RW-011-SB, RW-021-SB, RW-025-SB, RW-027-SB, RW-048-SB and RW-050-SB.

All groundwater samples will be analyzed for TCL-VOCs, TCL-SVOCs, TAL Metals, cobalt, hexavalent chromium, oil & grease, and cyanide. Groundwater samples that are collected in association with the truck repair shop and roll shop will also be analyzed for TPH-GRO and TPH-DRO. Analytical methods, sample containers, preservatives, and holding times for the sample analyses are listed in the QAPP **Worksheet 19 & 30—Sample Containers, Preservation, and Holding Times**. The anticipated laboratory reporting limits are provided in the QAPP **Worksheet 15 – Project Action Limits and Laboratory Specific Detection/Quantitation Limits**.

Each piezometer will be checked for the presence of Liquid Phase Hydrocarbon (LPH) using an oil-water interface probe, in accordance with methods referenced in the QAPP **Worksheet 21—Field SOPs** and **Appendix A** of the QAPP. All piezometers will also be surveyed to obtain groundwater elevation data. The elevation data from these piezometers will be used to create a groundwater contour map indicating groundwater flow direction.

Once each PVC piezometer has been sampled, surveyed and/or checked for LPH, it will be emptied, removed and discarded. The boreholes will then be abandoned in accordance with Maryland abandonment standards as stated in COMAR 26.04.04.11.

### 3.1.4 Existing Groundwater Monitoring Well Sampling

Five existing shallow and intermediate groundwater monitoring well clusters have been identified to be included as part of the groundwater sampling and analysis program for the Phase II Investigation. The wells to be sampled are dispersed geographically across the Rod and Wire Mill Area. The groundwater wells are as follows; locations of the wells are shown on **Figure 5**.

RW02-PZM000	RW07-PZM004	RW20-PZM000
RW02-PZM020	RW07-PZM017	RW20-PZM020
RW10-PZM004	RW19-PZM000	
RW10-PZM020	RW19-PZM020	

Groundwater samples will be obtained from these wells and the samples will be analyzed for TCL-VOCs, TCL-SVOCs, TAL Metals, cobalt, hexavalent chromium, oil & grease, and cyanide as well as various field parameters (pH, dissolved oxygen, oxidation-reduction potential, temperature, specific conductance,

turbidity, etc.). All groundwater samples will be collected according to procedures referenced in the QAPP **Worksheet 21 – Field SOPs and Appendix A** of the QAPP. Analytical methods, sample containers, preservatives, and holding times for the sample analyses are listed in the QAPP **Worksheet 19 & 30— Sample Containers, Preservation, and Holding Times**. The anticipated laboratory reporting limits are provided in the QAPP **Worksheet 15 – Project Action Limits and Laboratory Specific Detection/Quantitation Limits**. Groundwater samples that are collected for dissolved metals will be field filtered and then placed in the appropriate preserved laboratory container.

### 3.1.5 Sample Documentation

Samples will be numbered in accordance with the QAPP **Appendix C—Data Management Plan**. Samples will be labeled and recorded on the Chain-of-Custody form in accordance with methods referenced in the QAPP **Worksheet 26 & 27—Sample Handling, Custody and Disposal**.

### 3.1.6 Analytical Program

Pace Analytical of Greensburg, Pennsylvania has been contracted to perform the laboratory analysis for this project. All sample analyses to be performed are listed in the QAPP **Worksheet 15 – Project Action Limits and Laboratory Specific Detection/Quantitation Limits**. The samples will be submitted for analysis with a standard turnaround time (approximately 10 work days). The required compounds for each analysis (i.e. TCL-VOCs, TCL-SVOCs, etc.), and the Laboratory Reporting Limits are included in the QAPP **Worksheet 15 – Project Action Limits and Laboratory Specific Detection/Quantitation Limits**.

## 3.2 Pre Design Investigation

The Pre-Design Investigation scope of work will include the following tasks. The proposed locations for soil sampling are shown on **Figure 4** and groundwater sampling locations are shown on **Figure 5**.

- Screen and evaluate potential options for the final remedial approach,
- Provide data to screen potential corrective measure technologies, and to identify additional data requirements for the final remedial design. Potential corrective measure technologies include, but are not limited to:
  - installation of permeable reactive barrier (PRB) wall along the west side of the property
  - stabilization / capping of existing ponds/sources of zinc and cadmium on the property
  - continued operation of a pump and treat system as well as potential future expansion of recovery systems.

- Further define RECs
- Define extent of source and dissolved phase constituents associated with RECs
- Collect corrective measures data to evaluate potential remedial technologies
- Generate pre-design data in support of potential source area remedies
- Phase 1 (Initial) Groundwater Model Development
  - Working groundwater flow model that incorporates
    - the surrounding surface water,
    - the shallow, intermediate, and deep aquifer system,
    - the influence of the existing pumping system (RW15 and RW10)
  - hydraulic conductivity testing (slug testing)
  - aquifer testing
    - monitoring wells
    - drawdown and recovery testing
- Bench scale treatability testing of potential remedial alternatives
  - Batch testing of soil to assess effective reagents and dosage to “fix” metals mitigating future leaching (for both in-situ soil mixing and ex-situ soil mixing)
  - Column testing of soil and groundwater to represent a PRB type application (and possibly test an alternate injection application)
  - Batch testing of groundwater to determine optimum media for metals removal via ion exchange for design of possible onsite groundwater treatment system to replace the current IM or an expanded version of the current IM

There are various components of the field program proposed for the Pre-Design Investigation; specifics of the field program are shown in **Table 2**:

- Eighteen test borings (14 via Geoprobe, 4 via hollow stem auger)
  - Borings to recover soil at depth-specific intervals to define source nature and extent, stratigraphy of potential remedial measure locations
  - Sampling to include soil analyses for metals, treatability parameters, geotechnical analyses, and disposal characterization analyses
  - Sampling to include bulk collection of soil and groundwater for the various bench scale testing
- Groundwater sampling and analysis of existing wells, both shallow and intermediate depths
- Monitoring wells for groundwater modeling design purposes
- Pump tests for groundwater modeling design purposes

### 3.2.1 Potential Source Areas Definition

Contributing source areas to the groundwater contamination are anticipated to include the Former Sludge Bin Storage Area and the Former East Pond (see **Figure 4**). These areas are generally characterized as follows:



- The Former Sludge Bin Storage Area is located to the west of the former east pond, and was used to store bins of zinc-processing sludges. Based on the anticipated soil contamination in this area, a soil flushing program was initiated, along with the installation of a groundwater recovery and treatment system. The soil flushing program was halted when the area was razed, and then the current IM was instituted.
- The Former East Pond is located in the northeastern portion of the Former Rod and Wire Mill and historically received excess filtrate from the dewatering of zinc processing sludges. Currently, the area consists mainly of a narrow, heavily vegetated band of *Phragmites* with interspersed poison ivy. A portion of the Former East Pond is sparsely vegetated and consists of fine-grained soil. This area is surrounded by paved and unpaved roads and is partially covered by a BGE substation. An ecological risk characterization of the direct contact and food chain exposures identified the following COPCs in surface soils: barium, chromium, copper, lead, zinc, cadmium, and vanadium (*Final Baseline Ecological Risk Assessment for On-Site Areas (BERA) Report*, URS 2011).

Fourteen borings are planned to be drilled in the Former Sludge Bin Storage Area and the Former East Pond areas to provide additional data to assess the nature and extent of the potential source areas at the locations identified on **Figure 4**. Depending on site conditions, the borings will be advanced utilizing Geoprobe drilling methods. Discrete soil samples will be recovered at approximately 5 foot intervals from the ground surface to 35 feet bgs. Additional samples will also be collected of any obvious source area materials or soils suspected of containing the highest contaminant concentrations for the various treatability tests.

Field portable XRF instruments are being considered for use during field investigations to provide real-time results for TAL metals in soils. Results from XRF tests will be used to guide the investigation and select samples for subsequent laboratory analyses. Laboratory analyses, in accordance with **Table 2**, will be performed on the soil and groundwater samples recovered to provide additional definition of the source areas at the Rod and Wire Mill. The following analytical methods are proposed to be used:

TAL Metals via USEPA Method 6020,  
Free organic carbon analysis, and  
Grain size analysis.

Additional characterization analyses may be performed including:

Synthetic Precipitation Leaching Procedure (SPLP) testing to assess potential leaching to groundwater,  
Toxicity Characteristic Leaching Procedure (TCLP) testing to assess on-site landfilling options, and  
Total organic carbon, pH, and phosphate testing to support fate and transport and chemical stabilization evaluations.

Groundwater will be recovered from source area Borings RW-057-SB, RW-063-SB, RW-067-SB and RW-070-SB and analyzed for the following characterization and treatability parameters:

Total Organic Carbon (TOC),  
Total Dissolved Solids (TDS),  
Biological Oxygen Demand (BOD),  
Chemical Oxygen Demand (COD),  
Sulfide,  
pH,  
ORP,  
TAL metals,  
Ferrous iron,  
Dissolved Oxygen,  
Sulfate,  
Nitrate (as N), and  
Alkalinity (as CaCO<sub>3</sub>).

### 3.2.2 Groundwater Flow Modeling

Groundwater modeling at the former Rod and Wire Mill Area will be completed in two phases:

- Phase 1) Initial Groundwater Modeling, and
- Phase 2) Specific Design Modeling for Selected Remedy.

Phase 1 modeling will be completed now as part of the work effort planned as part of the Pre-Design Investigation; Phase 2 modeling will follow and be integrated as part of remedial design work plans.

The purpose of the Phase 1 modeling will be to develop a model that can be used to screen and evaluate potential options for the final remedial approach, to assist in developing a 60% design of the selected remedy, and to identify additional data requirements for the final remedial design.

The purpose of the Phase 2 model will be to assist in the design, construction, and justification of the final remedy and will be a more in depth detailed modeling approach. The Phase 2 modeling will also be used to develop a performance monitoring plan for the final remedy.

#### **Objectives of Phase 1 Groundwater Model**

The objectives of the Phase 1 model will be:

- to establish a numerical groundwater flow model based on the U.S. Geological Survey's SEAWAT, or equivalent that incorporates
  - the surrounding surface water,
  - the shallow, intermediate, and deep aquifer system,

- the influence of the existing pumping system (RW15 and RW10), and
- prediction / control of cadmium and zinc migration, primarily in the intermediate zone (based on flow, not transport) , and
- to screen and evaluate potential options for the final remedial approach, to assist in developing a 60% design of the selected remedy, and to identify additional data requirements for the final remedial design.

### **Data Requirements for the Phase 1 Groundwater Modeling**

The Phase 1 groundwater modeling will incorporate the existing site hydrogeologic and geologic information. The model will be calibrated using historic groundwater levels in the available monitoring wells in all hydrostratigraphic units. Tidal influences, if applicable, will also be used as a model calibration parameter.

### **Hydraulic Conductivity Testing**

Single well aquifer testing (slug testing) is proposed for existing monitoring wells completed in the shallow, intermediate, and deeper water bearing zones at the site. In addition, an aquifer test using the existing pumping wells RW10 and RW15 is proposed with additional nested piezometers installed in the shallow, intermediate, and deep zones.

### **Aquifer Testing**

Three monitoring wells are proposed to be installed in support of data collection requirements for the groundwater model. Specifics are as follows:

- RW24-PZM => located 50 feet from RW-10 in a northwesterly direction towards RW07 - intermediate zone

The rationale for this monitoring well will be to monitor drawdown from pumping well RW10 during both drawdown and recovery phases of the test. Anticipated drawdown could be on the order to 1 foot or potentially less based on the pumping rate of RW10.

- RW23-PZM => located directly between both pumping wells RW10 and RW15 - intermediate zone

The rationale for this well will be to monitor drawdown from both RW10 and RW15 to determine the composite influence of both pumping wells RW10 and RW15.

- RW22-PZM => located west of RW15 ~40 feet towards RW19 - intermediate zone

The rationale for this well will be to monitoring drawdown in RW15 and to gauge the influence of the surface water boundary condition to the east of RW19. Salinity parameters are also recommended at RW19 to determine if the RW15 well is causing surface water to invade the intermediate unit.

Placement of the three monitoring wells will be based on the above guidance, but field conditions during installation will also be taken into consideration prior to determining ultimate well placement. Proposed well locations are shown on **Figure 5**.

The approach to the aquifer testing will involve the following steps:

- Background groundwater level evaluation
  - place transducers in all monitoring wells listed below to automatically measure background groundwater variations over a one-week (minimum) time period prior to the Drawdown Test. Note that transducers shall remain in the monitoring wells for the duration of the aquifer testing task.
  - collect manual groundwater elevation measurements from all monitoring wells.
  - shut down both RW10 and RW15 for a 24- to 48-hour time period allowing these wells to fully recover from pumping.
  - Collect groundwater elevation measurements after RW10 and RW15 have fully recovered to determine non-pumping conditions / possible tidal influence.
  
- Drawdown Test (approximately 4 days)
  - begin pumping RW15 at a rate consistent with historical operational rates for a period of 48 hrs.
  - begin pumping RW10 (keeping RW15 pumping) at a rate to be defined for a period of 48 hrs.
  - continue to measure groundwater elevations in monitoring wells during the drawdown test using the methods presented in the table below.
  
- Recovery Test (approximately 4 days)
  - shutdown RW15 and measure recovery in pumping well and surrounding wells (see table).
  - after 24-48 hrs recovery for RW15, shut down RW10 and measure recovery for 24-48 hrs.
  - recovery period may be extended, as needed, to acquire groundwater elevation measurements during periods of precipitation or other potential events that could occur beyond a 4-day recovery period.
  
- Resume normal operations for RW15 and RW10 following QA/QC data review of aquifer test results.

Monitoring wells and associated monitoring methods to be utilized during aquifer testing are as follows:

<u>Well</u>	<u>Monitoring Method</u>	<u>Well</u>	<u>Monitoring Method</u>
RW19	Transducer	RW14	Transducer
RW22	Transducer	RW02	Transducer
RW15	Transducer, if possible	RW01	Transducer
RW23	Transducer	RW13	Transducer
RW24	Transducer	RW16	Transducer
RW10	Transducer, if possible	RW17	Transducer
RW07	Transducer		

### 3.2.3 Corrective Measure Alternatives Evaluation

There are various corrective measures and remediation technologies being considered for the final remedial approach. Options, or combination of options being considered are, in no particular order:

- In-situ stabilization of the source areas
- Source area material removal possibly including ex-situ stabilization of the impacted soils prior to disposal
- Installation of a PRB along the west side of the property, either in continuous format or in a funnel and gate type arrangement
- Capping of previous source areas including use of engineered barriers that would be incorporated with the site development plan
- Modification of the existing groundwater pump and treat system to provide a more cost effective alternative for treating recovered groundwater rather than the current system and reliance on the central wastewater treatment facility (HCWWTP)
  - Potential locations of additional recovery wells
  - Treating the groundwater “onsite” to support authorizations required for surface water discharges; treatment options being evaluated include:
    - Groundwater treatment via adsorbent ion exchange technology
    - Groundwater treatment via primary pH adjustment and secondary ion exchange resin

Additional information is provided below regarding bench scale testing in conjunction with the preliminary screening evaluation of treatment concepts. Please recognize that this scope is intended as a screening process to determine whether these concepts can be considered as a viable treatment technologies for the former Rod and Wire Mill Area. Should these technologies be determined to have potential suitability, work plans for additional design and pilot testing will be submitted for review and approval.

#### PRB Alternative

Four borings, designated as RW-01-GB through RW-04-GB, are planned along a potential PRB wall alignment as shown on **Figure 4**. The borings will be completed to a depth of 50 feet using hollow stem auger drilling methods and will be completed to ascertain the stratigraphy and geotechnical characteristics of the subsurface for constructability evaluations. Representative samples will be obtained from the borings for laboratory permeability, porosity and bulk density and grain size testing.

Column testing of soil and groundwater will be conducted to represent a PRB type application (and possibly test an alternate injection application). EAG worked primarily with PeroxyChem to determine requirements for bench-scale testing the efficacy of a PRB type application and the following program is planned:

- I. 1 L of composite soil and 2 L of composite groundwater samples will be provided, at a minimum, from the borings along the western edge of the site (RW-01-GB, RW-02-GB, RW-03-G and RW-04-GB; where a PRB would be installed, if that option is pursued).

- II. PeroxyChem has been selected to facilitate the study, though the actual tests would be done at ReSolution Partners (a laboratory subcontracted to PeroxyChem that specializes in metals testing).
- III. Two reagents, EHC<sup>®</sup> Metals and MetaFix<sup>™</sup>, each at 2 different dosages, will be evaluated for the purpose of the PRB. One untreated control sample will also be evaluated
  - a. Samples will be allowed to react with the reagents for a period of approximately 2 weeks in sealed containers
  - b. After the reaction period, the samples will be subjected to the Synthetic Precipitation Leaching Procedure (SPLP) and potentially leached with the site groundwater. Metals of concern will be evaluated using quick-turn screening analysis (1-2 business days). Metals to be evaluated will include arsenic, cadmium, chromium, copper, lead, nickel, zinc, and mercury.

Additional groundwater data will be provided to PeroxyChem if other chemicals of concern are present in the soil and/or groundwater (such as VOCs or other non-metal chemicals of concern).

#### Groundwater Pump and Treat System Alternative

Potential modifications for the existing groundwater treatment system are under consideration that would remediate contaminated groundwater with pumping and treatment equipment located at the Rod and Wire Mill Area. The treatment equipment would be designed to provide acceptable discharge to surface water through a NPDES discharge permit. Planned groundwater modeling will support the possible modification designs.

Bench scale treatability studies are planned to evaluate ion exchange and ozone/hydrogen peroxide treatment processes being considered for recovered groundwater treatment options. Ion exchange coupled with the adsorbent media is reported to routinely achieve effluent levels in the low part per billion range for most metals (including cadmium and zinc). The media acts as both an ion exchange resin and an adsorbent material. Another ion exchange option also being considered is a combination of pH adjustment followed by the use of a strong base cation exchange resin. Ozone and hydrogen peroxide may also be evaluated as a form of primary and secondary treatment should organics in the groundwater be identified as an issue with ion exchange treatment. Groundwater will be recovered directly from the current pumping wells to support the bench scale studies.

Batch testing of groundwater is planned to determine optimum media for metals removal via ion exchange for design of possible onsite groundwater treatment system to replace the current IM or an expanded version of the current IM. EAG worked primarily with Evoqua Water Technologies to outline this treatability study.

- I. At least 2 gallons of groundwater will be provided from Recovery Well RW-10.
- II. Evoqua Water Technologies will facilitate the study at their laboratory in Roseville, Minnesota.

- III. The lab would run metals content of the groundwater, as well as analyzing for water quality data such as iron, calcium, sodium, pH, total organic carbon (TOC), and total suspended solids (TSS)
- IV. The concept is to evaluate whether a “precipitation to microfilter to sludge press” system, likely with an ion-exchange bed as a polishing treatment, would be effective as a remedial treatment system for the groundwater
  - a. Samples will be run through a bench-scale two-stage reaction chamber to elevate pH to achieve metals precipitation. Sludge would then be collected and processed through a filter press (with the cake being properly disposed of by the laboratory including analysis to determine proper management if employed full scale).
  - b. The effluent from the two-stage process will then go through a microfilter to ensure all solids removal, and then through another vessel to neutralize the pH.
  - c. The final step will be to pass the water through a proprietary selective-media ion exchange vessel.
  - d. The final effluent will be analyzed for metals content to determine the overall reduction of cadmium, zinc, and any other metals of concern.

Once the efficacy of the groundwater treatment options is established via the bench studies, and if the concept of expanding the groundwater treatment system is determined to be a viable option, onsite “inline” pilot testing would likely be conducted via a portable and/or temporary system. The recovered groundwater from the two currently active recovery wells would be routed to and through the pilot test equipment with the pilot test effluent being routed back into the existing pipeline and on to the HCWWTP. Should this type of pilot test (or tests) be deemed appropriate and needed, various flowrates would be evaluated over the span of one to four weeks, depending on the treatability results and various other factors. An addendum work plan to this one would be submitted at a later date if this path is pursued.

#### Soil Stabilization Alternative

Bench scale treatability studies are planned to support the evaluation of soil stabilization options, whether in-situ or ex-situ. Batch testing will be conducted in order to determine the most effective reagent (or reagents), as well as to determine the most effective dosage. Various reagents and additive percentages will be evaluated, including Portland cement, granulated ground blast furnace slag (GGBFS), bentonite clay or attapulgite clay and possible other commercial alternatives. Column testing will also be completed to evaluate injection options vs soil mixing options for in-situ applications. Bulk soil (a minimum of 4 pounds of soil per area to be evaluated) and bulk groundwater samples (a minimum of 2 liters of unpreserved groundwater per area to be evaluated) will be collected from the source areas for use in these studies. These samples are not planned to be preserved. The geotechnical testing planned during field activities will also provide useful data to be incorporated in the soil stabilization evaluations.

## 4 Data Quality Objectives

Data Quality Objectives (DQOs) specify the appropriate quantity and type of data required to make informed environmental and risk management decisions, including tolerable levels of uncertainty. USEPA has developed a systematic process for developing DQOs that includes consideration of several critical elements. The process requires definition of the problem and statement of the decisions that will be made based on the study results. Information needed to support the decision-making process can then be defined, and includes identification of the constituents or parameters of interest, delineation of the physical boundaries of the study area, definition of the quantity of data that will be needed, identification of the means to collect the required data, and the level of uncertainty that will be acceptable. Program design can then be optimized to collect defensible data in the most efficient manner. For the purposes of this Phase II and Pre-Design Investigation Work Plan, the following specific decisions/questions have been identified:

*What is the current nature and extent of soil and groundwater contamination in the Rod and Wire Mill Area and are unacceptable risks to human health and the environment present?*

*Is soil stabilization a viable method for addressing dissolved groundwater impacts in the Rod and Wire Mill Area, particularly in the former Sludge Bin and East Pond potential source areas?*

*Is the use of permeable reactive barrier (PRB) a viable option to remediate dissolved phase groundwater contamination that is migrating from the Rod and Wire Mill Area to the west towards Bear Creek?*

*What groundwater treatment technologies are suitable to provide adequate treatment of groundwater to support ongoing pump and treat systems with acceptable discharges to surface water?*

As a result of the varying nature of the data required, there are several potentially applicable levels of data quality for this work plan. A primary component of data quality is selection of the appropriate analytical level for the intended data use. Analytical levels, as described in “Data Quality Objectives for Remedial Response Activities” (USEPA, March 1987), are as follows:

- Level I - Field screening or analysis using portable instruments. Results are often not compound-specific and not quantitative, but are available in real-time. Level I data are appropriate for initial field screening and for health and safety monitoring. They are frequently used to determine sample collection locations for laboratory analyses.
- Level II - Field analysis using more sophisticated portable analytical instruments; in some cases, the instruments may be set up in a mobile laboratory on location. There is a wide range in the quality of data that can be generated that is dependent on the use of suitable



calibration standards, reference materials and sample preparation equipment. Results are available in real-time or within several hours.

- Level III - All analyses are performed in an offsite analytical laboratory. Level III provides quantitative data. Documented sampling and analysis procedures must be used. Level III analyses may or may not use Contract Laboratory Program (CLP) procedures, but at a minimum, abbreviated CLP-type deliverables are required. Level III may require data validation and QA/QC procedures conducted in accordance with USEPA guidelines. The laboratory may or may not be a CLP laboratory.
  
- Level IV – CLP-equivalent routine analytical services. All analyses are performed in an offsite analytical laboratory following CLP protocols. Level IV is characterized by rigorous QA/QC protocols and documentation with full validation of all data.
  
- Level V - Analysis by nonstandard methods. All analyses are performed in an offsite laboratory that may or may not be a CLP laboratory. Method development or method modification may be required for specific constituents or detection limits. CLP Special Analytical Services (SAS) are Level V.

For the purposes of this Work Plan, the Analytical Levels to be employed consist of Levels I, IV, and V. The Analytical Levels to be employed consist of the following:

- Level I – Field Instrumentation Measurements
- Level IV – Contract Laboratory Program Equivalent Data
- Level V – Analysis by nonstandard methods to support bench scale treatability work

**Level I** - Level I analytical data will consist of information generated using portable field instrumentation, specifically, a Photoionization Detector (PID) and water quality monitoring meters for measurement of pH, dissolved oxygen, specific conductance, temperature, oxidation-reduction potential, and turbidity.

**Level IV** – Level IV analytical data will consist of information generated via analysis of solid and aqueous phase samples by offsite fixed-base laboratories. Contract Laboratory Program level deliverables will be required such that validation of analytical data in accordance with the National Function Guidelines for organic and inorganic data review (USEPA, June 2008 and USEPA, January 2010) can be completed if necessary, at a later date.

**Level V** - Pre-Design investigation data will not be validated in support of this work plan and will be labeled in accordance with USEPA requirements for labeling externally validated data. A NV (Not Validated) code will be applied to all pre-design data provided to the USEPA and MDE in electronic or hardcopy format, in accordance with USEPA requirements (USEPA, January 13, 2009). In the event that

validation is ultimately completed in support of risk assessment and/or fate and transport evaluations, the data will be relabeled accordingly.

#### 4.1 Quality Assurance and Quality Control

All soil and groundwater samples will be collected using dedicated equipment including new soil core liners and polyethylene tubing. Each cooler temperature will be measured and documented by the laboratory upon receipt.

Quality control (QC) samples are collected during field studies for various purposes, among which are to isolate site effects (control samples), to define background conditions (background sample), and to evaluate field/laboratory variability (spikes and blanks, trip blanks, duplicates, etc.).

The following QC samples will be submitted for analysis to support the data validation:

- Trip Blank – at a rate of one per day
  - Water - VOCs only
- Blind Field Duplicate – at a rate of one duplicate per twenty samples
  - Water - VOC, SVOC, Metals
  - Soil - VOC, SVOC, Metals
- Matrix Spike/Matrix Spike Duplicate – at a rate of one per twenty samples
  - Water - VOC, SVOC, Metals
  - Soil - VOC, SVOC, Metals

The QC samples will be collected and analyzed in accordance with the QAPP **Worksheet 12— Measurement Performance Criteria, Worksheet 20—Field Quality Control** and **Worksheet 28— Analytical Quality Control and Corrective Action**.

Since all samples will be collected using dedicated disposable sampling equipment, no equipment blanks will be required.

#### 4.2 Data Validation

The laboratory will provide full deliverable or CLP-equivalent data packages. Each data package from the laboratory will undergo data validation procedures as outlined in **Worksheet 34– Data Verification and Validation Inputs, Worksheet 35- Data Verification Procedures** and **Worksheet 36- Data Validation Procedures** in the QAPP.

### 4.3 Management of Investigation Derived Waste

All investigation derived waste procedures will be carried out in accordance with methods referenced in the QAPP **Worksheet 21 – Field SOPs** and **Appendix A** of the QAPP, **SOP No. 005 Investigation-Derived Wastes Management**.

## 5 Data Evaluation and Reporting

### 5.1 Data Evaluation

Data evaluation processes will be completed to document the sample collection procedures and supporting rationale and present and interpret the analytical results. Data results will be presented in tabular and graphical formats as appropriate to best summarize the data for future use. Field and laboratory data will be tabulated and evaluated to determine if the regulatory and scientific objectives of the sampling and analysis program have been achieved, and whether any data gaps still exist.

Phase II Investigation results will be compared against relevant criteria such as the EPA Regional Screening Levels, considering appropriate land use factors and institutional controls, to identify contaminants and exposure pathways of potential concern. Recommendations for any additional site investigation activities, if warranted, will also be identified and presented. It is anticipated that the investigation of some of the RECs may indicate no evidence of a release, or indicate concentrations that may warrant a No Further Action Determination with a relatively simple risk screening due to the limited potentials for exposure under the planned redevelopment. In such a case, a limited exposure pathway analysis may result in a report with more conclusive recommendations.

Evaluation of Pre-Design Investigation results, and the implications thereof, will be provided in textual, graphical, and tabular form. A recommended approach for the area wide responses will also be provided. Recommendations for collection of additional information will be provided as appropriate based on interpretation of the proof-of-concept information. It is planned that a project meeting with the USEPA and MDE will be conducted to discuss the results of the investigation and recommendations. Data gap analysis tools will be applied to confirm sufficient data has been collected to support decision making regarding the selection of potential final corrective actions for the Rod and Wire Mill Area.

### 5.2 Reporting

During implementation of the field work, it is planned that a monthly letter report will be provided to the USEPA and MDE. The letter report will summarize the work completed during the month, the implications of any observations, and the planned activities for the coming month. To the extent that figures are necessary to convey information, it is planned that informal drawings will be provided (i.e., sketches and hand mark-ups of existing figures or aerial photographs). Key milestones will be identified in addition to the monthly reports, as necessary, to apprise the agencies of findings.

Upon completion of the field work, sample analyses, and data evaluation, a Phase II and Pre-Design Investigation Report will be prepared for review by the USEPA and MDE. A summary of the field

activities and any deviations from the planned scope of work will be provided. The report will also include a narrative explaining all field activities including dates, work completed, tabulation of results, and conclusions and recommendations for the Rod and Wire Mill Area. The Report will include the following:

- Photo Documentation
  - Photos will have brief descriptions and will be dated
- Field Documentation
  - Copies of all laboratory chains of custody
  - Daily Field Report Summaries, including rough field sketches, as applicable
  - Any other pertinent documentation deemed appropriate by the Project Manager (especially if any deviation from this plan occurs)
- Tables
  - All geotechnical/engineering data collected
  - All chemical analytical data collected
  - All GPS coordinates collected
- Figures
  - GIS site maps showing the location of sampling points
  - Profile cross-sections
  - Current potentiometric maps under both pumping and non-pumping conditions
  - Current chemicals of concern iso-concentration/plume diagrams

## 6 Project Schedule

The field investigation, analytical testing, and bench testing activities are planned to be completed within six months of agency approval of this Work Plan. The Phase II and Pre-Design Investigation Summary Report will be submitted to the regulatory authorities 60 days from the completion of the above activities.

The general timeframes for the following components of the activities related to this work plan are as follows:

- Field investigation will take approximately eight (8) weeks to complete, including mobilization activities, once approval of the work plan is received.
- Soil and groundwater sample analysis, data validation, and review is expected to require approximately six (6) weeks to complete, once the field investigation is complete.
- Bench scale treatability testing will be conducted upon recovery of sample materials
  - The duration of the bench scale treatability testing varies, but typically should take approximately 4 to 6 weeks, though some testing may go as long as 3 months (in which case, the EPA and MDE would be notified, accordingly)
- Preparation of the Phase II and Pre-Design Investigation Summary Report, including the internal QA review cycle, will require eight (8) weeks prior to final submittal to the MDE and the EPA.

## **Figures**

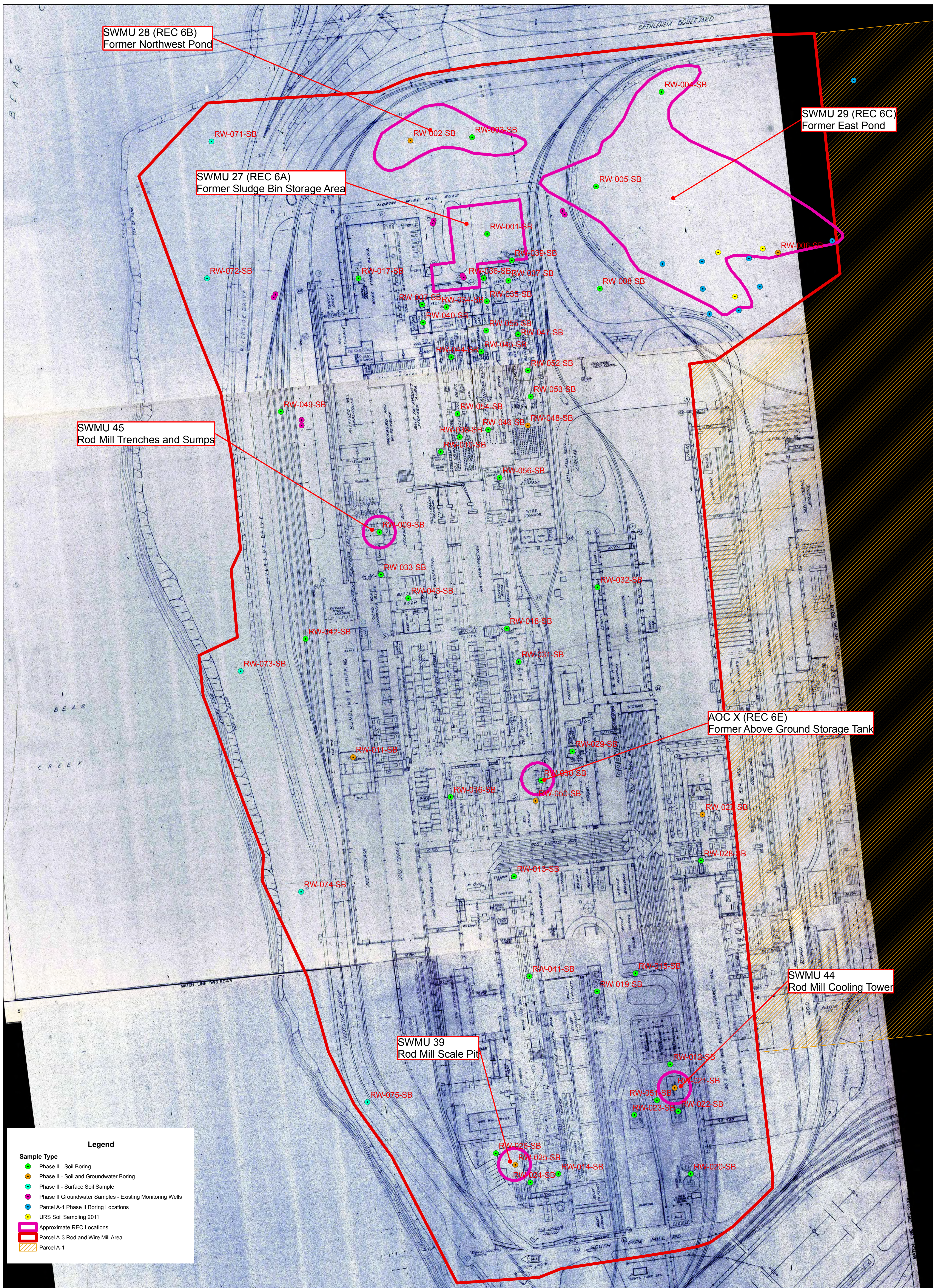


## Phase II and Pre-Design Investigation Work Plan Parcel A-3, Former Rod and Wire Mill Area

Sparrows Point Terminal  
Sparrows Point, Maryland  
Final September 17, 2015

Site Map  
**Figure 1**





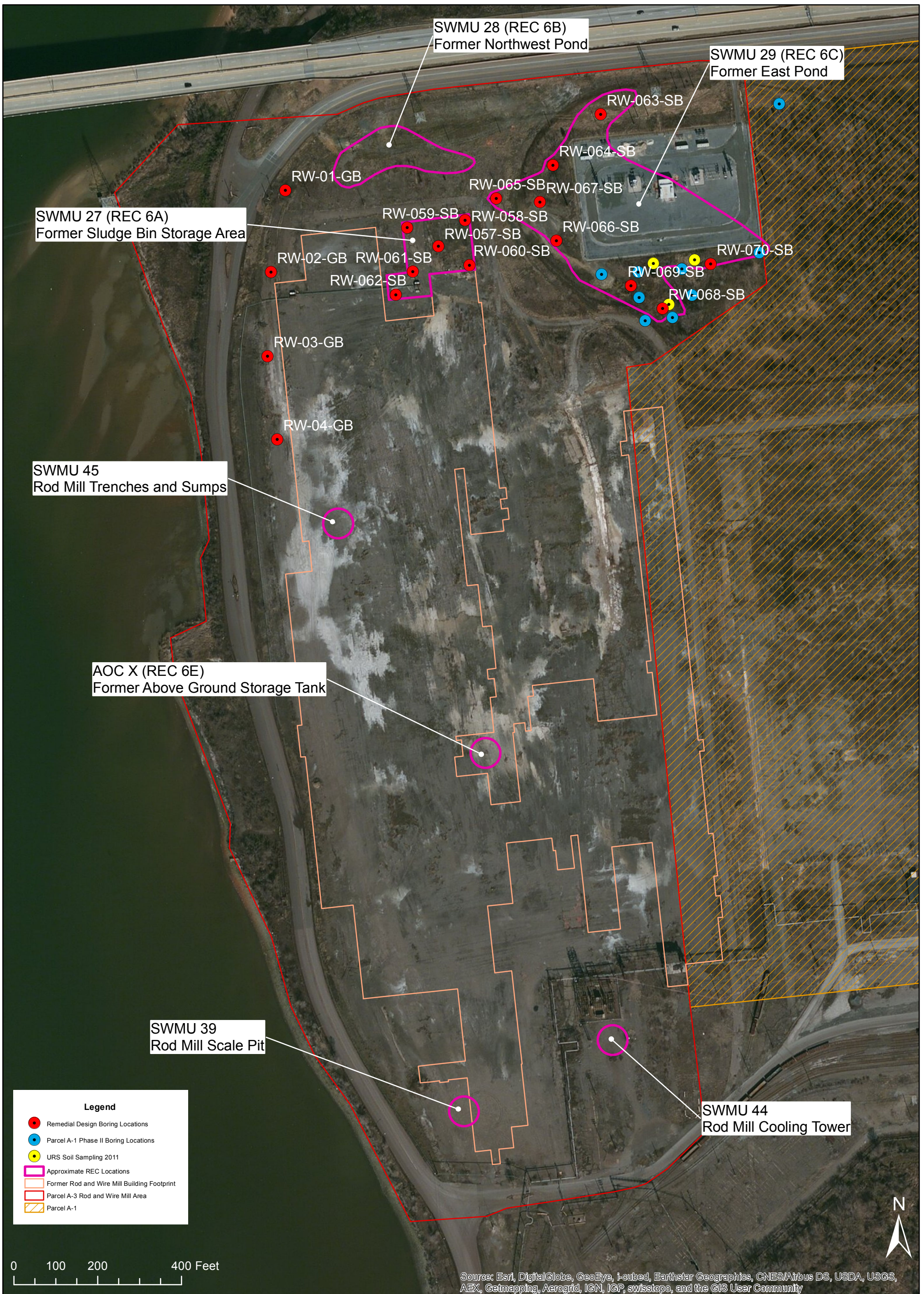
# Phase II and Pre-Design Investigation Work Plan Parcel A-3, Former Rod and Wire Mill Area



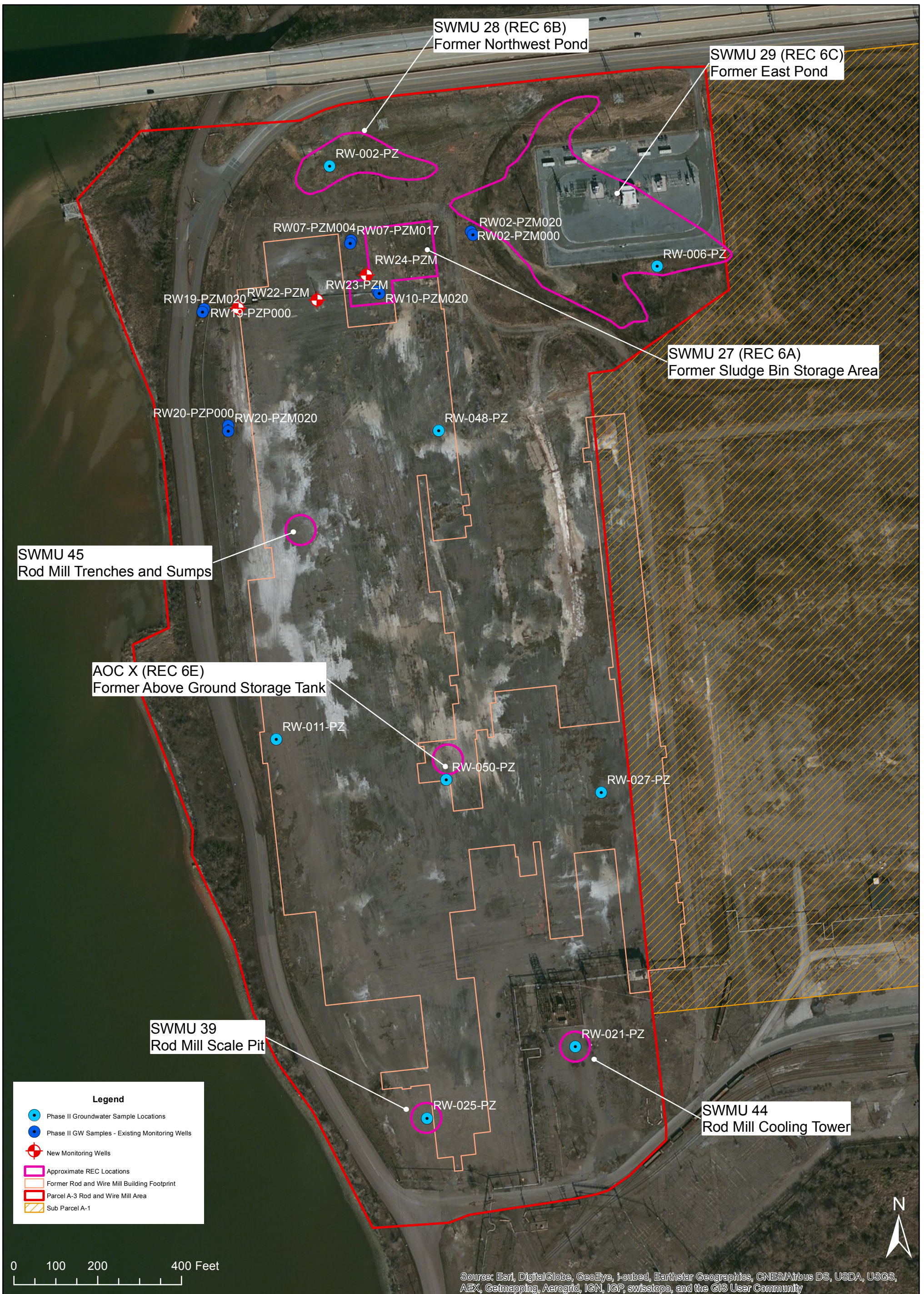
# Phase II and Pre-Design Investigation Work Plan Parcel A-3, Former Rod and Wire Mill Area

Sparrows Point Terminal  
Sparrows Point, Maryland  
Final September 17, 2015

Historical Site Drawings - 5500 Set  
Phase II ESA Boring Locations



## Phase II and Pre-Design Investigation Work Plan Parcel A-3, Former Rod and Wire Mill Area



## Phase II and Pre-Design Investigation Work Plan Parcel A-3, Former Rod and Wire Mill Area

Sparrows Point Terminal  
Sparrows Point, Maryland  
Final September 17, 2015

Groundwater Sampling Locations

**Figure 5**

# Tables

**Table 1**  
**Phase II Borings**

Sample Location	REC or Source Area	Boring Depth*	Sample Depth*	Analytical Parameters		Rationale
				Soil	Groundwater	
RW-001-SB	SMWU 27 (REC 6A)	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to define nature and extent of suspected source area
	Sludge Bin Storage Area		4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-002-SB	SWMU 28 (REC 6B)	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide	Characterize soil and groundwater to define nature and extent of suspected source area
	Northwest Pond		4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-003-SB	SWMU 28 (REC 6B)	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to define nature and extent of suspected source area
	Northwest Pond		4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-004-SB	SWMU 29 (REC 6C)	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to define nature and extent of suspected source area
	East Pond		4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-005-SB	SWMU 29 (REC 6C)	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to define nature and extent of suspected source area
	East Pond		4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-006-SB	SWMU 29 (REC 6C)	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide	Characterize soil and groundwater to define nature and extent of suspected source area
	East Pond		4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-007-SB	Paint Room	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former paint room
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-008-SB	SWMU 29 (REC 6C)	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to define nature and extent of suspected source area
	East Pond		4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-009-SB	SWMU 45	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to define nature and extent of suspected source area
	Rod Mill Trenches and Sumps		4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-010-SB	Oil Storage Area	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium, Cyanide, TPH-GRO and TPH-DRO		Characterize soil to investigate potential environmental concern from former oil storage area
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium, Cyanide, TPH-GRO and TPH-DRO		
RW-011-SB	Truck Repair Shop	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium, Cyanide, TPH-GRO and TPH-DRO	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium, Cyanide, TPH-GRO and TPH-DRO	Characterize soil and groundwater to investigate potential environmental concern from former truck repair shop
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium, Cyanide, TPH-GRO and TPH-DRO		
RW-012-SB	Cooling Tower	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former cooling tower
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		

\*Total depth of 20 feet or groundwater. Soil samples from 0-1', 4-5', 9-10' bgs. Lowest sample interval may be adjusted in the field based on observations or field screening.

**Table 1**  
**Phase II Borings**

Sample Location	REC or Source Area	Boring Depth*	Sample Depth*	Analytical Parameters		Rationale
				Soil	Groundwater	
RW-013-SB	Stelmor Pit	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former stelmor pit
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-014-SB	No. 3 Rod Mill Furnace	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former No. 3 Rod Mill Furnace
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-015-SB	Acid Tank	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former acid tank
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-016-SB	Soap Mixer Area	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former soap storage and soap mixer area
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-017-SB	Water Processing Machine	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former water processing machine
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-018-SB	Dye Room	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern in former dye room
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-019-SB	Compressor Room	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former compressor room
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-020-SB	Water Treatment System	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former water treatment system
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-021-SB	SWMU 44	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide	Characterize soil and groundwater to define nature and extent of suspected source area
	Rod Mill Cooling Tower		4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-022-SB	SWMU 44	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to define nature and extent of suspected source area
	Rod Mill Cooling Tower		4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-023-SB	Pump House	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former pump house
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-024-SB	Millwright Shop	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former millwright shop
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		

\*Total depth of 20 feet or groundwater. Soil samples from 0-1', 4-5', 9-10' bgs. Lowest sample interval may be adjusted in the field based on observations or field screening.

**Table 1**  
**Phase II Borings**

Sample Location	REC or Source Area	Boring Depth*	Sample Depth*	Analytical Parameters		Rationale
				Soil	Groundwater	
RW-025-SB	SWMU 39	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide	Characterize soil and groundwater to define nature and extent of suspected source area
	Rod Mill Scale Pit		4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-026-SB	SWMU 39	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to define nature and extent of suspected source area
	Rod Mill Scale Pit		4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-027-SB	Roll Shop	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium, Cyanide, TPH-GRO and TPH-DRO	VOCs, SVOCs, PPL Metals, O&G, Cobalt, Hexavalent Chromium, Cyanide, TPH-GRO and TPH-DRO	Characterize soil and groundwater to investigate potential environmental concern from former roll shop
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium, Cyanide, TPH-GRO and TPH-DRO		
RW-028-SB	Bearing Shop	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former bearing shop
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-029-SB	Pump House	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former pump house
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-030-SB	AOC X (REC 6E)	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to define nature and extent of suspected source area
	Above Ground Storage Tank		4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-031-SB	Maintenance Shop	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium, Cyanide, TPH-GRO and TPH-DRO		Characterize soil to investigate potential environmental concern from former maintenance shop
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium, Cyanide, TPH-GRO and TPH-DRO		
RW-032-SB	Fuel Shop	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium, Cyanide, TPH-GRO and TPH-DRO		Characterize soil to investigate potential environmental concern from former fuel shop
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium, Cyanide, TPH-GRO and TPH-DRO		
RW-033-SB	Oil Tanks	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium, Cyanide, TPH-GRO and TPH-DRO		Characterize soil to investigate potential environmental concern from former oil tanks
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium, Cyanide, TPH-GRO and TPH-DRO		
RW-034-SB	Electroplating Area	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former electroplating area
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-035-SB	Oil Room	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium, Cyanide, TPH-GRO and TPH-DRO		Characterize soil to investigate potential environmental concern from former oil room
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium, Cyanide, TPH-GRO and TPH-DRO		
RW-036-SB	Lead Room	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former lead room
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		

\*Total depth of 20 feet or groundwater. Soil samples from 0-1', 4-5', 9-10' bgs. Lowest sample interval may be adjusted in the field based on observations or field screening.



**Table 1**  
**Phase II Borings**

Sample Location	REC or Source Area	Boring Depth*	Sample Depth*	Analytical Parameters		Rationale
				Soil	Groundwater	
RW-037-SB	Leach Plant	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former leach plant
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-038-SB	Galvanizing Line	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former galvanizing line
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-039-SB	Acid Storage Area	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former acid storage area
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-040-SB	Lead Storage Room	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former lead storage room
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-041-SB	Stelmor Lines	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former stelmor lines
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-042-SB	Rail Activities	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former rail activities
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-043-SB	Battery Room	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former battery room
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-044-SB	Galvanizing Line	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former galvanizing line
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-045-SB	Bethanizing Plant	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former bethanizing plant
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-046-SB	Bethanizing Plant	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former bethanizing plant
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-047-SB	Bethanizing Plant	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former bethanizing plant
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-048-SB	Bethanizing Plant	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide	Characterize soil and groundwater to investigate potential environmental concern from former bethanizing plant
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		

\*Total depth of 20 feet or groundwater. Soil samples from 0-1', 4-5', 9-10' bgs. Lowest sample interval may be adjusted in the field based on observations or field screening.

**Table 1**  
**Phase II Borings**

Sample Location	REC or Source Area	Boring Depth*	Sample Depth*	Analytical Parameters		Rationale
				Soil	Groundwater	
RW-049-SB	Rail Activities	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to investigate potential environmental concern from former rail activities
			4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-050-SB	SWMU 45	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide	Characterize soil and groundwater to define nature and extent of suspected source area
	Rod Mill Trenches and Sumps		4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-051-SB	SWMU 45	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to define nature and extent of suspected source area
	Rod Mill Trenches and Sumps		4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-052-SB	SWMU 45	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to define nature and extent of suspected source area
	Rod Mill Trenches and Sumps		4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-053-SB	SWMU 45	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to define nature and extent of suspected source area
	Rod Mill Trenches and Sumps		4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-054-SB	SWMU 45	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to define nature and extent of suspected source area
	Rod Mill Trenches and Sumps		4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-055-SB	SWMU 45	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to define nature and extent of suspected source area
	Rod Mill Trenches and Sumps		4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-056-SB	SWMU 45	20 feet	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Characterize soil to define nature and extent of suspected source area
	Rod Mill Trenches and Sumps		4-5', 9-10'	VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide		
RW-071-SB	Parcel A3 Coverage	1 foot	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Investigate potential impacts of historical activities and characterize surface soils in areas not previously sampled
RW-072-SB	Parcel A3 Coverage	1 foot	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Investigate potential impacts of historical activities and characterize surface soils in areas not previously sampled
RW-073-SB	Parcel A3 Coverage	1 foot	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Investigate potential impacts of historical activities and characterize surface soils in areas not previously sampled
RW-074-SB	Parcel A3 Coverage	1 foot	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Investigate potential impacts of historical activities and characterize surface soils in areas not previously sampled
RW-075-SB	Parcel A3 Coverage	1 foot	0-1'	VOCs, SVOCs, TAL Metals, O&G, PCBs, Hexavalent Chromium and Cyanide		Investigate potential impacts of historical activities and characterize surface soils in areas not previously sampled

\*Total depth of 20 feet or groundwater. Soil samples from 0-1', 4-5', 9-10' bgs. Lowest sample interval may be adjusted in the field based on observations or field screening.

**Table 1**  
**Phase II Borings**

Sample Location	REC or Source Area	Boring Depth*	Sample Depth*	Analytical Parameters		Rationale
				Soil	Groundwater	
RW02-PZM000	Existing Monitoring Well		15 feet		VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide	Characterize groundwater in shallow zone
RW02-PZM020	Existing Monitoring Well		25 feet		VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide	Characterize groundwater in intermediate zone
RW07-PZM004	Existing Monitoring Well		15 feet		VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide	Characterize groundwater in shallow zone
RW07-PZM017	Existing Monitoring Well		25 feet		VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide	Characterize groundwater in intermediate zone
RW10-PZM004	Existing Monitoring Well		15 feet		VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide	Characterize groundwater in shallow zone
RW10-PZM020	Existing Monitoring Well		25 feet		VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide	Characterize groundwater in intermediate zone
RW19-PZM000	Existing Monitoring Well		15 feet		VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide	Characterize groundwater in shallow zone
RW19-PZM020	Existing Monitoring Well		25 feet		VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide	Characterize groundwater in intermediate zone
RW20-PZM000	Existing Monitoring Well		15 feet		VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide	Characterize groundwater in shallow zone
RW20-PZM020	Existing Monitoring Well		25 feet		VOCs, SVOCs, TAL Metals, O&G, Hexavalent Chromium and Cyanide	Characterize groundwater in intermediate zone

Soil Borings Sampling Density Requirements (from **Worksheet 17 - Sampling Design and Rationale**)

*No Engineered Barrier (41-70 acres): 1 boring per 2 acres with no less than 27 borings*

*Engineered Barrier (1-15 acres): 1 boring per 2 acres with no less than 2 borings*

No Engineered Barrier (59.1 acres) = **30 Samples**<sup>‡</sup>

Engineered Barrier - Parking/Roadways (5.2 acres) = **3 Samples**<sup>‡</sup>

<sup>‡</sup>Minimum total number of samples is 33, compare to sample numbers in Table 1 and Table 2

\*Total depth of 20 feet or groundwater. Soil samples from 0-1', 4-5', 9-10' bgs. Lowest sample interval may be adjusted in the field based on observations or field screening.

**Table 2**  
**Pre-Design Investigation Borings**

Sample Location	REC or Source Area	Boring Depth	Sample Depth	Analytical Parameters		Rationale
				Soil	Groundwater	
RW-001-GB	Possible PRB Wall Alignment	50 feet	0-1' Every 5' to 50'	FOC, Bulk Density, Total Porosity and Grain Size Analysis		Characterize soil to evaluate viability of possible PRB wall for groundwater treatment
RW-002-GB	Possible PRB Wall Alignment	50 feet	0-1' Every 5' to 50'	FOC, Bulk Density, Total Porosity and Grain Size Analysis		Characterize soil to evaluate viability of possible PRB wall for groundwater treatment
RW-003-GB	Possible PRB Wall Alignment	50 feet	0-1' Every 5' to 50'	FOC, Bulk Density, Total Porosity and Grain Size Analysis		Characterize soil to evaluate viability of possible PRB wall for groundwater treatment
RW-004-GB	Possible PRB Wall Alignment	50 feet	0-1' Every 5' to 50'	FOC, Bulk Density, Total Porosity and Grain Size Analysis		Characterize soil to evaluate viability of possible PRB wall for groundwater treatment
RW-057-SB	SMWU 27 (REC 6A) Sludge Bin Storage Area	35 feet	0-1' Every 5' to 35'	COPI List (RCRA) Metals and Grain Size Analysis	TOC, TDS, BOD, COD, Total Metals, pH, ORP, Sulfide, Ferrous Iron, DO, Sulfate, Nitrate (as N) and Alkalinity (CaCO3)	Characterize soil and groundwater to define nature and extent of suspected source area
RW-058-SB	SMWU 27 (REC 6A) Sludge Bin Storage Area	35 feet	0-1' Every 5' to 35'	COPI List (RCRA) Metals and Grain Size Analysis		Characterize soil to define nature and extent of suspected source area
RW-059-SB	SMWU 27 (REC 6A) Sludge Bin Storage Area	35 feet	0-1' Every 5' to 35'	COPI List (RCRA) Metals and Grain Size Analysis		Characterize soil to define nature and extent of suspected source area
RW-060-SB	SMWU 27 (REC 6A) Sludge Bin Storage Area	35 feet	0-1' Every 5' to 35'	COPI List (RCRA) Metals and Grain Size Analysis		Characterize soil to define nature and extent of suspected source area
RW-061-SB	SMWU 27 (REC 6A) Sludge Bin Storage Area	35 feet	0-1' Every 5' to 35'	COPI List (RCRA) Metals and Grain Size Analysis		Characterize soil to define nature and extent of suspected source area
RW-062-SB	SMWU 27 (REC 6A) Sludge Bin Storage Area	35 feet	0-1' Every 5' to 35'	COPI List (RCRA) Metals and Grain Size Analysis		Characterize soil to define nature and extent of suspected source area
RW-063-SB	SWMU 29 (REC 6C) East Pond	35 feet	0-1' Every 5' to 35'	COPI List (RCRA) Metals, FOC and Grain Size Analysis	TOC, TDS, BOD, COD, Total Metals, pH, ORP, Sulfide, Ferrous Iron, DO, Sulfate, Nitrate (as N) and Alkalinity (CaCO3)	Characterize soil and groundwater to define nature and extent of suspected source area
RW-064-SB	SWMU 29 (REC 6C) East Pond	35 feet	0-1' Every 5' to 35'	COPI List (RCRA) Metals, FOC and Grain Size Analysis		Characterize soil to define nature and extent of suspected source area
RW-065-SB	SWMU 29 (REC 6C) East Pond	35 feet	0-1' Every 5' to 35'	COPI List (RCRA) Metals, FOC and Grain Size Analysis		Characterize soil to define nature and extent of suspected source area
RW-066-SB	SWMU 29 (REC 6C) East Pond	35 feet	0-1' Every 5' to 35'	COPI List (RCRA) Metals, FOC and Grain Size Analysis		Characterize soil to define nature and extent of suspected source area
RW-067-SB	SWMU 29 (REC 6C) East Pond	35 feet	0-1' Every 5' to 35'	COPI List (RCRA) Metals, FOC and Grain Size Analysis	TOC, TDS, BOD, COD, Total Metals, pH, ORP, Sulfide, Ferrous Iron, DO, Sulfate, Nitrate (as N) and Alkalinity (CaCO3)	Characterize soil and groundwater to define nature and extent of suspected source area
RW-068-SB	SWMU 29 (REC 6C) East Pond	35 feet	0-1' Every 5' to 35'	COPI List (RCRA) Metals, FOC and Grain Size Analysis		Characterize soil to define nature and extent of suspected source area
RW-069-SB	SWMU 29 (REC 6C) East Pond	35 feet	0-1' Every 5' to 35'	COPI List (RCRA) Metals, FOC and Grain Size Analysis		Characterize soil to define nature and extent of suspected source area
RW-070-SB	SWMU 29 (REC 6C) East Pond	35 feet	0-1' Every 5' to 35'	COPI List (RCRA) Metals, FOC and Grain Size Analysis	TOC, TDS, BOD, COD, Total Metals, pH, ORP, Sulfide, Ferrous Iron, DO, Sulfate, Nitrate (as N) and Alkalinity (CaCO3)	Characterize soil and groundwater to define nature and extent of suspected source area
RW02-PZM020	Existing Monitoring Well		25 feet		TOC, TDS, BOD, COD, Total Metals, pH, ORP, Sulfide, Ferrous Iron, DO, Sulfate, Nitrate (as N) and Alkalinity (CaCO3)	Characterize groundwater to evaluate possible remedial technologies
RW07-PZM017	Existing Monitoring Well		25 feet		TOC, TDS, BOD, COD, Total Metals, pH, ORP, Sulfide, Ferrous Iron, DO, Sulfate, Nitrate (as N) and Alkalinity (CaCO3)	Characterize groundwater to evaluate possible remedial technologies
RW10-PZM020	Existing Monitoring Well		25 feet		TOC, TDS, BOD, COD, Total Metals, pH, ORP, Sulfide, Ferrous Iron, DO, Sulfate, Nitrate (as N) and Alkalinity (CaCO3)	Characterize groundwater to evaluate possible remedial technologies
RW19-PZM020	Existing Monitoring Well		25 feet		TOC, TDS, BOD, COD, Total Metals, pH, ORP, Sulfide, Ferrous Iron, DO, Sulfate, Nitrate (as N) and Alkalinity (CaCO3)	Characterize groundwater to evaluate possible remedial technologies
RW20-PZM020	Existing Monitoring Well		25 feet		TOC, TDS, BOD, COD, Total Metals, pH, ORP, Sulfide, Ferrous Iron, DO, Sulfate, Nitrate (as N) and Alkalinity (CaCO3)	Characterize groundwater to evaluate possible remedial technologies

Soil Borings Sampling Density Requirements (from **Worksheet 17 - Sampling Design and Rationale**)

See Table 1 Footnotes

# Appendix A

# HEALTH AND SAFETY PLAN

## SPARROWS POINT TERMINAL SPARROWS POINT, MARYLAND

Prepared by:



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Environmental Engineers

January 2015

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**ATTACHMENTS**

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Attachment A – EAG Acknowledgment Form

Attachment B – MSDSs

## **1.0 INTRODUCTION**

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### **1.1 Background**

The Sparrows Point Terminal site has historically been a steel making facility. It is located in Baltimore County, Maryland in the southeast corner of the Baltimore metropolitan area (approximately 9 miles from the downtown area), on the Sparrows Point Peninsula in the Chesapeake Bay watershed. The facility occupies the entire peninsula and is bounded to the west by Bear Creek; to the south by Patapsco River; and to the east by Jones Creek, Old Road Bay and residential areas of the City of Edgemere. The facility is bounded to the north by the Sparrows Point Country Club. The site is approximately 3,100 acres in size.

Pennsylvania Steel built the furnace at Sparrows Point in 1887 and the first iron was cast in 1889. Bethlehem Steel Corporation (BSC) purchased the facility in 1916 and enlarged it by building additional and plating facilities. BSC filed for bankruptcy in 2001. A series of entities has owned the site between then and now: the International Steel Group (ISG), Mittal Steel, ISG Sparrows Point, LLC, Severstal Sparrows Holding LLC, which was renamed to Severstal Sparrows Point, LLC, RG Steel Sparrows Point, LLC, and then a joint venture to Sparrows Point LLC (SP) and HRE Sparrows Point LLC. Most recently, in 2014, the property and assets were sold to Sparrows Point Terminal LLC (SPT). Environmental liability was retained by SP and work is currently being conducted by EnviroAnalytics Group, LLC (EAG) on behalf of SP.

- In addition to the current environmental investigation and remediation being conducted onsite by EAG and their consultants, there are other entities conducting work on the facility. Demolition of the remaining structures is currently ongoing at the site, and those contractors are being managed by SPT.
- The purpose of this document is to provide an overall health and safety plan (HASP) for EAG personnel and EAG directed contractors who are engaging in environmental investigation and remediation activities onsite. EAG directed contractors will also be expected to have their own Health and Safety Program, and they may opt to draft their own site specific HASP, provided it meets the requirements in this HASP.

### **1.2 Historic Operations**

Steel manufacturing involves handling vast amounts of raw material including coke, iron ore, limestone and scrap steel, as well as recovering byproducts and managing waste materials. The operations listed below either were or are currently performed at the Sparrows Point Facility.

- Iron and steel production
- Coal chemical recovery system
- Other byproducts recovery systems
- Wastewater treatment systems
- Solid waste management
- Air pollution control

A number of site-specific environmental and hydrogeologic investigations have been prepared for the Sparrows Point facility. For the purposes of this HASP, information was obtained from the “Special Study Area Release Site Characterization” completed in 2001 by CH2MHill, as well as additional documents submitted since that time. There are five separate Special Study Areas as put forth in the Consent Decree:

- Humphrey Impoundment,
- Tin Mill Canal/Finishing Mills Areas,
- Coke Oven Area,
- Coke Point Landfill, and
- Greys Landfill.

Contaminated soils and groundwater may be present at the site. This plan was prepared based on an assessment of hazards expected to be present and a review of data from the previous site investigations and groundwater sampling events.

During the current investigations and remedial efforts, all related work will be performed in accordance with the requirements of this HASP and Occupational Safety and Health Administration (OSHA) regulations as defined in 29 Code of Federal Regulations (CFR) 1910.120 and 1926.65.

## **2.0 PURPOSE, SCOPE AND ORGANIZATION**

This section describes the purpose, scope and organization of this HASP and the health and safety responsibilities of EAG, their employees, and their subcontractors involved in the field investigation and remediation activities at the Sparrows Point facility.

### **2.1 Scope**

Field investigation and remediation activities for this project may include, but are not limited to:

- Groundwater sampling and monitoring,
- Groundwater and remediation well installation,
- Groundwater and remediation well repairs,
- Groundwater and remediation well closure and abandonment,
- Surface water sampling,
- Sediment sampling,
- Soil boring and subsurface soil sampling,
- Soil excavations for remedial purposes,
- Installation and operation of remediation systems for soil, soil vapor, and groundwater,
- Decommissioning and closure of remediation systems,
- Soil excavations for remedial purposes,
- Insitu soil mixing/soil stabilization,
- Exsitu soil mixing/soil stabilization,
- Dredging operations along Tin Mill Canal,
- Insitu chemical and/or biological injections, and
- Recovery of non-aqueous phase liquids (NAPL)

When EAG personnel are providing oversight of subcontractors, they will attend the safety and health briefings held by the contractor. EAG personnel will follow the requirements of this HASP, as well as any potentially more stringent requirements of the contractor’s health and safety plan.

When EAG personnel are conducting tasks on their own, with or without subcontractors, they will follow the requirements of this HASP. EAG contractors, such as drillers, will also be required to follow the requirements of this HASP, as well as any more stringent requirements of the contractor’s health and safety plan.

All EAG field personnel, including subcontractors to EAG, will be required to read and understand this HASP and agree to implement its provisions. All site personnel will sign the Acknowledgement Form included in **Attachment A** stating that they have read, understood, and agree to abide by the guidelines and requirements set forth in this plan.

**2.2 Organization of Document**

This HASP includes health and safety procedures for all generally anticipated project field activities. This plan also meets the OSHA requirements contained in the CFR, specifically 29 CFR 1910.120 and 29 CFR 1926, by including the following items:

- A description of staff organization, qualifications and responsibilities (Section 2.3),
- Hazard analysis (Section 3.0),
- Health hazard information (Section 4.0),
- Personal protective equipment (PPE), including available first aid, emergency, and safety equipment (Section 5.0),
- Employee and subcontractor training and standard safety procedures (section 6.0),
- Exposure monitoring plan (Section 7.0),
- Medical surveillance (Section 8.0),
- Site control measures and decontamination procedures for personnel and equipment (Section 9.0),
- Emergency response and contingency procedures (section 10.0), and
- Material Safety Data Sheets (MSDSs) for chemicals used on-site (**Attachment B**).

**2.3 EAG Health and Safety Personnel**

Personnel responsible for implementing this HASP include:

<b>EAG Contacts for Sparrows Point Project Work</b>	
VP Remediation, Russ Becker	(314) 686-5611
Senior Project Manager, James Calenda	(314) 620-3056
Senior Project Engineer, Elizabeth Schlaeger	(314) 307-1732
Josh Burke – Field Operations Manager	(314) 686-5623
Project Field Team Members, Jeff Wilson and Bill Trentzsch	(314) 620-3135, (314) 686-5598

## **3.0 HAZARD ANALYSIS**

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This section outlines the potential hazards related to the field activities listed in Section 2.1.

### **3.1 Hazard Analysis**

The field activities planned for this project pose potential health and safety hazards for field team members. This section describes the hazards associated with the above-listed field activities. Detailed chemical, physical, and biological hazards information is provided in Section 4.0 (Health Hazard Information).

Hazards to which employees and subcontractors may be exposed to as a result of the above-listed activities include potential chemical exposures, lacerations, excessive noise, thermal stress, lifting of excessive weight or bulk, hand tools and heavy equipment, drilling and slips, trips and falls.

#### **3.1.1 Chemical Hazards**

Potential exposures to chemicals in the soil or groundwater include the possibility of dermal exposure (contact and/or absorption), inhalation of chemical contamination that may be encountered during sampling or during equipment decontamination activities, or ingestion of contaminants if good personal hygiene practices are not followed.

Benzene, naphthalene, and various metals are the major contaminants that have been identified in groundwater during previous investigations at the site. In addition, light NAPL (LNAPL – benzene, in particular) and dense NAPL (DNAPL – naphthalene, in particular) have also been identified or are heavily suspected in various locations in the Coke Oven Area. Dissolved metals the chemicals of concern primarily located in the area of Tin Mill Canal and the Rod and Wire Mill Area. Treatment chemicals, such as sulfuric acid, are currently being used in remediation systems. All appropriate MSDS sheets will be reviewed that apply to the investigation or remedial tasks being conducted. MSDS sheets are located in **Attachment B**. It should be noted that this is a dynamic document: should any additional chemicals be introduced or discovered, the MSDS sheets will be added to **Attachment B**, as necessary.

#### **3.1.2 Physical Hazards**

The potential physical hazards associated with field activities include:

- Excessive lifting
- Slips, trips, and falls
- Working at heights
- Exposure to extreme outside temperatures and weather
- Equipment hazards
- Drilling Hazards
- Noise
- Dust and fumes
- Injury from tools, equipment, rotating parts
- Electrical hazards
- Buried and overhead hazards
- Work over water
- Driving to, from, and around the site (including working in trafficked areas)

Additional hazards may be encountered based on the various task at hand. It will be the responsibility of the site manager, with the help of field staff, to identify and address any additional hazards on a “per task or job” basis. A Job Safety Analyses (JSA) may need to be conducted prior to the start of various tasks. Safety meetings will be conducted with all staff in attendance, before the start of any new task or when any significant personnel or other changes (such as a swift change in weather, for example) occur. Updated information relating to physical hazards will be presented during these meetings in an effort to familiarize the crew with potential hazards, discuss new situations, and determine how the associated risks can be reduced. Further, good housekeeping practices will be enforced to preclude other risks resulting from clutter and inattention to detail. In addition, internal field audits will be randomly conducted to ensure adherence to all procedures are being followed.

### **3.1.3 Biological Hazards**

Biological hazards that may be encountered when conducting field activities include the following:

- Poisonous snakes and spiders
- Ticks and tick-borne diseases
- Stinging insects such as chiggers, bees, wasps, etc.
- Various viruses and diseases spread via animal to human contact such as West Nile virus or rabies
- Various viruses and diseases spread via human to human contact such as colds or the flu
- Dermal contact with poison ivy, oak, and/or sumac
- Bloodborne pathogens when administering first aid

First aid kits will be available on-site. It is crucial to note that any site personnel who has significant allergies should communicate that information to the field team they are working with, along with the location of their auto-injector pen (such as an Epi-Pen) for use in case of going into anaphylactic shock from something that would cause such a reaction (like a bee sting, for example). Personnel who suffer from such allergies are responsible for providing their own auto-injector devices as those are typically prescription based as well as specific to their particular allergy.

## **4.0 HEALTH HAZARD INFORMATION**

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This section provides chemical hazard information for those potentially hazardous materials expected to be present at the facility. Potential physical and biological hazards are also discussed in this section.

### **4.1 Chemical Hazards**

Exposure to chemicals through inhalation, ingestion, or skin contact may result in health hazards to field workers. Hazards associated with exposure will be evaluated using OSHA Permissible Exposure Limits (PELs) and the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs). Each of these values are 8-hour, time-weighted averaged (TWAs) above which an employee cannot be exposed. EAG may also use the National Institute of Occupational Safety and Health (NIOSH) Recommended Exposure Limits (RELs) where applicable. Although the OSHA PELs are the only exposure limits enforceable by law, the most stringent of exposure limits will be used as the EAG-enforced exposure criteria during field activities.

The following is a summary of the potential hazards created by the compounds that may be encountered during field activities. Data from sampling of groundwater wells was reviewed to identify potential contaminants at the site. Contaminants of concern may include benzene, toluene, ethylbenzene and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHs), phenols, metals and water treatment chemicals. Table 4-1 contains chemical information and exposure limits for various chemicals that may be expected to be present in the investigation and remediation efforts. During the recovery of NAPL, the major contaminants of concern are benzene and naphthalene. It is possible that carbon monoxide may also be encountered from the use of various internal combustion engines (vehicular or otherwise); however, it is anticipated that since any such engine will be used outdoors, it is not expected that concentrations of concern will accumulate. With the use of any such engine, the engine should be positioned such that site personnel are upwind of the engine exhaust.

If any chemicals are brought on-site, MSDS must be made available and added to **Attachment B**. Personnel must be trained in the hazards and use of chemicals.

**Table 4-1  
Chemical Contaminants of Potential Concern**

<b>Chemical Name Synonyms (trade name)</b>	<b>Exposure Limits</b>	<b>Characteristics</b>	<b>Route of Exposure</b>	<b>Symptoms of Exposure</b>
Benzene	PEL: 1PPM REL: 0.1 CA TLV: 0.5PPM STEL: 1PPM (NIOSH) Skin: YES	Colorless to light-yellow liquid with aromatic odor. LEL: 1.2% UEL: 7.8% VP: 75mm Fl.P: 12°F	INH ABS ING CON	Irritation of eyes, skin, nose, respiratory system, giddiness, headache, nausea, fatigue, anorexia, dermatitis, bone marrow depression
Ethylbenzene	PEL: 100PPM REL: 100PPM TLV: 100PPM STEL: 125PPM IDLH: 800PPM Skin: NO	Colorless liquid with an aromatic odor. LEL: 0.85 UEL: 6.7% IP: 8.76EV VP: 7mm Fl.P: 55°F	INH ING CON	Irritation of eyes, skin, mucous membranes; headache; dermatitis
1,1 dichloroethane	PEL: 100PPM REL: 100PPM TLV: 100PPM STEL: NA IDLH: 3000PPM Skin: NO	Colorless, oily liquid with a chloroform-like odor. LEL: 6.2% UEL: 16% IP: 11.05EV Vp: 64mm Fl.P: 56°F	INH ING CON	Irritation of eyes, CNS depression, liver, kidney, lung damage
Phenol	PEL: 5PPM REL: 5PPM, 15.6PPM (C) TLV: 5PPM STEL: NA IDLH 250PPM Skin: YES	Colorless to light pink crystalline solid with a sweet, acrid odor. LEL: 1.8% UEL: 5.9% IP: 8.12EV Vp: 0.08mm Fl.P: 175°F	INH ING CON ABS	Irritated eyes, nose, throat, anorexia, weakness, muscular ache, pain, dark urine, cyanosis, liver, kidney damage, skin burns, dermatitis, tremor, convulsions, twitch
Naphthalene	PEL: 10PPM REL: 10PPM TLV: 10PPM STEL: 15PPM IDLH: 250PPM Skin: YES	Colorless to brown solid with an odor of mothballs LEL: 0.9% UEL: 5.9% IP: 8.12EV Vp: 0.08mm Fl.P: 174°F	INH ABS ING CON	Irritation of eyes, headache, confusion, excitement, malaise, nausea, vomiting, abdominal pain, irritated bladder, profuse sweating, jaundice, hematuria, renal shutdown, dermatitis, optical neuritis, corneal damage
Toluene	PEL: 200PPM, 300PPM (C) REL: 100PPM TLV: 20PPM STEL: 150PPM IDLH: 500PPM Skin: YES	Colorless liquid with a sweet, pungent benzene-like odor. LEL: 1.1% UEL: 7.1% IP: 8.82EV VP: 21MM Fl.P: 40°F	INH ABS ING CON	Irritation of eyes, nose, fatigue, weakness, confusion, euphoria, dizziness, headache, dilated pupils, lacrimation, nervousness, muscle fatigue, insomnia, dermatitis, liver, kidney damage
Xylenes	PEL: 100PPM REL: 100PPM TLV: 100PPM STEL: 150PPM IDLH: 900PPM Skin: NO	Colorless liquid with an aromatic odor. LEL: 0.9% UEL: 6.7% IP: 8.40EV VP: 5MM Fl.P: 88°F	INH ABS ING CON	Irritated eyes, nose, respiratory system, headache, fatigue, dizziness, confusion, malaise, drowsiness, incoherence, staggering gait, corneal vacuolization, anorexia, nausea, vomiting, abdominal pain, dermatitis



Chemical Name Synonyms (trade name)	Exposure Limits	Characteristics	Route of Exposure	Symptoms of Exposure
Styrene	PEL: 100PPM, 200PPM (C) REL: 50PPM TLV: 20PPM STEL: 40PPM IDLH: 700PPM Skin: NO	Colorless to yellow, oily liquid with a sweet, floral odor. LEL: 0.9% UEL: 6.8% IP: 8.40eV VP: 5MM F.I.P: 88°F	INH ABS ING CON	Irritated eyes, nose, respiratory system, headache, fatigue, dizziness, confusion, malaise, drowsiness, weakness, narcosis, dermatitis
Chlorodiphenyl (54% chlorine) (11097-69-1)	PEL: 0.5mg/m <sup>3</sup> REL: 0.001mg/m <sup>3</sup> TLV: 0.5mg/m <sup>3</sup> STEL: N/A IDLH: 5mg/m <sup>3</sup> (CA) Skin: YES	Colorless to pale yellow viscous liquid with a mild hydrocarbon odor. LEL: NA UEL: NA IP: UNKNOWN VP: 0.00006MM F.I.P: NA	INH ABS ING CON	Irritated eyes, chloracne, liver damage, reproductive effects (carcinogen)
Polynuclear aromatic hydrocarbons (PAHs) (coal tar pitch volatiles) (65996-93-2)	PEL: 0.2mg/m <sup>3</sup> REL: 0.1mg/m <sup>3</sup> TLV: 0.2 mg/m <sup>3</sup> STEL: N/A IDLH: 80mg/m <sup>3</sup> (CA) Skin: NO	The pitch of coal tar is black or dark brown amorphous residue that remains after the redistillation process. LEL: N/A UEL: N/A IP: VARIES VP: VARIES F.I.P: VARIES	INH CON	Direct contact or exposure to vapors may be irritating to the eyes. Direct contact can be highly irritating to the skin and produce dermatitis. Exposure to vapors may cause nausea and vomiting. A potential human carcinogen.
Arsenic (inorganic)	PEL: 0.01mg/m <sup>3</sup> REL: NONE TLV: 0.5 mg/m <sup>3</sup> STEL: N/A IDLH: 5mg/m <sup>3</sup> (CA) Skin: NO	Silver-gray or tin-white brittle odorless solid. Air odor threshold: N/D.	INH ABS CON ING	Symptoms include ulceration of nasal septum, gastrointestinal disturbances, respiratory irritation and peripheral neuropathy. Potential occupational carcinogen.
Barium	PEL: 0.5mg/m <sup>3</sup> REL: 0.5mg/m <sup>3</sup> TLV: 0.5mg/m <sup>3</sup> STEL: N/A IDLH: 50mg/m <sup>3</sup> Skin: NO	White, odorless solid. Air odor threshold: N/D.	INH ING CON	Irritated eyes, skin, upper respiratory system, skin burns, gastroenteritis, muscle spasm, slow pulse, cardiac arrhythmia
Cadmium (elemental)	PEL: 0.005mg/m <sup>3</sup> REL: CA TLV: 0.01mg/m <sup>3</sup> STEL: N/A IDLH: 9mg/m <sup>3</sup> (CA) Skin: NO	Silver-white, blue-tinged lustrous, odorless solid. Air odor threshold: N/D.	INH ING	Symptoms include pulmonary edema, cough, tight chest, head pain, chills, muscle aches, vomiting and diarrhea. Potential occupational carcinogen.
Chromium (Metal)	PEL: 1.0mg/m <sup>3</sup> REL: 0.5mg/m <sup>3</sup> TLV: 0.5mg/m <sup>3</sup> STEL: N/A IDLH: 250mg/m <sup>3</sup> Skin: NO	Blue-white to steel-gray lustrous, brittle, hard odorless solid. Air odor threshold: N/D.	INH ING CON	Symptoms may include irritated eyes and skin, lung fibrosis.
Chromium (Chromium III inorganic compounds)	PEL: 0.5mg/m <sup>3</sup> REL: 0.5mg/m <sup>3</sup> TLV: 0.5mg/m <sup>3</sup> STEL: N/A IDLH: 25mg/m <sup>3</sup> Skin: NO	Varies depending on specific compound.	INH ING CON	Irritation of eyes, sensitivity dermatitis

Chemical Name Synonyms (trade name)	Exposure Limits	Characteristics	Route of Exposure	Symptoms of Exposure
Copper	PEL: 1mg/m <sup>3</sup> REL: 1mg/m <sup>3</sup> TLV: 1mg/m <sup>3</sup> STEL: N/A IDLH: 100mg/m <sup>3</sup> Skin: NO	Reddish, lustrous, malleable, odorless solid	INH ING CON	Irritation of eyes, nose, pharynx, nasal septum perforations, metallic taste, dermatitis
Lead (Elemental & Inorganic as Pb)	PEL: 0.05mg/m <sup>3</sup> RELO.1mg/m <sup>3</sup> TLV: 0.05mg/m <sup>3</sup> STEL: N/A IDLH: 100mg/m <sup>3</sup> Skin: NO	A heavy, ductile soft gray solid. Air odor threshold: N/D.	INH ING CON	Accumulative poison may cause weakness, insomnia, facial pallor, anorexia, malnutrition, constipation, abdominal pain, anemia, gingival lead line, paralysis of wrists and ankles, hypertension and kidney disease.
Nickel	PEL: 1mg/m <sup>3</sup> REL: 0.015mg/m <sup>3</sup> (Ca) TLV: 0.1mg/m <sup>3</sup> STEL: N/A IDLH: 10mg/m <sup>3</sup> Skin: NO	Lustrous, silvery, odorless solid. Air odor threshold: N/A VP: 0mm	INH CON ING	Sensitivity dermatitis, allergic asthma, pneumonitis
Vanadium pentoxide dust	PEL: 0.5mg/m <sup>3</sup> (C) REL: 0.05mg/m <sup>3</sup> (C) TLV: 0.05mg/m <sup>3</sup> STEL: N/A IDLH: 35mg/m <sup>3</sup> Skin: NO	Yellow-orange powder or dark gray, odorless flakes dispersed in air. VP: 0mm	INH ING CON	Irritated eyes, skin, throat, green tongue, metallic taste, eczema, cough, fine rales, wheezing, bronchitis
Zinc oxide	PEL: 5mg/m <sup>3</sup> REL: 5mg/m <sup>3</sup> TLV: 2mg/m <sup>3</sup> STEL: 10mg/m <sup>3</sup> IDLH: 500mg/m <sup>3</sup> Skin: NO	White, lustrous solid	INH	Metal fume fever, chills, muscular ache, nausea, fever, dry throat, cough, weakness, metallic taste, headache, blurred vision, low back pain, vomiting, fatigue, malaise
Sulfuric Acid (water treatment chemical)	PEL: 1mg/m <sup>3</sup> TLV: 0.2mg/m <sup>3</sup> Skin: YES	Oily, colorless to slightly yellow, clear to turbid liquid	IHN ABS ING CON	Can cause irritation or corrosive burns to the upper respiratory system, lung irritation, pulmonary edema, burns to mouth throat and stomach, erode teeth, skin lesions
Antiscale (water treatment chemical)	PEL: 1mg/m <sup>3</sup> TLV: 0.2mg/m <sup>3</sup> Skin: YES	Liquid, colorless, clear	IHN ABS ING CON	May cause severe skin burns and eye damage, can cause cancer, fatal if inhaled, may damage organs through prolonged exposure
Antifoam (water treatment chemical)	N/E	Liquid emulsion, white, opaque	IHN ABS ING CON	May be harmful to skin, if inhaled and if swallowed
<b>Gases</b>				
Carbon Monoxide	PEL: 50PPM REL: 35PPM TLV: 25PPM STEL: 200PPM (C) IDLH: 1200PPM Skin: NO	Colorless, odorless gas LEL: 12.5% UEL: 74% IP: 14.01eV VP: >35atm FI.P: N/A	INH	Headache, rapid breathing, nausea, tiredness, dizziness, confusion

**NOTES:**

OSHA PEL	Occupational Safety and Health administration Final Rule Limits, Permissible Exposure Limit for an eight-hour, time-weighted average
ACGIH TLV	American Conference of Governmental Industrial Hygienists, Threshold Limit Value for eight-hour, time-weighted average
STEL	Short-term Exposure Limit for a 15-minute, time-weighted average
NIOSH IDLH	National Institute for Occupational Safety and Health, Immediately Dangerous to Life or Health concentration
PPM	Part of vapor or gas per millions parts of air by volume at 25°Celsius and 760mm Hg mg/m <sup>3</sup> (milligram of substance per cubic meter of air)
CA	NIOSH has identified numerous chemicals that it recommends to be treated as potential or confirmed human carcinogens.
(C)	The (ceiling) concentration that should not be exceed during any part of the working exposure.
Skin	Refers to the potential contribution to the overall exposure by the cutaneous (absorption) route, including mucous membranes and eye, either by airborne or more particularly by direct contact with the substance.
UEL	Upper Explosive Limit – the highest concentration of a material in air that produces an explosion in fire or ignites when it contacts an ignition source.
LEL	Lower Explosive Limit – the lowest concentration of the material in air that can be detonated by spark, shock, fire, etc.
INH	Inhalation
ABS	Skin absorption
ING	Ingestion
CON	Skin and/or eye contact

## 4.2 Physical Hazards

Field employees and subcontractors may be exposed to a number of physical hazards during this project. Physical hazards that may be encountered include the following:

- Heat and cold stress
- Lifting hazards
- Slips, trips and falls
- Working around heavy equipment
- Drilling hazards
- Noise
- Use of hand and power tools
- Buried hazards
- Electrical hazards
- Underground and overhead utilities
- Working over water
- Travel to and from site

### 4.2.1 Heat Stress

Local weather conditions may produce an environment that will require restricted work schedules in order to protect employees from heat stress. The Project Manager or the Field Lead Team Member will observe workers for any potential symptoms of heat stress. Adaptation of work schedules and training on recognition of heat stress conditions should help prevent heat-related illnesses from occurring. Heat stress controls will be stated at 70°F for personnel in protective clothing and at 90°F for personnel in regular work clothing. Heat stress prevention controls include:

- Allow workers to become acclimatized to heat (three to six days)
- Provide rest breaks in a shaded or air-conditioned break area
- Provide sun screen to prevent sun burn
- Provide drinking water and electrolyte-replenishing fluids
- Keep ice readily available to rapidly cool field team members

The following Heat Stress Index should be used as a guide to evaluate heat stress situations. If the Heat Stress exceeds 105 degrees Fahrenheit, contact the project manager prior to conducting work for detailed guidance.

<b>Heat Stress Index</b>									
Temp. °F	Relative Humidity								
	10%	20%	30%	40%	50%	60%	70%	80%	90%
105	98	104	110	120	132				
102	97	101	108	117	125				
100	95	99	105	110	120	132			
98	93	97	101	106	110	125			
96	91	95	98	104	108	120	128		
94	89	93	95	100	105	111	122		
92	87	90	92	96	100	106	114	122	
90	85	88	90	92	96	100	106	114	122
88	82	86	87	89	93	95	100	106	115
86	80	84	85	87	90	92	96	100	109
84	78	81	83	85	86	89	91	95	99
82	77	79	80	81	84	86	89	91	95
80	75	77	78	79	81	83	85	86	89
78	72	75	77	78	79	80	81	83	85
76	70	72	75	76	77	77	77	78	79
74	68	70	73	74	75	75	75	76	77

**NOTES: Add 10° F when protective clothing is being used; Add 10° F when in direct sunlight**

HSI Temp	Category	Injury Threat
Above 130° F	Extreme Danger	No work unless emergency exists. Contact Cardno ATC RSC and Corporate Risk Management Department prior to proceeding. Heat cramps or exhaustion likely, heat stroke possible if exposure is prolonged and there is physical activity.
105° to 130° F	Danger	Contact RSC prior to proceeding. Requires strict adherence to ACGIH Heat Stress Guidelines, including use of on-site WBGT equipment. Heat cramps or exhaustion likely, heat stroke possible if exposure is prolonged and there is physical activity.
90° to 105° F	Extreme Caution	Heat cramps or exhaustion likely, heat stroke possible if exposure is prolonged and there is physical activity.
80° to 90° F	Caution	Heat cramps or exhaustion likely, heat stroke possible if exposure is prolonged and there is physical activity.
Below 80° F	Normal Range	Typical conditions for time of year. Little or no danger under normal circumstances. As always, anticipate problems and work safely.

#### **4.2.2 Cold Stress**

Frostbite and hypothermia are two types of cold injury that personnel must be protected against during the performance of field duties. The objective is to prevent the deep body temperature from falling below 96.8° F and to prevent cold injury to body extremities. Two factors influence the development of a cold injury the ambient temperature, and wind velocity. Reduced body temperature will very likely result in reduced mental alertness, reduction in rational decision making, and/or loss of consciousness with the threat of death.

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Use appropriate cold weather clothing when temperatures are at or below 40° F as exposed skin surfaces must be protected. These protective items can include facemask, hand wear, and foot wear. Workers handling evaporative solvents during cold stress conditions will take special precautions to avoid soaking gloves and clothing because of the added danger of prolonged skin contact and evaporative cooling. Personnel will wear protective clothing appropriate for the level of cold and planned physical activity. The objective is to protect all parts of the body, with emphasis on the hands and feet. Eye protection against glare and ultraviolet light should be worn in snowy and icy conditions.

The work rate should not be so great as to cause heavy sweating that could result in wet clothing. If heavy work must be done, opportunities for rest breaks will be provided where workers have the opportunity to change into dry clothing. Conversely, plan work activities to minimize time spent sitting or standing still. Rest breaks should be taken in a warm, dry area. Windbreaks can also be used to shield the work area from the cooling effects of wind.

If extreme cold-related weather conditions occur, EAG field personnel and subcontractors will take the following precautions:

- Wear adequate insulated clothing when the air temperature drops below 40°F
- Reduce work periods in extreme conditions to allow adequate rest periods in a warm area
- Change clothes when work clothes become wet
- Avoid caffeine (which has diuretic and circulatory effects)

#### **4.2.3 Lifting Hazards**

Field personnel may be exposed to injury caused by lifting heavy objects and various pieces large or unwieldy pieces of equipment. All field team members will be trained in the proper methods for lifting heavy and/or large equipment and are cautioned against lifting objects that are too heavy or too big for one person. Proper lifting techniques include the following:

- Keep feet approximately shoulder width apart
- Bend at the knees
- Tighten abdominal muscles
- Lift with the legs
- Keep the load close to the body
- Keep the back upright
- Use the buddy system for larger or heavy pieces of equipment

All drums will be staged using an approved drum dolly or other appropriate equipment. Proper care will be taken in the use of this equipment. Healthy employees with no medical restrictions may lift and carry a maximum of 50 pounds using proper lifting and carrying techniques. This recommended weight limit may be reduced depending on physical and workplace factors.

#### **4.2.4 Slips, Trips and Falls**

The most common hazards that will be encountered during field activities will be slips, trips and falls. Field team members are trained to use common sense to avoid these hazards such as using work boots/safety shoes with nonskid soles. When working on slippery surfaces, tasks will be planned to decrease the risk of slipping via avoiding the slippery areas, if possible, or utilizing engineering controls. Engineering controls may involve the placement of supplemental material such as boards, gravel, or ice melt should be utilized to mitigate slippery conditions. Other engineering controls may involve the use of footgear traction control devices. Employees and subcontractors will avoid slippery surfaces, use engineering controls as appropriate, not hurry, and maintain good housekeeping.

#### **4.2.5 Buried Hazards**

Whenever the ground is penetrated, the potential for contacting buried hazards exists. During the planning/mobilization phase, prior to drilling or other excavation activities, EAG personnel and/or their contractors will establish the location of underground utility lines (gas, electrical, telephone, fiber optic cable, etc.) and/or substructures or other potential buried hazardous items. This may be conducted by review of historic utility and substructure maps, private utility locates, ground penetrating radar, or other technologies. If there is any evidence of utilities or subsurface objects/structures, drilling or excavation activities may be offset. If activities cannot be offset, measures will be taken to remove, disconnect, and/or protect the utilities and/or subsurface structures and/or objects. Every reasonable effort will be made to clear the area of intrusive work prior to fieldwork being started.

#### **4.2.6 Electrical Hazards**

It may be possible that overhead power lines will be in proximate locations during drilling or excavation activities. At least a 20 foot clearance must be maintained from overhead power lines. No equipment such as drill rigs or dump trucks can be moved while masts or buckets are in the upright position. Field personnel and subcontractors performing electrical work are required to be appropriately trained to work on the electrical systems in question prior to start of work. Authorization from project management personnel is required prior to any electrical work or work near overhead power lines. . When using extension cords, all field workers will ensure that they are in good working condition, are correctly rated for use, and do not contain abrasions such that bare wires could be exposed to the environment. Extension cords will not be used in wet areas without plugging the extension cord into a ground fault circuit interrupter (GFCI). GFCIs will detect a short circuit and cut power.

#### **4.2.7 Heavy Equipment Operations**

Heavy equipment must be operated in a safe manner and be properly maintained such that operators and ground personnel are protected.

### Requirements for Operators

- Only qualified, trained, and authorized operators are allowed to operate equipment
- Seat belts will be used at all times in all equipment and trucks
- Operators will stop work whenever ground personnel or other equipment enter their work area; work will resume only when the area has been cleared
- No personnel may ride on equipment other than the Authorized Operator
- No personnel may be carried or lifted in the buckets or working “arms” of the equipment
- Spotters will be used when ground personnel are in the vicinity of heavy equipment work areas and/or when an operator is backing equipment near other structures or congested area

### Requirements for Ground Personnel

- All ground personnel must wear orange protective vests in work areas with any operating heavy equipment
- Ground personnel will stay outside of the swing zone or work area of any operating equipment
- Ground personnel may only enter the swing or work area of any operating equipment when:
  - They have attracted the operators attention and made eye contact
  - The operator has idled the equipment down and grounded all extensions
  - The operator gives the ground personnel permission to approach
- Ground personnel shall never walk or position themselves between any fixed object and running equipment or between two running pieces of equipment

### Equipment

- Maintain operations manuals at the site for each piece of equipment that is present and in use
- Ensure operators are familiar with the manual for the equipment and operate the equipment within the parameters of the manual
- Ensure all equipment is provided with roll-over protection systems
- Verify that seatbelts are present and functional in all equipment
- Prohibit the use of equipment that has cab glass which is broken or missing
- Ensure that backup alarms are functional on all trucks and equipment
- Require all extensions such as buckets, blades, forks, etc. to be grounded when not in use
- Require brakes to be set and wheels chocked (when applicable) when not in use

Daily inspections of equipment are required using a Daily Heavy Equipment Safety Checklist. Equipment deemed to be unsafe as a result of daily inspection will not be used until required repairs or maintenance occurs. During maintenance/repair, ensure that motors are turned off, all extensions are grounded or securely blocked, controls are in a neutral position, and the brakes are set.

#### **4.2.8 Drilling and Excavation Safety**

Prior to any intrusive work, as previously mentioned, the location of underground utilities, such as sewer, telephone, gas, water and electric lines must be determined and plainly staked. Necessary arrangements must be made with the utility company or owner for the protection, removal or relocation of the underground utilities. In such circumstances, excavation will be done in a manner that

does not endanger the field personnel engaged in the work or the underground utility. Utilities left in place will be protected by barricading, shoring, suspension or other measures, as necessary.

The use of unsafe or defective equipment is not permitted. Equipment must be inspected regularly. If found to be defective, equipment must be immediately removed from use and either repaired or replaced prior to resuming work with that equipment. Field personnel will be familiar with the location of first-aid kits and fire extinguishers. Telephone numbers for emergency assistance must be prominently posted and kept current.

Good housekeeping conditions will be observed in and around the work areas. Suitable storage places will be provided for all materials and supplies. Pipe, drill rods, etc. must be securely stacked on solid, level sills. Work surfaces, platforms, stairways, walkways, scaffolding, and access ways will be kept free of obstructions. All debris will be collected and stored in piles or containers for removal and disposal.

The area of the site to undergo intrusive activity must be walked over with the drillers and/or heavy equipment operators to identify all work locations, as well as making sure all marked utilities are seen by those doing the intrusive work.

**Drilling Specific Concerns:**

In areas where utilities have been identified or may be suspected, pre-drilling clearance such as hand-augering, hand excavation (with shovels or post-hole diggers), or air-knifing to a depth of at least 5' below ground surface (BGS) may be required. The Project Manager will provide guidance in those instances on what has been determined as an acceptable means of clearing drilling locations. It should be noted that if the soil lithology changes to gravel within those 5 feet, that may be an indication of a utility trench and extreme caution should be taken OR the drilling location should be offset 5 horizontal feet from the original location. Should 3 consecutive attempts be made without success to offset a particular drilling location, the field personnel should stop and contact the Project Manager for further instruction.

Special precaution must be taken when using a drill rig on a site within the vicinity of electrical power lines and other overhead utilities. Electricity can shock, burn and cause death. When overhead electrical power lines exist at or near a drilling site, all wires will be considered dangerous.

A check will be made for sagging power lines before a site is entered. Power lines will not be lifted to gain entrance. The appropriate utility company will be contacted and a request will be made that it lift or raise cut off power to the lines.

The area around the drill rig will be inspected before the drill rig mast (derrick) is raised at a site in the vicinity of power lines. The minimum distance from any point on the drill rig to the nearest power line will be determined when the mast is raised or is being raised. The mast will not be raised and the drill rig will not be operated if this distance is less than 20 feet, because hoist lines and overhead power lines can be moved toward each other by the wind.



Before the mast is raised, personnel will be cleared from the immediate area, with the exception of the operator and a helper, when necessary. A check will be made to ensure safe clearance from energized power lines or equipment (minimum 20-foot clearance). Unsecured equipment must be removed from the mast and cables, mud lines and catline ropes must be adequately secured to the mast before raising. After it is raised, the mast must be secured to the rig in an upright position with steel pins.

**Excavation Specific Concerns:**

For excavation work, entry into an excavated area or trench will only be allowed when:

- Shoring, sloping, and spoil pile placement is in conformance with 29 CFR 1926 Subpart P, and
- Personal protection and monitoring, as detailed in this HASP, has been implemented.

All excavation contractors are required to provide an OSHA trained and certified Competent Person. Daily inspections of excavations, the adjacent areas, and protective systems shall be made by the Competent Person for evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the Competent Person prior to the start of work and as needed throughout each shift. Inspections shall also be made after every rainstorm or other hazard increasing occurrence. All inspections made by the Competent Person should be recorded in the field log book. No personnel shall perform work in a trench or excavation that contains accumulated water (any accumulated water will need to be either pumped out until the trench/excavation is dry, or the accumulated water is allowed to disperse naturally). Each employee in an excavation shall be protected from cave-ins by an adequate protective system except when excavations are made entirely in stable rock or the excavation is less than 5 feet in depth and examination by the Competent Person provides no indication of a potential cave-in. Protective systems consist of sloping or benching, use of trench boxes or other shielding mechanisms, or the use of a shoring system in accordance with the regulations.

When mobile equipment is operated adjacent to an excavation and the operators/drivers do not have a clear and direct view of the edge of the excavation, a warning system such as barricades, hand or mechanical signals, or spotters are required.

Adequate protection shall be provided to protect employees from loose rock or soil that could pose a hazard to personnel in the excavation. All temporary spoil piles shall be kept at least 2 feet away from the edge of the excavation. Spoil piles should be placed to channel rainwater or other run-off water away from the excavation.

All excavations deeper than 4 feet deep and which have the potential to have a hazardous atmosphere or oxygen deficient atmospheres (less than 19.5% oxygen) must be tested to ensure safe working conditions, prior to entry.

**4.2.9 Use of Hand Tools and Portable Power Tools**

Hand tools will be kept in good repair and used only for their designed purposes. Proper protective eyewear will be worn when using hand tools and portable power tools. Unguarded sharp-edged or

pointed tools will not be carried in field personnel's pockets. The use of tools with mushroomed heads, split or defective handles, worn parts, or other defects will not be permitted. Inspect all tools prior to start-up or use to identify any defects. Tools that have become unsafe will be reconditioned before reissue or they will be discarded and replaced. Throwing or dropping of tools from one level to another will not be permitted; rather, containers and hand lines will be used for transporting tools from one level to another if working at heights.

Non-sparking tools will be used in atmospheres where sources of ignition may cause fire or explosion. Electric-powered shop and hand tools will be of the double-insulated, shockproof type, or they will be effectively grounded. Power tools will be operated only by designated personnel who are familiar and trained with their use. When not in use, tools will not be left on scaffolds, ladders or overhead working surfaces.

#### **4.2.10 Noise**

Exposure to high levels of noise may occur when working near drill rigs or other heavy equipment. Also, depending upon where the work is being performed, local equipment (e.g., airports, factory machines, etc.) may produce high levels of noise. A good indication of the need for hearing protection is when verbal communication is difficult at a distance of 2-3 feet. Personnel will be provided with ear plugs and/or earmuffs when exposed to noise levels in excess of the 8-hour Permissible Exposure Limit (PEL) of 90 decibels.

#### **4.2.11 Work Zone Traffic Control**

Personnel will exercise caution when working near areas of vehicular traffic. Work zones will be identified by the use of delineators (traffic cones, flags, vehicles, DOT approved devices, temporary or permanent fencing, and/or safety barrier tape). Personnel will wear reflective vests when working in these areas. Depending on frequency, proximity, and nature of traffic, a flag person may also be utilized.

#### **4.2.12 Work Over Water**

If personnel will be working near, above or immediately adjacent to or within 6 feet of water that is 3 feet or more deep or where water presents a drowning hazard (e.g., fast-moving stream, water body with a soft bottom), employees are required to a U.S. Coast Guard (USCG) approved personal flotation device (PFD). All PFDs must have reflective tape on them to facilitate visibility. Employees must inspect PFDs daily before use for defects. Do not use defective PFDs.

#### **4.2.13 Vehicle Use**

Personnel must use caution when driving to, from, and across the site, paying special attention to other site traffic, as well as weather and road conditions. Heavy equipment should be transported during non-rush hour traffic.

### **4.3 Biological Hazards**

Site activities on this Site may expose workers to other hazards such as poisonous plants, insects, animals, and indigenous pathogens. Protective clothing and respiratory protection equipment, and being capable of identifying poisonous plants, animals, and insects, can greatly reduce the chances of exposure. Thoroughly washing any exposed body parts, clothing, and equipment will also protect against infections. Avoiding contact with biological hazards is the best way to prevent potential adverse health effects. Recognition of potential hazards is essential. When avoidance is impractical or impossible, PPE, personal hygiene, good general health and awareness must be used to prevent adverse effects. If working in wooded/grassy areas, use appropriate insect repellants (containing DEET and/or Permethrin) and apply them per the manufacturers' directions. The following is a list of biological hazards that may be encountered while performing field activities at the project site and surrounding areas:

BIOLOGICAL HAZARD and LOCATION	CONTROL MEASURES
<p><b>Snakes</b> typically are found in underbrush and tall grassy areas.</p>	<p>If you encounter a snake, stay calm and look around; there may be other snakes. Turn around and walk away on the same path you used to approach the area. If a person is bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Seek medical attention immediately. <b>DO NOT</b> apply ice, cut the wound or apply a tourniquet. Carry the victim or have him/her walk slowly if the victim must be moved. Try to identify the snake: note color, size, patterns and markings.</p>
<p><b>Poison ivy, poison oak and poison sumac</b> typically are found in brush or wooded areas. They are more commonly found in moist areas or along the edges of wooded areas.</p>	<p>Become familiar with the identity of these plants. Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and water immediately. If the reaction is severe or worsens, seek medical attention.</p>
<p>Exposure to <b>bloodborne pathogens</b> may occur when rendering first aid or CPR, or when coming into contact with medical or other potentially infectious material or when coming into contact with landfill waste or waste streams containing such infectious material.</p>	<p>Training is required before a task involving potential exposure is performed. Exposure controls and personal protective equipment (PPE) area required. Hepatitis B vaccination must be offered before the person participates in a task where exposure is a possibility.</p>
<p><b>Bees, spiders and other stinging insects</b> may be encountered almost anywhere and may present a serious hazard particularly to people who are allergic.</p>	<p>Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past and inform the Project Manager and/or the buddy. If a stinger is present, remove it carefully with tweezers. Watch for allergic reaction; seek medical attention if a reaction develops.</p>
<p><b>Ticks</b> typically are in wooded areas, bushes, tall grass and brush. Ticks are black, black and red or brown and can be up to one-quarter inch in size.</p>	<p>Avoid tick areas. Wear tightly woven, light-colored clothing with pants tucked into boots or socks. Spray outside of clothing with insect repellent containing permethrin. Check yourself for ticks often. If bitten, carefully remove tick with tweezers. Report the bit to the Project Manager. Look for symptoms of Lyme</p>

	disease that include a rash that looks like a bulls eye and chills, fever, headache, fatigue, stiff neck or bone pain. If symptoms appear, seek medical attention.
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## **5.0 PERSONAL PROTECTIVE EQUIPMENT**

PPE ensembles are used to protect employees and subcontractors from potential contamination hazards while conducting project field activities. Level D is expected to be used for most activities at the site. The following subsections describe the PPE requirements for the field activities.

### **5.1 Level D Protection**

When the atmosphere contains no known hazards and work functions preclude splashes, immersions or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals, Level D protection may be used. Level D does not provide respiratory protection and only provides minimal dermal protection. The Level D ensemble consists of the following:

- Work clothes that may consist of a short or long-sleeved cotton shirt and cotton pants, cotton overalls, or disposal overalls such as Tyvek™
- Steel-toe/steel-shank work boots
- Safety glasses with side shields
- Hearing protection, as necessary
- Hand protection, as appropriate
- Hard hat when working around overhead equipment such as a drilling rig
- Reflective vests when working around heavy equipment or near roadways
- Body harness and life vests when working on or within 6 feet of bulkheads, at heights, or in 3 feet or more of standing water (such as in Tin Mill Canal)

### **5.2 Modified Level D Protection**

This is the level of protection that may be needed for material handling, sampling operations, and operation of remediation equipment when splash hazards are present. Modified Level D protection consists of the following:

- Disposable overalls such as polyethylene-coated Tyvek™
- Latex, vinyl, or nitrile inner gloves when handling liquids/fluids
- Nitrile outer gloves (taped to outer suit)
- Chemical-protective over-boots (taped to outer suit)
- Steel-toe/steel-shank, high-ankle work boots
- Hard hat with face shield
- Safety glasses with side shields or goggles
- Hearing protection, as necessary

### **5.3 Level C Protection**

Level C protection will be used when site action levels are exceeded and respiratory protection is required. The Level C ensemble consists of Modified Level D with the following modifications:

- Half or full-face air-purifying respirator (APR) equipped with appropriate cartridges/filters
- Chemical resistant clothing such as poly-coated Tyvek™
- Inner and outer nitrile gloves
- Chemical-resistant safety boots or boot covers to go over safety boots

Upgrading or downgrading the level of protection used by EAG employees and subcontractors is a decision made by EAG based on the air monitoring protocols presented in Section 7.0 for respiratory protection, the potential for inhalation exposure to toxic chemicals, and the need for dermal protection during the activity.

#### **5.4 First Aid, Emergency and Safety Equipment**

The following first aid, emergency and safety equipment will be maintained onsite at the work area:

- A portable eye wash
- Appropriate ABC-type fire extinguishers (minimum of 10 pounds; remediation systems to house individual 20 pound extinguishers) carried in every vehicle used during field operations
- Industrial first-aid kit (one 16-unit that complies with American National Standards Institute (ANSI) Z308A for every 25 persons or less)
- Bloodborne pathogen precaution kit with CPR mouth shield
- Instant cold packs
- Soap or waterless hand cleaner and towels
- American Red Cross First Aid and CPR Instruction Manuals

## **6.0 PERSONNEL TRAINING AND STANDARD SAFETY PROCEDURES**

Employees must have received, at the time of project assignment, a minimum of 40 hours of initial OSHA health and safety training for hazardous waste site operations. Personnel who have not met the requirements for the initial training will not be allowed in the Exclusion Zone (EZ) or Contamination Reduction Zone (CRZ) of any active work area. A copy of each subcontractor site worker's 40-hour training certificate must be sent to the Project Manager for review prior to the start of the site work.

The 8-hour refresher training course must be taken at a minimum of once per year. At the time of the job assignment, all site workers must have received 8 hours of refresher training within the past year. This course is required of all field personnel to maintain their qualifications for hazardous waste site work. A copy of each subcontractor site worker's most recent 8-hour refresher training certificate must be sent to the Project Manager for review prior to the start of the site work.

A site-specific safety orientation will be conducted by EAG for all EAG employees and subcontractors engaged in fieldwork.

#### **6.1 Onsite Safety, Health and Emergency Response Training**

The OSHA 1910.120 standard requires that site safety and health training be provided by a trained, experienced supervisor. “Trained” is defined to mean an individual that has satisfactorily completed the OSHA 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) course and 8-hour site supervisor training. Training will be offered at the time of the initial task assignment and/or whenever new chemicals are introduced into the workplace. Training will include all applicable regulatory requirements, location of the program, inventory and MSDSs, chemicals used and their hazards (chemical, physical, and health), how to detect the presence or release of chemicals, safe work practices and methods employees can take to protect themselves from hazards, how to read MSDSs and site or project specific information on hazard warnings and labels in use at that location. All training will be documented and training certificates will be kept in the employee’s permanent training file. All applicable training will also require annual refreshers.

EAG qualified personnel must also provide safety meetings.

## **6.2 Standard Safety Procedures**

This section describes the standard safety procedures that EAG requires all onsite personnel to follow during site activities.

### **6.2.1 General Safety Work Practices**

All onsite employees and subcontractors will observe the following general safety work practices:

- Health and safety tailgate briefings will occur to introduce new activities, any new safety issues, and emergency egress routes for work areas; any significant change (added personnel, change in scope, or change in field conditions) will trigger a second (or more) tailgate meeting to address whatever change occurred
- No food, drink, or tobacco products will be allowed in the Exclusion and Contamination Reduction Zones
- Loose clothing, hair, and/or jewelry will not be permitted around moving or rotating equipment
- The “buddy system” will be implemented as necessary whereby a pair of co-workers watches out for each other while in proximity of potential physical work hazards
- Good housekeeping of all work areas will be maintained on an ongoing basis

### **6.2.2 Hand Safety**

This standard is intended to protect employees from activities that may expose them to injury. This standard provides information on recognizing those conditions that require personal protective equipment (PPE) or specific work practices to reduce the risk of hand injury.

Appropriate gloves must be worn when persons work with materials or equipment that presents the potential for hand injury due to sharp edges, corrosives, flammable and irritating materials, extreme temperatures, splinters, etc.

#### Guidelines for Working With and Around Equipment (Hand Tools, Portable Powered Equipment):

- Employees should be trained in the use of all tools.
- Keep hand and power tools in good repair and use them only for the task for which they were designed.

- Inspect tools before use and remove damaged or defective tools from service.
- Operate tools in accordance with manufacturer's instructions.
- Do not remove or bypass a guarding device for any reason.
- Keep surfaces and handles clean and free of excess oil to prevent slipping.
- Wear proper PPE, including gloves, as necessary.
- Do not carry sharp tools in pockets.
- Clean tools and return to the toolbox or storage area upon completion of a job.
- Before applying pressure, ensure that wrenches have a good bite.
- Brace yourself by placing your body in the proper position so you will not fall if the tool slips.
- Make sure hands and fingers have sufficient clearance in the event the tool slips.
- Always pull on a wrench, never push.
- When working with tools overhead, place tools in a holding receptacle when not in use.
- Do not throw tools from place to place or from person to person, or drop tools from heights.
- Inspect all tools prior to start-up or use to identify any defects.
- Powered hand tools should not be capable of being locked in the ON position.
- Require that all power-fastening devices be equipped with a safety interlock capable of activation only when in contact with the work surface.
- Do not allow loose clothing, long hair, loose jewelry, rings, and chains to be worn while working with power tools.
- Do not use cheater pipes.
- Make provisions to prevent machines from restarting through proper lockout/tagout.

Guidelines for using Cutting Tools:

- Always use the specific tool for the task. Tubing cutters, snips, self-retracting knives, concealed blade cutters, and related tools are task specific and minimize the risk of hand injury. For more information about cutting tools, see Supplemental Information A.
- Fixed open-blade knives (FOBK) are prohibited from use. Examples of fixed open-blade knives include pocket knives, multitools, hunting knives, and standard utility knives.
- When utilizing cutting tools, personnel will observe the following precautions to the fullest extent possible:
  - Use the correct tool and correct size tool for the job.
  - Cut in a direction away from yourself and not toward other workers in the area.
  - Maintain the noncutting hand and arm toward the body and out of the direction of the cutting tool if it were to slip out of the material being cut.
  - Ensure that the tool is sharp and clean; dirty and dull tools typically cause poor cuts and more hazard than a sharp, clean cutting tool.
  - Store these tools correctly with covers in place or blades retracted, as provided by the manufacturer.
  - On tasks where cutting may be very frequent or last all day (e.g., liner samples), consider Kevlar® gloves in the PPE evaluation for the project.
  - Do not remove guards on paper cutters.

### **6.2.3 Respiratory Protection**

Based on air monitoring, an upgrade to Level C protection may be indicated. Half or full-face APRs will be utilized for protection against organic vapors and particulates. All employees required to wear respirators will be need to be medically cleared, in writing to do so by a qualified Occupational Physician.

All respirator users must be trained before they are assigned a respirator, annually thereafter, whenever a new hazard or job is introduces and whenever employees fail to demonstrate proper use or knowledge. Training will include, at a minimum:

- Why the respirator is necessary and what conditions can make the respirator ineffective.
- What limitation and capabilities of the respirators area.
- How to inspect, put on and remove and check the seals of the respirator.
- What respirator maintenance and storage procedures are.
- How to recognize medicals signs and symptoms that may limit or prevent effective use of the respirator.
- The engineering and administrative controls being used and the need for respirators.
- The hazards and consequences of improper respirator use.
- How to recognize and handle emergency situations.

Training will be documented and training certificated will be kept in the employee's permanent training file.

### **6.2.4 Personal Hygiene Practices**

The field team must pay strict attention to sanitation and personal hygiene requirements to avoid personal contamination. The following instructions will be discussed and must be followed:

- During field activities, never put anything in the mouth, including fingers
- All employees must wash their hands, forearms, face, and neck before eating drinking, smoking or using the restroom
- Smoking is prohibited except in designated areas outside the work zone
- At the end of the day, all employees will shower upon returning home or to their hotel

### **6.2.5 Electrical Safety**

All extension cords used onsite must be heavy-duty variety and must be properly grounded. All temporary circuitry must incorporate the use of GFCI devices. Refer to electrical safety in Section 4.2.6, Electrical Hazards.

### **6.2.6 Fire Safety**

All flammable liquids will be used only for their intended purpose and stored and handled only in approved containers. Portable containers must be the approved red safety containers equipped with flame arresters and self-closing lids. All transfers of flammable liquids must be made with the containers grounded or bonded. Also, gasoline containers will be clearly labeled and storage areas (if



applicable) will be posted with “No Smoking” signs. Fire extinguishers will be stalled in all areas that contain flammable liquids.

### **6.2.7 Illumination**

All work is planned for daylight hours. No special requirements are anticipated. However, should any work take place outdoors after daylight hours, suitable lighting will be required. In addition, suitable lighting is to be provided in each remediation system building or enclosure.

### **6.2.8 Sanitation**

Potable water and toilet facilities will be provided in compliance with the OSHA 1926.51 standard. Any container used to distribute drinking water shall be clearly marked and not used for any other purpose. Single drinking cups will be supplied, both a sanitary container for the unused cups and a receptacle for disposed of the used cups will also be provided. Port-a-johns will be provided since there are no sanitary sewers on the job site.

## **7.0 EXPOSURE MONITORING PLAN**

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This section describes air and personnel monitoring protocols, sampling methods, and instrumentation to be used, as well as the methods and frequency of sampling instrument calibration and action levels for potential work site hazards. When engaged in air monitoring, EAG personnel and subcontractors must use the forms to record air monitoring data and air monitoring instrument calibration records. All monitoring records/forms are to be maintained in the project file by the EAG Project Manager.

### **7.1 Air Monitoring**

The surveillance program is established to detect changes in the ambient air at the work site and to ensure the continuing safety of the work zones and adequacy of the level of worker protection. During field activities, the designated field team member will monitor the work site for combustible gas concentrations and organic vapors. Calibration of all monitoring equipment will be performed in accordance with the manufacturers’ procedures by trained EAG employees and subcontractors. The Project Manager, Project Field Team Leader or representative will be notified immediately of any contaminant levels that could trigger an upgrade in PPE or cause a suspension of site activities.

- One or more of the following direct-reading instruments may be used to aid in this determination. Photoionization Detectors (PID) and Flame Ionization Detectors (FID) will measure non-specific organic gases and vapors. Combustible Gas Indicators (CGI) will detect explosive atmospheres. Oxygen (O<sub>2</sub>) meters will detect fluctuations in oxygen concentrations. These instruments should be calibrated or bump tested daily and whenever the readings may be erratic. All readings should be recorded in the field log books.

Air monitoring results obtained from the breathing zone during field activities will be recorded in field log books. All such records will also include the location, date/time, weather conditions, person monitored, background concentration, and identification of specific contaminant whenever possible. Air monitoring information will be utilized to evaluate personnel exposure and assess the appropriateness of PPE for Site conditions.

#### **7.1.1 Combustible Gas and Oxygen Deficiency/Excess Monitoring**

Explosive gas concentrations are not expected to exceed 10% of the lower explosive level (LEL). Should the need be indicated for monitoring, action guidance for the CGI/O<sub>2</sub> meter responses is contained in **Table 7-1**.

**Table 7-1**

<b>CGI/Oxygen Meter Action Levels</b>	
<b>Meter Response</b>	<b>Action</b>
CGI response 0%-10% LEL	Continue normal operations
CGI initial response >10% and <20% LEL	Eliminate all sources of ignition from the work area; temporarily retreat from work area for 15-30 minutes and then monitor area again
CGI response after 15-30 minute retreat >10% and <20% LEL	Retreat from work area; notify Project Manager
CGI response >20%	Discontinue operations; retreat from work area
Oxygen level <19.5%	Retreat from work area; notify Project Manager
Oxygen level >23.5%	Retreat from work area; notify Project Manager

### 7.1.2 Organic Vapor Concentrations

Real-time monitoring for organic vapor concentrations in the breathing zone and down hole will be conducted during field operations (installation of groundwater monitoring and groundwater sampling by EAG and EAG subcontractor personnel) with a PID equipped with a 10.2- or 11.7-electron volt (eV) probe. The PID will be taken into the field and operated during site activities where contaminated soil and/or groundwater may be present. Air monitoring will be conducted during well installation and when a well is opened for groundwater measurements. Measurements will be made at the well head and personnel breathing zones where activities are being performed. The instrument will be calibrated using ultra-high purity air and isobutylene vapor of known concentration before and after use each day. Air calibration measurements will be documented in writing and kept in the project file. Action guidance for PID responses is contained in **Table 7-2**.

**Table 7-2**

<b>Action Levels for General Site Work</b>	
<b>Meter Response in Breathing Zone (minimum of 3 minutes)</b>	<b>Action Required</b>
<5ppm above background	Use Level D PPE
>5ppm above background	Level C PPE, including half or full-face APR with organic vapor cartridges/P100 filters
>50ppm above background	Stop work
<b>Action Levels for Handling NAPL</b>	
<b>Meter Response in Breathing Zone (minimum of 3 minutes)</b>	<b>Action Required</b>
<1ppm above background	Use Modified Level D PPE
>1ppm to <10ppm	Level C PPE, including half or full-face APR with organic vapor cartridges
>10ppm above background	Immediately withdraw; monitoring will continue until action levels will allow safe re-entry

If air concentrations of organic vapors are greater than 5 ppm above background in the breathing zone for a 3-minute period, personnel will stop work, retreat from site, and allow time (at least 15 minutes) for vapors to dissipate. If monitoring indicates that concentrations still exceed 5 ppm, workers will upgrade to Level C PPE. If monitoring indicates that concentrations exceed 50 ppm, work will be stopped until site conditions can be re-evaluated.

These action levels are based on the assumption that the major component of free product being recovered will be benzene or naphthalene.

Work involving NAPL recovery from monitoring wells will be conducted in Level C PPE. This level may be downgraded based on air monitoring data and actual field conditions. Downgrading of PPE must be approved by the PM and HSE staff. If ventilation is conducted, additional air monitoring will be performed to the resumption of work to determine the level of PPE required.

## **7.2 Physical Conditions Monitoring**

Site workers will be monitored by the Project Manager for signs of weather-related symptoms from exposure to excessive heat or cold.

Whenever the air temperature exceeds 70°F for personnel wearing chemical protective clothing or 90°F for personnel wearing regular work clothes, the Project Manager will assess conditions that may cause heat stress in site workers.

## **8.0 MEDICAL SURVEILLANCE**

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This section discusses the medical surveillance program, how the results are reviewed by a physician and how participation is documented.

### **8.1 Medical Surveillance Program**

All personnel who will be performing any task where potential exposure to hazardous material exists will undergo medical surveillance as outlined in OSHA 29 CFR 1910.120(f). All personnel performing tasks in the Exclusion Zone or Contamination Reduction Zone will be required to have passed the EAG medical surveillance examination (or equivalent), performed by a licensed Occupational Physician. The Project Manager will verify that all EAG and subcontractor personnel meet applicable OSHA medical surveillance requirements.

Applicable field employees will undergo an annual comprehensive medical examination, including a comprehensive health history, blood chemistry with complete blood count and differential, urinalysis, medical history, required chest x-rays, audiogram, pulmonary function testing, testing for heavy metals (as needed), and a physician's interpretation of each employee's medical surveillance examination, including the ability of the employee to wear a respirator. A comprehensive medical examination will be performed if an employee develops signs or symptoms indicating possible overexposure to hazardous substances and/or heat or cold stress.

### **8.2 Physician Review**

All medical surveillance and examination results are reviewed by a licensed physician who is certified in Occupational Medicine by the American Board of Preventive Medicine. EAG employee participation in the medical surveillance program is a part of their permanent medical record maintained in the employee's home office. A copy of the current medical clearance signed by the occupational health physician for all EAG employees must be maintained at the home office.

## **9.0 SITE CONTROL MEASURES AND DECONTAMINATION**

To provide for the protection of public health and safety and minimize the possibility of transferring hazardous substances from the site, contamination control procedures are required. These procedures consist of site control measures (which entail the delineation of work zones, communications, and site security) and decontamination procedures (which are necessary for both personnel and equipment). Contaminants that may be uncovered during sampling operations must not be transferred outside the work zone unless properly containerized, and must be removed from clothing, personnel, and equipment prior to relocation from that zone. This section discusses site control measures and decontamination procedures to be used during the collection of samples, the installation of soil borings and/or groundwater monitoring/remediation wells, excavations, and other intrusive work where contact with impacted soils and groundwater could occur by EAG and/or EAG subcontractor personnel.

### **9.1 Site Control Measures**

Site control can be achieved by effectively delineating the work zone, providing appropriate communication, and establishing site security.

#### **9.1.1 Work Zone Delineation**

To minimize the transfer of hazardous substances from the site and to ensure proper protection of employees and subcontractors, work zones will be established by the Field Project Team Leader. Applicable site work and the associated requirement for work zones will be determined by the Project Manager. The work area will be divided into an Exclusion Zone (EZ), a Contamination Reduction Zone (CRZ), and a Support Zone (SZ). A typical work zone delineation setup is shown as **Figure 9-1**, below.

##### *Exclusion Zone (EZ)*

Contamination does or could exist in this zone. Only properly authorized and trained individuals (refer to Section 6.0) wearing appropriate PPE will be allowed to enter and work in this zone. All people entering the EZ must wear, at a minimum, Level D protection. An entry and exit point for personnel and equipment will be established at the periphery of the EZ (between the EZ and the CRZ) to regulate the flow of personnel and equipment.

##### *Contamination Reduction Zone (CRZ)*

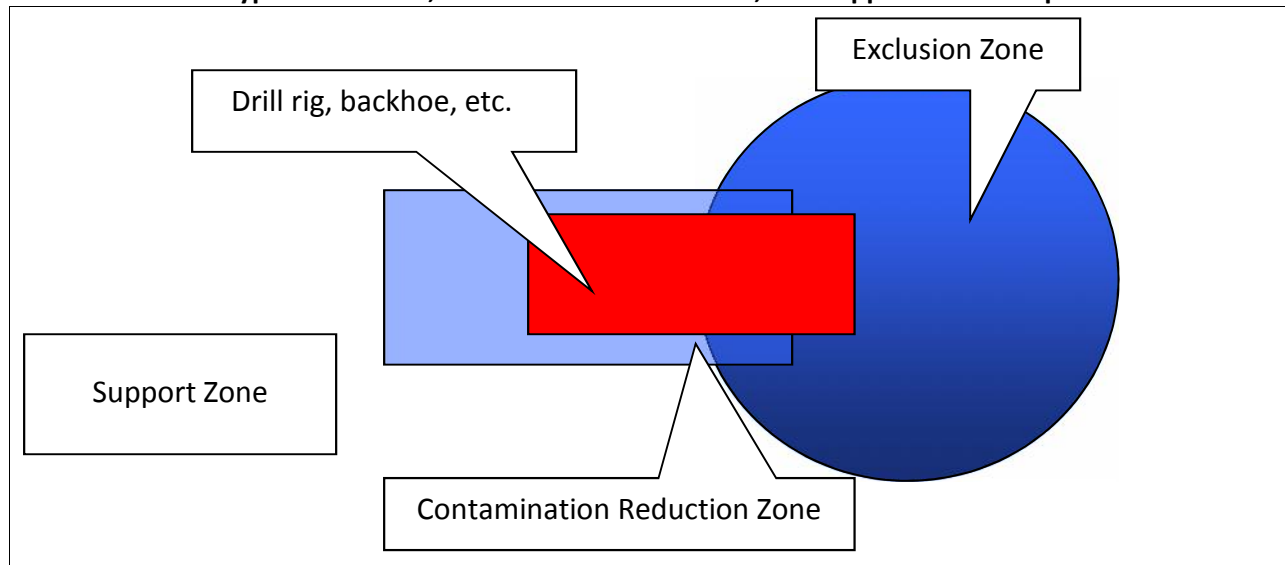
Between the EZ and the SZ will be the CRZ, which will provide a transition between the potentially contaminated EZ and the clean SZ. The CRZ (located upwind of the EZ, if possible) will be a corridor leading from the EZ and will serve as a buffer to further reduce the probability of the SZ becoming contaminated. Exit from the EZ will only be allowed through this CRZ. The CRZ will provide additional assurance that the physical transfer of contaminating substances on people, equipment, and/or in the air will be limited through a combination of decontamination and zone restrictions. Within this zone, employees and subcontractors may perform personal decontamination (e.g., face and hand washing), and certain PPE and small equipment decontamination. Buckets or wash basins for boot

washing and equipment decontamination will be stationed on a sheet of plastic (a minimum of 8 feet by 8 feet), the boundaries of which will constitute the CRZ.

*Support Zone (SZ)*

The Support Zone will be considered a non-contaminated area. The location of support facilities in the SZ will be upwind of the EZ (where possible) and readily accessible to the nearest road. The field office/support facilities, equipment vehicles, a first aid station and a visitors/personnel entry and exit log for the work site will be located in this zone. Potentially contaminated personal clothing, equipment and samples are not permitted in this zone unless properly containerized.

**Figure 9-1  
Typical Exclusion, Contamination Reduction, and Support Zone setups**



**9.1.2 Communications**

A loud and clear form of communication should be made available for Site personnel entering the work zones. Site communication may be in the form of hand signals, voice, or other communication devices. All forms of communication should be understood by all workers on the Site prior to starting work. Offsite communications may be conducted with mobile phones or walkie-talkies only if the atmosphere has been deemed non-explosive, and the person using the mobile device is in the SZ while placing the call, or inside the cab of a stationary vehicle.

**9.1.3 Site Security**

The Sparrows Point facility is not open to the public, and there is a strictly monitored main entrance with a security guard on duty at all times who only allows authorized personnel onto the Site. This limited access to the facility should eliminate the need for many requirements for specific site security except those needed to maintain work zone integrity, such as visible barriers around open excavations or EZs and CRZs. No site visitors will be allowed to travel unescorted by EAG or subcontractor personnel around the facility.

Once site visitors arrive at their intended work zone, they must check in with the Field Team Lead. If visitors are authorized to enter the CRZ and/or the EZ, they must have completed OSHA 1910.120 medical surveillance and training requirements (refer to Section 8.0 and Section 6.0). Visitors must wear

appropriate PPE before they will be allowed to enter the CRZ and/or the EZ. They must also be taken through this HASP during a brief tail-gate meeting and sign the Acknowledgement page in the back prior to engaging in any activities inside the CRZ or the EZ. All site visitors must follow the same site control measures and decontamination procedures as EAG personnel and subcontractors. The Project Manager must also be informed of each visitor's name, purpose for their visit, time of entry (and exit), location of tasks they wish to perform, whether they completed their intended task(s), and any other relevant information pertaining to their visit.

## **9.2 Decontamination Procedures**

Decontamination of employees, subcontractors, and equipment leaving the EZ will be performed to minimize human exposure to hazardous substances and to minimize the spread of contamination to surrounding areas. The purpose of the CRZ is to provide a location to perform limited personnel decontamination and certain PPE and small equipment decontamination.

### **9.2.1 Personnel Decontamination**

Persons leaving the EZ must pass through the CRZ and follow decontamination procedures before entering the SZ. Hand tools and other sampling equipment used in the EZ and reusable PPE (boots, safety glasses, etc.) will be appropriately cleaned prior to removal from the site each day. The step-by-step sequence for personnel decontamination is as follows:

- Remove boot covers (if used) at the boot washing station and place them in the disposal container provided
- Wash outer gloves and chemical resistant boots (if used) at the boot washing station
- Remove wrist tape (if used) and outer gloves and place them in the disposal container provided
- Remove ankle tape (if used) and disposable coveralls (if used) and place them in the disposal container provided
- Remove respirators (if used) and place each in designated locations in the CRZ
- Remove inner gloves and discard in the disposal container provided
- Wash hands and face and proceed to the SZ

Respirators must be fully decontaminated after each use by the personnel who previously wore them. All project employees and subcontractors are required to take a thorough soap and water shower in their home or motel room at the end of each workday. If monitoring or a general exposure assessment indicates that an employee has become contaminated, the employee or subcontractor will notify the EAG Project Manager and the Field Team Lead as soon as the contaminated state has been discovered.

### **9.2.2 Equipment Decontamination**

All equipment leaving the EZ must be decontaminated either within the CRZ or at the central decontamination area. Small equipment, such as hand tools, will be thoroughly decontaminated within the CRZ before being placed in the SZ. The field tools may be scrubbed visually clean using a detergent solution (Alconox/Liquinox) with water and a stiff, long-bristled scrub brush. Following the solution scrubbing, the tools may be rinsed with distilled water or isopropyl alcohol. Any vehicle working in an EZ will be decontaminated before leaving the site. The vehicle will be cleaned by sweeping excess soil and debris off the wheels. A high-pressure sprayer will then be used to wash the wheels, if necessary.

Each piece of equipment will be inspected after cleaning for any soil remaining on the tires or elsewhere. All vehicles will be cleaned to the satisfaction of the Field Team Lead or a designated assistant prior to entering the SZ or leaving the site. Employees or subcontractors performing decontamination shall wear the appropriate level of PPE (refer to Section 5.0).

### **9.2.3 Waste Management**

The Project Manager and the Field Team Leads will be responsible for overseeing the containerization and disposal of any field derived wastes. Contaminated or suspected contaminated field derived wastes shall be disposed of in accordance with all local, state, and/or federal regulations. Field derived wastes include decontamination rinse waters and other related decontamination generated wastes.

Soils and groundwater expected to be encountered during any sampling or intrusive work not to be contaminated, based on existing data, may be discharged to the ground surface in the immediate vicinity of the monitoring well. However, any known or suspected to be contaminated soil (in small quantities) or groundwater will be containerized for future removal, likely in 55-gallon drums or other approved storage vessels. Depending on the suspected contaminants, the recovered groundwater may be sent through one of the onsite groundwater treatment units. However, the treatment unit must be designed to address the contaminants of concern in the groundwater being treated. Otherwise, the liquid must be staged onsite for eventual offsite disposal at an approved facility.

Impacted soil, if in drums, will be staged in an area designated by the Project Manager or Field Team Lead for eventual disposal. For large excavations, where excavated soil is stockpiled, it may be necessary to place soils on plastic and cover with plastic to prevent any potential leachable runoff. The Project Manager and/or Field Team Lead will provide the proper guidance necessary for handling bulk soil piles.

Any NAPL recovered via remediation systems or manual recovery efforts will be properly containerized and either disposed of offsite as a recyclable material, if possible, or as a hazardous waste. The receiving facility must be an approved facility.

## **10.0 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES**

The objective of emergency response and contingency procedures is to ensure that effective actions are implemented in a timely manner to minimize or control the effects of adverse events (e.g., potential chemical exposures, personal injuries, fires/explosions, and spills/releases). The following subsections describe the basic emergency responses required should an emergency take place during field investigation or remedial effort activities.

### **10.1 Emergency Phone Numbers**

Emergency telephone numbers are listed in **Table 10-1**.

**Table 10-1  
Emergency Telephone Numbers and Agencies**

Agency	Telephone Number
Security (Sparrows Point facility)	(410) 388-7761
Ambulance	911
Fire	911
Occupational Health Clinic	(410) 633-3600
Hospital	(410) 550-0100 (general) (410) 550-0350 (emergency)
National Response Center	(800) 424-8802
Poison Control Center - Maryland	(800) 222-1222
EAG Main Contact	
VP Remediation, Russ Becker	(314) 686-5611
Project Manager, James Calenda	(314) 620-3056

**10.2 Injury/Illness Treatment**

In the event of illness or injury, the following steps will be taken:

- Evaluate the extent of injuries or seriousness of illness.
- When employees require urgent medical attention, call for emergency assistance. First aid should be administered while awaiting an ambulance or paramedics. All emergency medical treatment, other than first aid, will be administered by the local paramedics. **Table 10-1** lists site emergency telephone numbers. In all cases, critical injuries must be immediately referred for professional medical attention.
- For a non-critical injury/illness, first aid will be administered by onsite personnel. Anyone sustaining a non-critical injury/illness who continues to work will be monitored by the Field Team Lead for any signs of worsening condition, if it is deemed that the person can return to work by the Team Lead and Project Manager. Injured personnel who later suffer any worsening change in status are to immediately notify the Team Lead or the Project Manager.



### 10.3 Occupational Health Clinic and Hospital Information

#### Occupational Health Clinic

The Concentra Medical Center, located at 1833 Portal Street, Baltimore, MD, is the closest occupational health clinic, just over 6 miles away. A map to the clinic is included as **Figure 10-1**. The clinic should be used for non-emergency injuries and illnesses.

#### Directions:

From Sparrow's Point Road, turn left onto Wharf Road;  
Turn left onto MD-158 W/Bethlehem Blvd. (0.4 mile);  
Turn right onto MD-157 N/Peninsula Expy. (2.7 miles);  
Turn slight left onto Merritt Ave. (0.1 mile);  
Merritt Ave. becomes Sollers Point Rd. (0.3 mile);  
Turn left to stay on Sollers Point Rd (0.6 mile);  
Turn left onto Williams Ave. (0.2 mile);  
Turn right onto Dundalk Ave. (<0.1 miles);  
Turn left onto Chandlery St. (0.1 mile);  
Turn left onto Portal St.

**Figure 10-1: Health Clinic (Non-Emergency) Map**



## Hospital

The Johns Hopkins Bayview Hospital is the closest emergency facility, just over 9 miles away. The hospital is located at 4940 Eastern Avenue in Baltimore, MD. **Figure 10-2** is a map to this hospital. Maps are also included in **Attachment E**.

Directions:

From the Sparrows Point Industrial Complex, go north on Route 151 for approximately one mile.

Take ramp (right) onto I-695 towards I-695/Essex.

At exit 40, take ramp (right) onto Route 151/North Point Boulevard North/MD 150;

Take ramp (right) onto Route 150 (Eastern Avenue).

Continue on Eastern Avenue to hospital on right.

**Figure 10-2: Hospital Map**



Prior to the start of field activities, the Project Field Team Leader will call to verify the telephone numbers and directions for the clinic and hospital, and then distribute location maps and the emergency telephone list to workers and vehicles.

## 10.4 Accident and Emergency Medical Response

All field team members will be aware of the location of a first aid kit kept onsite. All vehicles used to transport injured persons to an offsite medical facility will be provided with directions and a map to the medical facility.

If treatment beyond first aid is required, emergency response personnel will be contacted for assistance and transport. Before beginning site activities, the Project Field Team Leader will ensure that each field team member knows where the nearest emergency medical facilities are and how to get there. The closest hospital will be used in cases of life-threatening emergencies at the direction of the Project Field Team Leader. The telephone numbers of the local emergency services will be available in the SZ, and the Project Field Team Leader will brief the field team on the procedures for calling for help in an emergency.

Site personnel will inform the Project Manager of any medications, allergies, or other medical information that may be applicable for their medical treatment. The Project Manager will supply this information to emergency response personnel, and will accompany the victim to the hospital, if possible.

### 10.4.1 Chemical Exposure

In case of accidental overexposure to a hazardous material (groundwater, soil, and/or off-gas materials), guidelines shown in **Table 10-2** will be used.

**Table 10-2**  
**Chemical Exposure Guidelines**

Type of Overexposure	First Aid Guidelines
Skin Contact	Skin: Wash/rinse the affected area thoroughly with copious amounts of soap and water.
	Eyes: Eyes should be rinsed for at least 15 minutes following chemical contamination.
	Contact emergency response personnel if required, or transport victim to the hospital.
Inhalation	Move the victim to fresh air.
	Contact emergency response personnel if required, or transport victim to the hospital.
Ingestion	Contact Poison Control Center.
	Contact emergency response personnel, or transport victim to the hospital.

### 10.4.2 Decontamination During a Medical Emergency

For minor medical problems or injuries, regular decontamination procedures will be followed. If emergency, life-saving first aid and/or medical treatment are required, regular decontamination procedures may need to be abbreviated or omitted:

- Do not attempt to wash or rinse an unresponsive victim unless the victim has been contaminated with an extremely toxic or corrosive chemical that may cause injury or loss of life to emergency response personnel.
- Outer garments can be removed if it does not cause a delay, interfere with treatment, or aggravate the problem.

- PPE can be cut away and respiratory protective equipment must always be removed.
- If contaminated clothing cannot be safely removed, then the victim should be wrapped in a blanket or plastic sheeting to prevent contamination to the inside of the ambulance and/or emergency response personnel.

The Project Manager or Field Team Lead will advise the medical staff as to the type of contamination possibly involved.

#### **10.4.3 Small or Incipient Fire**

A small fire is defined as a fire that can be extinguished with an available 20 pound type ABC fire extinguisher. An incipient fire is a fire that is small because it has just started. In the event of a small or incipient fire, the following minimum actions will be taken:

- Evacuate nearby personnel from the area, if possible, to an upwind location or to an area not affected by smoke or hazardous decomposition products if an upwind location is not feasible.
- Attempt to extinguish fire using portable fire extinguisher or by smothering.
- Contact emergency response personnel, as needed, for any injuries or exposures to hazardous decomposition products, or if fire cannot be put out.
- After the fire has been extinguished, or emergency response personnel have been contacted, notify the following project personnel:

The Project Manager

#### **10.4.4 Large Fire or Explosion**

An explosion, large fire or a small fire which cannot be extinguished is beyond the first line capabilities of EAG personnel. Professional emergency response personnel would be needed to provide emergency assistance for these types of incidents. In the event of a large fire, explosion or a small fire that cannot be extinguished, the following minimum actions will be taken:

- Evacuate all personnel from the site, if possible, to an upwind location, or to an area not affected by smoke or hazardous decomposition products if an upwind location is not feasible
- Perform a quick role call to account for all site personnel
- Contact the fire department
- Contact emergency response personnel, as needed, for any injuries or exposures to hazardous decomposition products
- After emergency response personnel have been contacted, notify the following project personnel:

The Project Manager

#### **10.4.5 Adverse Weather Conditions**

In the event of adverse weather conditions, the Project Manager will determine if work can continue without sacrificing the health and safety of site personnel. Threatening weather conditions will be monitored by the Project Manager and possibly the Team Lead via radio, television, internet, and/ or calls to the National Weather Service. Some of the conditions to be considered include:

- Potential for heat or cold stress
- Limited visibility

- Electrical storms
- Treacherous weather-related working conditions (i.e., heavy rainfall, icy conditions causing slippery footing hazards, etc.).

#### **10.4.6 First Aid for Heat Stress/Cold Stress**

First aid treatment for **heat cramps** includes shade, rest and fluid replacement. If available, the individual should drink electrolyte replacement fluids (e.g., Gatorade, Squincher or 10-K). The individual should recover within half an hour.

First aid treatment for **heat exhaustion** includes cooling the victim, elevating the feet and fluid replacement. If the individual has not recovered within half an hour, then transport the victim to the hospital for medical attention.

**Heat stroke** is a medical emergency, requiring the immediate cooling of the victim and transport to the hospital for medical treatment immediately.

First aid treatment for **frost nip** and **frostbite** includes covering the affected area with warmth and retreating to a warm area. If the individual has not recovered within half an hour, then transport the victim to the hospital for medical attention.

**Frozen tissue** is a medical emergency and the victim must receive medical attention immediately. Contact emergency response personnel immediately or transport the victim to the hospital.

First aid treatment of **mild hypothermia** includes using heat to raise the individual's body temperature. Heat may be applied to the victim in the form of heat packs, hot water bottles and blankets. If the individual has not recovered within half an hour, then transport the victim to the hospital for medical attention.

**Severe hypothermia** is a medical emergency and the victim must be transported to the hospital immediately. First aid treatment for severe hypothermia includes handling the victim very gently; rough handling may set off of an irregular heartbeat. **DO NOT** attempt to re-warm the severely hypothermic victim; re-warming may cause the development of an irregular heartbeat.

#### **10.4.7 Snake Bites**

If bitten, lower the extremity below the heart to reduce the poison's dissemination through the body. Remain calm, try to keep the heart rate reduced and seek medical attention immediately. Do not cut the wound or attempt to suck out the venom. Note any physical features (e.g., shape of head and color or pattern on body) of the snake.

#### **10.4.8 Animal Bites**

All bites should be treated as contaminated soft tissue injuries. Bites should be washed immediately with large amounts of soap and water. If soap is not available, flush the wound with water. The severity and onset of any infection is dependent upon the number of organisms (viruses or bacteria) introduced into the wound. Washing saliva out of the wound immediately will reduce the number of bacteria or viruses that can enter the tissue. Medical attention must be sought if rabies is suspected or the individual has not had a recent tetanus booster.

#### 10.4.9 Insect Bites and Stings

Emergency care for insect bites and stings depends on the individual's reaction. To treat a sting that results in a minor reaction, remove the stinger by gently scraping it off the skin. Do not try to grasp the sac or stinger, because this forces the remaining venom into the skin. Once the stinger has been removed, clean the wound and surrounding area. Apply cold packs to slow the absorption of the venom and reduce pain and swelling. The treatment for a severe reaction to insect stings includes the following:

- Confirm with the victim whether they are highly allergic to the insect that stung them
  - If victim has gone into anaphylactic shock, retrieve their epi pen or other auto-injector and administer per the directions as hastily as possible
- Assuming the victim remains conscious, ask them to refrain from moving around, and to lie down
- Immobilize the injured area immediately
- If an extremity is involved, remove any rings or watch
- Keep the affected part low, below the level of the heart
- Apply cold compresses to the affected area
- If possible, try to identify the type of insect that inflicted the sting
- Transport the victim to a medical facility immediately, continuing supportive measures en route.

All employees and subcontractors must report severe reactions to insect stings prior to the beginning of work to both the Project Manager and Field Team Lead.

#### 10.4.10 Poisonous Plants

**Decontamination:** Wash the skin immediately after contact with the plant. Proper washing may not be practical in the middle of the woods, but a product such as Technu or a small wash-up kit with prepackaged, alcohol-based cleansing tissues can be effective. Employees and subcontractors should not forget to wash contaminated clothing and clean up contaminated equipment prior to re-use.

**Treatment:** Options are as follows:

- Home treatment: Calamine lotion and an oatmeal bath (one cup to a tub full of water) can help relieve itching. To prevent secondary skin infection, scratching is not helpful and the fingernails should be cut to avoid damage to the skin. Over-the-counter hydrocortisone cream can decrease inflammation and itching; however, the label should be read and the cream used according to directions.
- When to see the doctor: Severe cases may require further treatment. A physician should be seen if the rash appears infected, is on the face or other sensitive body areas, or is too extensive to be easily treated at home.

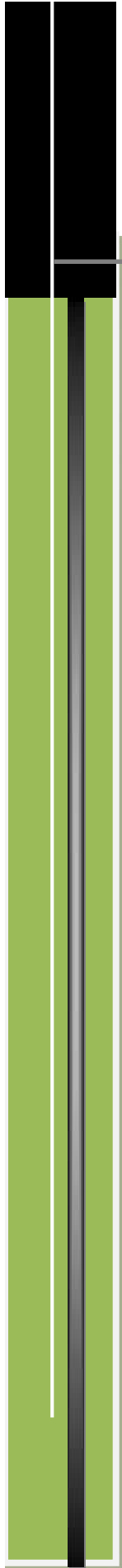
#### 10.4.11 Ticks

To remove an attached tick:

- Use fine-tipped tweezers or a "tick tool" to grasp the tick at the surface of the skin
- If tweezers are not available, use a tissue to protect the fingers (exposure to the tick's body fluid may lead to transmission of disease)
- With a steady motion, pull the tick straight out

Disinfect the bite site and the tweezers. Wash your hands thoroughly with soap and water. Save the tick if you can by placing it in a Ziploc bag in the freezer; this may help with diagnosis in the future.

If flu-like symptoms such as fatigue, headache, neck-stiffness or jaw discomfort begin following a tick bite, seek medical attention.



# APPENDICES



Environmental Engineers



**ATTACHMENT A**  
**COMPLIANCE AGREEMENT**

## EAG HEALTH AND SAFETY PLAN

### ACKNOWLEDGEMENT FORM

I, \_\_\_\_\_, have read (or had read to me), EAG's health and safety plan.  
(Print Name)

I understand my responsibilities as they are defined in this plan and will abide by these rules and procedures, as well as any regulations or otherwise governing safety. When in doubt concerning safe job performance, I will speak to my immediate supervisor and/or Project Manager.

I understand EAG reserves the right to change or amend the HASP at any time.

I understand any violation to the plan policies or procedures will be cause for disciplinary action up to and including termination.

\_\_\_\_\_  
Employee Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
EAG Supervisor/Project Manager Signature

\_\_\_\_\_  
Date

## **ATTACHMENT B**

**Material Safety Data Sheets (MSDSs)**

# MATERIAL SAFETY DATA SHEET

## Section 1. Chemical Product and Company Identification

**Product Name:** ChemTreat CL5432  
**Product Use:** Cooling Water Treatment Dispersant  
**Supplier's Name:** ChemTreat, Inc.  
**Emergency Telephone Number:** (800) 424-9300 (Toll Free)  
(703) 527-3887  
**Address (Corporate Headquarters):** 5640 COX ROAD  
Glen Allen, VA 23060  
**Telephone Number for Information:** (800) 648-4579  
**Date of MSDS:** February 6, 2013

## Section 2. Hazard(s) Identification



**Signal Word:** DANGER!

**Hazard Statement(s):** Causes severe skin burns and eye damage.  
Causes serious eye damage.  
Harmful in contact with skin.  
Harmful if inhaled.  
Harmful if swallowed.

**Precautionary Statement(s):** Wear protective gloves/clothing and eye/face protection. Do not breathe dust/fume/gas/mist/vapors/spray. Do not eat, drink or smoke when using this product. Wash hands thoroughly after handling. Use only outdoors or in a well-ventilated area.

## Section 3. Composition/Hazardous Ingredients

Component	CAS Registry #	Wt. %
1-Hydroxyethylidene-1,1-diphosphonic acid	2809-21-4	10 - 30

## ***Section 4. First Aid Measures***

---

<b>Inhalation:</b>	Remove victim to fresh air and keep at rest in a position comfortable for breathing. Immediately call a poison center or doctor/physician.
<b>Eyes:</b>	Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center or doctor/physician.
<b>Skin:</b>	Wash with plenty of soap and water. Call a poison center or doctor/physician if you feel unwell.
<b>Ingestion:</b>	DO NOT INDUCE VOMITING. Rinse mouth. Call a POISON CENTER or doctor/physician.
<b>Notes to Physician:</b>	N/A
<b>Additional First Aid Remarks:</b>	N/A

## ***Section 5. Fire Fighting Measures***

---

<b>Flammability of the Product:</b>	Not flammable.
<b>Suitable Extinguishing Media:</b>	Use extinguishing media suitable to surrounding fire.
<b>Specific Hazards Arising from the Chemical:</b>	None known.
<b>Protective Equipment:</b>	If product is involved in a fire, wear full protective clothing including a positive-pressure, NIOSH approved, self-contained breathing apparatus.

## ***Section 6. Accidental Release Measures***

---

<b>Personal Precautions:</b>	Use appropriate Personal Protective Equipment (PPE).
<b>Environmental Precautions:</b>	Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains, and sewers.
<b>Methods for Cleaning up:</b>	Contain and recover liquid when possible. Flush spill area with water spray.
<b>Other Statements:</b>	None.

## Section 7. Handling and Storage

---

**Handling:** Wear appropriate Personal Protective Equipment (PPE) when handling this product. Do not get in eyes, or on skin and clothing. Wash thoroughly after handling. Do not ingest. Avoid breathing vapors, mist or dust.

**Storage:** Store away from incompatible materials (see Section 10). Store at ambient temperatures. Keep container securely closed when not in use. Label precautions also apply to empty container. Recondition or dispose of empty containers in accordance with government regulations. For Industrial use only.

## Section 8. Exposure Controls/Personal Protection

---

### Exposure Limits

Component	Source	Exposure Limits
1-Hydroxyethylidene-1,1-diphosphonic acid		N/E

### Carcinogenicity Category

Component	Source	Code	Brief Description
1-Hydroxyethylidene-1,1-diphosphonic acid			N/E

**Engineering Controls:** Use only with adequate ventilation. The use of local ventilation is recommended to control emission near the source.

### Personal Protection

**Eyes:** Wear chemical splash goggles or safety glasses with full-face shield. Maintain eyewash fountain in work area.

**Skin:** Maintain quick-drench facilities in work area. Wear butyl rubber or neoprene gloves. Wash them after each use and replace as necessary. If conditions warrant, wear protective clothing such as boots, aprons, and coveralls to prevent skin contact.

**Respiratory:** If misting occurs, use NIOSH approved organic vapor/acid gas dual cartridge respirator with a dust/mist prefilter in accordance with 29 CFR 1910.134.

## Section 9. Physical and Chemical Properties

---

<b>Physical State and Appearance:</b>	Liquid, Dark Straw, Clear
<b>Specific Gravity:</b>	1.230 @ 20°C
<b>pH:</b>	1.6 @ 20°C, 100.0%
<b>Freezing Point:</b>	32°F
<b>Flash Point:</b>	N/D
<b>Odor:</b>	Mild
<b>Melting Point:</b>	N/D
<b>Boiling Point:</b>	N/D
<b>Solubility in Water:</b>	Complete
<b>Evaporation Rate:</b>	N/D
<b>Vapor Density:</b>	N/D
<b>Molecular Weight:</b>	N/D
<b>Viscosity:</b>	<100CP
<b>Flammable Limits:</b>	N/A
<b>Autoignition Temperature:</b>	N/A
<b>Density:</b>	10.26 lb/ga
<b>Vapor Pressure:</b>	N/D
<b>% VOC:</b>	N/D

## Section 10. Stability and Reactivity

---

<b>Chemical Stability:</b>	Stable at normal temperatures and pressures.
<b>Incompatibility with Various Substances:</b>	Strong reducing agents, Strong bases
<b>Hazardous Decomposition Products:</b>	Oxides of carbon, Oxides of nitrogen, Oxides of phosphorus
<b>Possibility of Hazardous Reactions:</b>	None known.

## Section 11. Toxicological Information

---

Chemical Name	Exposure	Type of Effect	Concentration	Species
1-Hydroxyethylidene-1,1-diphosphonic acid	Oral	LD50	2400 mg/kg	Rat
	Dermal	LD50	7940 mg/kg	Rabbit

**Comments:** None.

## Section 12. Ecological Information

---

Species	Duration	Type of Effect	Test Results
Ceriodaphnia dubia	48h	LC50	892 mg/l
Fathead Minnow	96h	LC50	3252 mg/l

**Comments:** None.

## Section 13. Disposal Considerations

---

Dispose of in accordance with local, state and federal regulations.  
EPA corrosivity characteristic hazardous waste D002 when disposed of in the original product form.

## Section 14. Transport Information

---

### DOT

**Proper Shipping Name:** CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.  
**Technical Name:** (1-HYDROXYETHYLIDENE-1, 1-DIPHOSPHONIC ACID)  
**Hazard Class:** Corrosive  
**UN/NA#:** UN3265  
**Packing Group:** PGIII

## Section 15. Regulatory Information

---

### Inventory Status

**United States (TSCA):** All ingredients listed.  
**Canada (DSL/NDSL):** All ingredients listed.

### Federal Regulations

**SARA Title III Rules**



**Sections 311/312 Hazard Classes**

**Fire Hazard:** No  
**Reactive Hazard:** No  
**Release of Pressure:** No  
**Acute Health Hazard:** Yes  
**Chronic Health Hazard:** No

**Other Sections**

Component	Section 313 Toxic Chemical	Section 302 EHS TPQ	CERCLA RQ
1-Hydroxyethylidene-1,1-diphosphonic acid	N/A	N/A	N/A

**Comments:** None.

**State Regulations**

**California Proposition 65:** None known.

**Special Regulations**

Component	States
1-Hydroxyethylidene-1,1-diphosphonic acid	None

**International Regulations**

**Canada**

**WHMIS Classification:** D2B (Toxic Material)  
 E (Corrosive Material)

**Controlled Product Regulations (CPR):** This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

**Section 16. Other Information**

---

**HMIS Hazard Rating**

**Health:** 2  
**Flammability:** 0  
**Physical Hazard:** 0  
**PPE:** X

**Notes:** The PPE rating depends on circumstances of use. See Section 8 for recommended PPE.  
 The Hazardous Material Information System (HMIS) is a voluntary, subjective alpha-numeric symbolic system for

recommending hazard risk and personal protection equipment information. It is a subjective rating system based on the evaluator's understanding of the chemical associated risks. The end-user must determine if the code is appropriate for their use.

**NSF:** N/A

**FDA/USDA/GRAS:** N/A

**KOSHER:** This product has not been evaluated for Kosher approval.

**FIFRA:** N/A

**Other:** None

### Abbreviations

Abbreviation	Definition
<	Less Than
>	Greater Than
ACGIH	American Conference of Governmental Industrial Hygienists
EHS	Environmental Health and Safety Dept
N/A	Not Applicable
N/D	Not Determined
N/E	Not Established
OSHA	Occupational Health and Safety Dept
PEL	Personal Exposure Limit
STEL	Short Term Exposure Limit
TLV	Threshold Limit Value
TWA	Time Weight Average
UNK	Unknown

**Prepared by: Regulatory Affairs Department**

### *Disclaimer*

Although the information and recommendations set forth herein (hereinafter "information") are presented in good faith and believed to be correct as of the date hereof, ChemTreat, Inc. makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will ChemTreat, Inc. be responsible for damages of any nature whatsoever resulting from the use or reliance upon information. No representation or warranties, either expressed or implied, of merchantability, fitness for a particular purpose, or of any other nature are made hereunder with respect to information or the product to which information refers.

# SAFETY DATA SHEET

## Section 1. Chemical Product and Company Identification

---

<b>Product Name:</b>	ChemTreat CL561
<b>Product Use:</b>	Cooling Water Treatment
<b>Supplier's Name:</b>	ChemTreat, Inc.
<b>Emergency Telephone Number:</b>	(800) 424-9300 (Toll Free) (703) 527-3887
<b>Address (Corporate Headquarters):</b>	5640 COX ROAD Glen Allen, VA 23060
<b>Telephone Number for Information:</b>	(800) 648-4579
<b>Date of MSDS:</b>	February 27, 2014

## Section 2. Hazard(s) Identification

---



<b>Signal Word:</b>	<b>DANGER</b>
<b>Hazard Statement(s):</b>	May be corrosive to metals. Causes severe skin burns and eye damage. May cause cancer. Fatal if inhaled. May cause damage to organs through prolonged or repeated exposure.
<b>Precautionary Statement(s):</b>	Keep only in original packaging. Do not breathe dust/fume/gas/mist/vapors/spray. Wash thoroughly after handling. Wear protective gloves/protective clothing/eye protection/face protection. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use only outdoors or in a well-ventilated area. Wear respiratory protection.

### ***Section 3. Composition/Hazardous Ingredients***

---

<b>Component</b>	<b>CAS Registry #</b>	<b>Wt. %</b>
Sulfuric acid	7664-93-9	15 - 40

### ***Section 4. First Aid Measures***

---

<b>Inhalation:</b>	Remove victim to fresh air and keep at rest in a position comfortable for breathing. Immediately call a poison center or doctor/physician.
<b>Eyes:</b>	Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center or doctor/physician.
<b>Skin:</b>	Immediately remove/take off all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before re-use. Immediately call a poison center or doctor/physician.
<b>Ingestion:</b>	DO NOT INDUCE VOMITING. Rinse mouth. Call a POISON CENTER or doctor/physician.
<b>Notes to Physician:</b>	N/A
<b>Additional First Aid Remarks:</b>	N/A

### ***Section 5. Fire Fighting Measures***

---

<b>Flammability of the Product:</b>	Not flammable.
<b>Suitable Extinguishing Media:</b>	Use extinguishing media suitable to surrounding fire.
<b>Specific Hazards Arising from the Chemical:</b>	None known.
<b>Protective Equipment:</b>	If product is involved in a fire, wear full protective clothing including a positive-pressure, NIOSH approved, self-contained breathing apparatus.

## Section 6. Accidental Release Measures

---

<b>Personal Precautions:</b>	Use appropriate Personal Protective Equipment (PPE).
<b>Environmental Precautions:</b>	Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains, and sewers.
<b>Methods for Cleaning up:</b>	Contain and recover liquid when possible. Flush spill area with water spray.
<b>Other Statements:</b>	If RQ (Reportable Quantity) is exceeded, report to National Spill Response Office at 1-800-424-8802.

## Section 7. Handling and Storage

---

<b>Handling:</b>	Wear appropriate Personal Protective Equipment (PPE) when handling this product. Do not get in eyes, or on skin and clothing. Wash thoroughly after handling. Do not ingest. Avoid breathing vapors, mist or dust.
<b>Storage:</b>	Store away from incompatible materials (see Section 10). Store at ambient temperatures. Keep container securely closed when not in use. Label precautions also apply to empty container. Recondition or dispose of empty containers in accordance with government regulations. For Industrial use only. Do not store or handle in aluminum, zinc, copper, or their alloys.

## Section 8. Exposure Controls/Personal Protection

---

### Exposure Limits

Component	Source	Exposure Limits
Sulfuric acid	ACGIH TLV	0.2 ppm TWA
	OSHA PEL	1 mg/m <sup>3</sup> TWA; Aerosol

### Carcinogenicity Category

Component	Source	Code	Brief Description
Sulfuric acid	NTP	NTP-K	Known to be a human carcinogen

<b>Engineering Controls:</b>	Use only with adequate ventilation. The use of local ventilation is recommended to control emission near the source.
------------------------------	--

## Personal Protection

- Eyes:** Wear chemical splash goggles or safety glasses with full-face shield. Maintain eyewash fountain in work area.
- Skin:** Maintain quick-drench facilities in work area.  
Wear butyl rubber or neoprene gloves. Wash them after each use and replace as necessary. If conditions warrant, wear protective clothing such as boots, aprons, and coveralls to prevent skin contact.
- Respiratory:** If misting occurs, use NIOSH approved organic vapor/acid gas dual cartridge respirator with a dust/mist prefilter in accordance with 29 CFR 1910.134.

## Section 9. Physical and Chemical Properties

---

<b>Physical State and Appearance:</b>	Liquid, Colorless, Clear
<b>Specific Gravity:</b>	1.264 @ 20°C
<b>pH:</b>	0.5 @ 20°C, 10.0%
<b>Freezing Point:</b>	<-11°F
<b>Flash Point:</b>	N/D
<b>Odor:</b>	Mild
<b>Melting Point:</b>	N/A
<b>Boiling Point:</b>	230°F
<b>Solubility in Water:</b>	Complete
<b>Evaporation Rate:</b>	<1
<b>Vapor Density:</b>	3.40 lb/ga
<b>Molecular Weight:</b>	N/D
<b>Viscosity:</b>	N/D
<b>Flammable Limits:</b>	N/A
<b>Autoignition Temperature:</b>	N/A
<b>Density:</b>	10.54 lb/ga
<b>Vapor Pressure:</b>	1 mmHg, @ 145C
<b>% VOC:</b>	0

## Section 10. Stability and Reactivity

---

- Chemical Stability:** Stable at normal temperatures and pressures.
- Incompatibility with Various Substances:** Bases, Strong oxidizers, Halogens, Metals or metal oxides, Reducing agents, Combustible materials
- Hazardous Decomposition Products:** Oxides of sulfur
- Possibility of Hazardous Reactions:** None known.

## Section 11. Toxicological Information

---

Chemical Name	Exposure	Type of Effect	Concentration	Species
Sulfuric acid	Oral	LD50	2140 mg/kg	Rat

**Comments:** None.

## Section 12. Ecological Information

---

Species	Duration	Type of Effect	Test Results
Bluegill Sunfish	96h	LC50	10.5 ppm

**Comments:** None.

## Section 13. Disposal Considerations

---

Dispose of in accordance with local, state and federal regulations.  
EPA corrosivity characteristic hazardous waste D002 when disposed of in the original product form.

## Section 14. Transport Information

---

### DOT

**Proper Shipping Name:** SULFURIC ACID, 35%  
**Technical Name:** N/A  
**Hazard Class:** Corrosive  
**UN/NA#:** UN2796  
**Packing Group:** PGII

### Over 271 GA

**Proper Shipping Name:** RQ SULFURIC ACID, 35%  
**Technical Name:** N/A  
**Hazard Class:** Corrosive  
**UN/NA#:** UN2796  
**Packing Group:** PGII



**IMDG**

**Proper Shipping Name:** SULFURIC ACID, 35%  
**Technical Name:** N/A  
**Hazard Class:** Corrosive  
**UN/NA#:** UN2796  
**Packing Group:** PGII

**TDG**

**Proper Shipping Name:** SULFURIC ACID, 35%  
**Technical Name:** N/A  
**Hazard Class:** Corrosive  
**UN/NA#:** UN2796  
**Packing Group:** PGII

**ICAO**

**Proper Shipping Name:** SULFURIC ACID, 35%  
**Technical Name:** N/A  
**Hazard Class:** Corrosive  
**UN/NA#:** UN2796  
**Packing Group:** PGII

***Section 15. Regulatory Information***

---

**Inventory Status**

**United States (TSCA):** All ingredients listed.  
**Canada (DSL/NDSL):** All ingredients listed.

**Federal Regulations**

**SARA Title III Rules**

**Sections 311/312 Hazard Classes**

<b>Fire Hazard:</b>	No
<b>Reactive Hazard:</b>	Yes
<b>Release of Pressure:</b>	No
<b>Acute Health Hazard:</b>	Yes
<b>Chronic Health Hazard:</b>	Yes





### Other Sections

Component	Section 313 Toxic Chemical	Section 302 EHS TPQ	CERCLA RQ
Sulfuric acid	N/A	1000	1000

**Comments:** None.

### State Regulations

**California Proposition 65:** None known.

### Special Regulations

Component	States
Sulfuric acid	MA, MN, NJ, NY, PA, WA

### International Regulations

#### Canada

**WHMIS Classification:** D2B (Toxic Material)  
E (Corrosive Material)

**Controlled Product Regulations (CPR):** This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

## Section 16. Other Information

---

### HMIS Hazard Rating

**Health:** 3  
**Flammability:** 0  
**Physical Hazard:** 2  
**PPE:** X

**Notes:** The PPE rating depends on circumstances of use. See Section 8 for recommended PPE.  
The Hazardous Material Information System (HMIS) is a voluntary, subjective alpha-numeric symbolic system for recommending hazard risk and personal protection equipment information. It is a subjective rating system based on the evaluator's understanding of the chemical associated risks. The end-user must determine if the code is appropriate for their use.

**NSF:** N/A



**FDA/USDA/GRAS:** N/A

**KOSHER:** This product is certified by the Orthodox Union as kosher pareve. Only when prepared by the following ChemTreat facilities: Ashland, VA; Eldridge, IA; Nederland, TX; Vernon, CA.

**FIFRA:** N/A

**Other:** None

**Abbreviations**

Abbreviation	Definition
<	Less Than
>	Greater Than
ACGIH	American Conference of Governmental Industrial Hygienists
EHS	Environmental Health and Safety Dept
N/A	Not Applicable
N/D	Not Determined
N/E	Not Established
OSHA	Occupational Health and Safety Dept
PEL	Personal Exposure Limit
STEL	Short Term Exposure Limit
TLV	Threshold Limit Value
TWA	Time Weight Average
UNK	Unknown

**Prepared by: Product Compliance Department;  
ProductCompliance@chemtreat.com**

***Disclaimer***

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Although the information and recommendations set forth herein (hereinafter "information") are presented in good faith and believed to be correct as of the date hereof, ChemTreat, Inc. makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will ChemTreat, Inc. be responsible for damages of any nature whatsoever resulting from the use or reliance upon information. No representation or warranties, either expressed or implied, of merchantability, fitness for a particular purpose, or of any other nature are made hereunder with respect to information or the product to which information refers.

# MATERIAL SAFETY DATA SHEET

## Section 1. Chemical Product and Company Identification

**Product Name:** ChemTreat FO220  
**Product Use:** Defoamer  
**Supplier's Name:** ChemTreat, Inc.  
**Emergency Telephone Number:** (800) 424-9300 (Toll Free)  
(703) 527-3887  
**Address (Corporate Headquarters):** 5640 COX ROAD  
Glen Allen, VA 23060  
**Telephone Number for Information:** (800) 648-4579  
**Date of MSDS:** January 5, 2012

## Section 2. Hazard(s) Identification



**Signal Word:** WARNING!

**Hazard Statement(s):** May be harmful in contact with skin.  
May be harmful if inhaled.  
May be harmful if swallowed.

**Precautionary Statement(s):** No significant health risks are expected from exposures under normal conditions of use.

## Section 3. Composition/Hazardous Ingredients

Component	CAS Registry #	Wt. %
There are no hazardous ingredients in this product as defined in 29 CFR 1910.1200.	Proprietary	N/A

## Section 4. First Aid Measures

**Inhalation:** Remove to fresh air and keep at rest in a position comfortable for breathing. Call a poison center or doctor/physician if you feel unwell.

**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.

**Skin:** Wash with plenty of soap and water. Call a poison center or doctor/physician if you feel unwell.

**Ingestion:** DO NOT INDUCE VOMITING. Rinse mouth. Call a POISON CENTER or doctor/physician if you feel unwell.

**Notes to Physician:** N/A

**Additional First Aid Remarks:** N/A

## ***Section 5. Fire Fighting Measures***

---

**Flammability of the Product:** Not flammable.

**Suitable Extinguishing Media:** Use extinguishing media suitable to surrounding fire.

**Specific Hazards Arising from the Chemical:** None known.

**Protective Equipment:** If product is involved in a fire, wear full protective clothing including a positive-pressure, NIOSH approved, self-contained breathing apparatus.

## ***Section 6. Accidental Release Measures***

---

**Personal Precautions:** Use appropriate Personal Protective Equipment (PPE).

**Environmental Precautions:** Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains, and sewers.

**Methods for Cleaning up:** Contain and recover liquid when possible. Flush spill area with water spray.

**Other Statements:** None.

## ***Section 7. Handling and Storage***

---

**Handling:** Wear appropriate Personal Protective Equipment (PPE) when handling this product. Do not get in eyes, or on skin and clothing. Wash thoroughly after handling. Do not ingest. Avoid breathing vapors, mist or dust.

**Storage:** Store away from incompatible materials (see Section 10). Store at ambient temperatures. Keep container securely closed when not in use. Label precautions also apply to empty container. Recondition or dispose of empty containers in accordance with government regulations. For Industrial use only. Keep from freezing. Protect from heat and sources of ignition.

## Section 8. Exposure Controls/Personal Protection

### Exposure Limits

Component	Source	Exposure Limits
There are no hazardous ingredients in this product as defined in 29 CFR 1910.1200.		N/E

### Carcinogenicity Category

Component	Source	Code	Brief Description
There are no hazardous ingredients in this product as defined in 29 CFR 1910.1200.			N/E

### Engineering Controls:

Use only with adequate ventilation. The use of local ventilation is recommended to control emission near the source.

### Personal Protection

- Eyes:** Wear chemical splash goggles or safety glasses with full-face shield. Maintain eyewash fountain in work area.
- Skin:** Maintain quick-drench facilities in work area. Wear butyl rubber or neoprene gloves. Wash them after each use and replace as necessary. If conditions warrant, wear protective clothing such as boots, aprons, and coveralls to prevent skin contact.
- Respiratory:** If misting occurs, use NIOSH approved organic vapor/acid gas dual cartridge respirator with a dust/mist prefilter in accordance with 29 CFR 1910.134.

## Section 9. Physical and Chemical Properties

<b>Physical State and Appearance:</b>	Liquid Emulsion, White, Opaque
<b>Specific Gravity:</b>	1.009 @ 20°C
<b>pH:</b>	N/A
<b>Freezing Point:</b>	32°F
<b>Flash Point:</b>	>200°F
<b>Odor:</b>	Mild
<b>Melting Point:</b>	N/A
<b>Boiling Point:</b>	>212°F
<b>Solubility in Water:</b>	Dispersible
<b>Evaporation Rate:</b>	Similar to water
<b>Vapor Density:</b>	Lighter than air
<b>Molecular Weight:</b>	N/D
<b>Viscosity:</b>	600–2000
<b>Flammable Limits:</b>	N/A
<b>Autoignition Temperature:</b>	N/A
<b>Density:</b>	8.42 lb/ga

Vapor Pressure:  
% VOC

Similar to water  
N/D

## ***Section 10. Stability and Reactivity***

---

**Chemical Stability:** Stable at normal temperatures and pressures.

**Incompatibility with Various Substances:** Strong oxidizers, Excessive heat

**Hazardous Decomposition Products:** Carbon dioxide, Carbon monoxide

**Possibility of Hazardous Reactions:** None known.

## ***Section 11. Toxicological Information***

---

Chemical Name	Exposure	Type of Effect	Concentration	Species
N/D				

**Comments:** None.

## ***Section 12. Ecological Information***

---

Species	Duration	Type of Effect	Test Results
Ceriodaphnia dubia	48h	LC50	7878 mg/l
Fathead Minnow	96h	LC50	4204 mg/l
	48h	LC50	4665 mg/l
Daphnia pulex	48h	LC50	>10000 mg/l

**Comments:** None.

## ***Section 13. Disposal Considerations***

---

Dispose of in accordance with local, state and federal regulations.

## ***Section 14. Transport Information***

---

### **DOT**

**Proper Shipping Name:** COMPOUND, INDUSTRIAL WATER TREATMENT, LIQUID  
**Technical Name:** N/A  
**Hazard Class:** Not D.O.T. Regulated  
**UN/NA#:** N/A  
**Packing Group:** N/A

### **IMDG**

**Proper Shipping Name:** COMPOUND, INDUSTRIAL WATER TREATMENT, LIQUID  
**Technical Name:** N/A  
**Hazard Class:** Not D.O.T. Regulated  
**UN/NA#:** N/A  
**Packing Group:** N/A

### **TDG**

**Proper Shipping Name:** COMPOUND, INDUSTRIAL WATER TREATMENT, LIQUID  
**Technical Name:** N/A  
**Hazard Class:** Not D.O.T. Regulated  
**UN/NA#:** N/A  
**Packing Group:** N/A

### **ICAO**

**Proper Shipping Name:** COMPOUND, INDUSTRIAL WATER TREATMENT, LIQUID  
**Technical Name:** N/A  
**Hazard Class:** Not D.O.T. Regulated  
**UN/NA#:** N/A  
**Packing Group:** N/A

## ***Section 15. Regulatory Information***

---

### **Inventory Status**

**United States (TSCA):** All ingredients listed.  
**Canada (DSL/NDSL):** All ingredients listed.

**Federal Regulations**

**SARA Title III Rules**

**Sections 311/312 Hazard Classes**

**Fire Hazard:** No  
**Reactive Hazard:** No  
**Release of Pressure:** No  
**Acute Health Hazard:** Yes  
**Chronic Health Hazard:** No

**Other Sections**

Component	Section 313 Toxic Chemical	Section 302 EHS TPQ	CERCLA RQ
There are no hazardous ingredients in this product as defined in 29 CFR 1910.1200.	N/A	N/A	N/A

**Comments:** None.

**State Regulations**

**California Proposition 65:** None known.

**Special Regulations**

Component	States
There are no hazardous ingredients in this product as defined in 29 CFR 1910.1200.	None

**International Regulations**

**Canada**

**WHMIS Classification:** N/A

**Controlled Product Regulations (CPR):** N/A



## Section 16. Other Information

---

### HMIS Hazard Rating

**Health:** 1  
**Flammability:** 1  
**Physical Hazard:** 0  
**PPE:** X

**Notes:** The PPE rating depends on circumstances of use. See Section 8 for recommended PPE.  
 The Hazardous Material Information System (HMIS) is a voluntary, subjective alpha-numeric symbolic system for recommending hazard risk and personal protection equipment information. It is a subjective rating system based on the evaluator's understanding of the chemical associated risks. The end-user must determine if the code is appropriate for their use.

**NSF:** N/A

**FDA:** N/A

**KOSHER:** This product has not been evaluated for Kosher approval.

**FIFRA:** N/A

**Other:** None

### Abbreviations

Abbreviation	Definition
<	Less Than
>	Greater Than
ACGIH	American Conference of Governmental Industrial Hygienists
EHS	Environmental Health and Safety Dept
N/A	Not Applicable
N/D	Not Determined
N/E	Not Established
OSHA	Occupational Health and Safety Dept
PEL	Personal Exposure Limit
STEL	Short Term Exposure Limit
TLV	Threshold Limit Value
TWA	Time Weight Average
UNK	Unknown

Prepared by: Regulatory Affairs Department



## *Disclaimer*

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Bill of Lading # -0505537

SULFURIC ACID 66 DEG BE

November 25, 2014

SAFETY CONTACT  
ENVIRO ANALYTICS GROUP  
1430 SPARROWS POINT BLVD  
SPARROWS POINT MD, 21219

DEAR SAFETY CONTACT

We have enclosed Material Safety Data Sheets for those chemicals you have just received from us either for the first time or since our last MSDS revision.

Product Name: SULFURIC ACID 66 DEG BE

The OSHA right to know requires that you distribute or make available the MSDS's to people in your company who are involved with these chemicals.

We thank you for your valued business and hope we may continue to merit serving your future requirements.

Very truly yours,  
*Jack Thorne*  
*Director of Quality Assurance*

## Material Safety Data Sheet

### Sulfuric Acid

#### 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

**PRODUCT NAME:** Sulfuric Acid  
**OTHER/GENERIC NAMES:** Sulfuric Acid, Battery Acid  
**PRODUCT USE:** Industrial Chemical.  
**MANUFACTURER:** Honeywell  
101 Columbia Road  
Morristown, New Jersey 07962-1139

**FOR MORE INFORMATION CALL:**  
(Monday-Friday, 8:30am-5:00 pm) (EST)  
Customer Service  
1-877-370-7007

**IN CASE OF EMERGENCY CALL:**  
(24 Hours/Day, 7 Days/Week)  
1-800-707-4555 (Honeywell)  
Transportation Emergencies  
1-800-424-9300 (CHEMTREC-Domestic)  
703-527-3887 (CHEMTREC - International)  
Health Emergencies  
1-800-498-5701 (PROSAR)

#### 2. COMPOSITION/INFORMATION ON INGREDIENTS

<u>INGREDIENT NAME</u>	<u>CAS NUMBER</u>	<u>WEIGHT %</u>
Sulfuric Acid	7664-93-9	93.0 - 99.0
Water	7732-18-5	1.0 - 7.0

Trace impurities and additional material names not listed above may also appear in Section 15 towards the end of the MSDS. These materials may be listed for local "Right-To-Know" compliance and for other reasons.

#### 3. HAZARDS IDENTIFICATION

**EMERGENCY OVERVIEW:** An oily, colorless to slightly yellow, clear to turbid liquid. Odorless. Corrosive. Causes severe burns to skin, eyes and respiratory tract. Do not get in eyes, on skin or on clothing. Do not breathe vapor or mist.

#### POTENTIAL HEALTH HAZARDS

- SKIN:** Can cause severe burns.
- EYES:** Liquid contact can cause irritation, corneal burns, and conjunctivitis. Blindness, or severe or permanent injury may result.

MSDS Number: HPWI-0003  
Current Issue Date: January 2007

Page 1 of 7

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## Material Safety Data Sheet

### Sulfuric Acid

**INHALATION:** Inhalation of fumes or acid mist can cause irritation or corrosive burns to the upper respiratory system, including nose, mouth, and throat. Lung irritation and pulmonary edema can also occur.

**INGESTION:** Can cause irritation and corrosive burns to mouth, throat, and stomach. Can be fatal if swallowed.

**DELAYED EFFECTS:** Erosion of teeth, lesions of the skin, tracheo-bronchitis, mouth inflammation, conjunctivitis, and gastritis. NOTE: IARC has classified workplace exposures to sulfuric acid mist as a Group 1 carcinogen (known human carcinogen).

Ingredients found on one of the OSHA designated carcinogen lists are listed below.

<u>INGREDIENT NAME</u>	<u>NTP STATUS</u>	<u>IARC STATUS</u>	<u>OSHA LIST</u>
Sulfuric Acid	No	No *(See Section 3-Delayed Effects	No

#### 4. FIRST AID MEASURES

**SKIN:** Immediately flush with plenty of water for at least 15 minutes. Remove contaminated clothing while washing. Continue flushing with water if medical attention is not immediately available. Get immediate medical attention for irritation or burns.

**EYES:** Immediately flush eyes with water for at least 15 minutes. Get immediate medical attention.

**INHALATION:** Remove to fresh air. Observe for possible delayed reaction. If breathing has stopped, apply artificial respiration. If breathing is difficult, give oxygen provided a qualified operator is available. Get immediate medical attention.

**INGESTION:** Do not induce vomiting. If conscious, give several glasses of milk (preferred) or water. Get immediate medical attention.

**ADVICE TO PHYSICIAN:** No additional instructions.

## Material Safety Data Sheet

### Sulfuric Acid

#### 5. FIRE FIGHTING MEASURES

##### FLAMMABLE PROPERTIES

FLASH POINT: Not flammable.

FLASH POINT METHOD: Not applicable.

AUTOIGNITION TEMPERATURE: Not applicable.

UPPER FLAME LIMIT (Volume % in air): Not applicable.

LOWER FLAME LIMIT (Volume % in air): Not applicable.

FLAME PROPAGATION RATE (Solids): Not applicable.

OSHA FLAMMABILITY CLASS: Not flammable.

##### EXTINGUISHING MEDIA:

If involved in a fire, use water spray; avoid spraying water into containers. If only a small amount of combustibles is present, smother fire with dry chemical. Do not use solid water streams near ruptured tanks or spills of sulfuric acid. Acid reacts violently with water can can spatter acid onto personnel.

##### UNUSUAL FIRE AND EXPLOSION HAZARDS:

Flammable and potentially explosive hydrogen gas can be generated inside metal drums and storage tanks. Concentrated sulfuric acid can ignite combustible materials on contact.

##### SPECIAL FIRE FIGHTING PRECAUTIONS/INSTRUCTIONS:

At high temperatures, sulfuric acid mist or sulfur trioxide gas can be released from vented or ruptured containers. If water is added to concentrated sulfuric acid, violent spattering can occur, and considerable heat may be evolved. Wear NIOSH approved self-contained breathing apparatus with full facepiece and full protective clothing. Cool non-leaking fire-exposed containers with water spray.

#### 6. ACCIDENTAL RELEASE MEASURES

**IN CASE OF SPILL OR OTHER RELEASE:** (Always wear recommended personal protective equipment.) Dilute small spills or leaks cautiously with plenty of water. Neutralize residue with alkali such as soda ash or lime. Adequate ventilation is required when adding soda ash due to release of carbon dioxide gas. Major spills must be handled by a pre-determined plan. Diking with soda ash is recommended. Attempt to keep out of sewer. Any release to the environment of this product may be subject to Federal and/or State reporting requirements.

Spills and releases may have to be reported to Federal and/or local authorities. See the Regulatory Information (#15) regarding requirements.



## Material Safety Data Sheet

### Sulfuric Acid

#### 7. HANDLING AND STORAGE

**NORMAL HANDLING:** (Always wear recommended personal protective equipment.)

Do not get in eyes, on skin or on clothing. Do not breath vapor or mist. Use only with adequate ventilation and with protective equipment. Do not add water to acid. When diluting, always add acid to water cautiously and with agitation.

**STORAGE RECOMMENDATIONS:** Protect from physical damage. Store in cool, well-ventilated area away from comubstibles and reactive chemicals. Keep out of sun and away from heat. Keep containers upright. Vent tanks routinely to prevent hydrogen gas buildup.

#### 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

**ENGINEERING CONTROLS:** Use ventilation sufficient to reduce vapor and acid mists to permissible levels. Packaging and unloading areas and open processing equipment may require mechanical exhaust systems. Corrosion-proof construction recommended..

##### PERSONAL PROTECTIVE EQUIPMENT

**SKIN PROTECTION:** As a minimum, wear acid-resistant apron (preferably rubber), protective clothing, boots, and gauntlet gloves gloves for routine product use. For increased protection, include acid-resistant trousers and jacket.

**EYE PROTECTION:** As a minium, wear hard hat, chemical safety goggles, and full-face shield. Do not wear contact lenses. For increased protection, use supplied-air acid hood.

**RESPIRATORY PROTECTION:** Minimum recommended respiratory protection for exposures above the PEL/TLV: NIOSH approved full-face mask with acid gas/high efficiency particulate canister/cartridges. Exposures above 100 mg/m<sup>3</sup> require a self-contained breathing apparatus with full facepiece or supplied-air respirator with a full facepiece, helmet or hood. llowing:

**ADDITIONAL RECOMMENDATIONS:** Eyewash and quick-drench shower facilities (protected from freezing) should be available wherever sulfuric acid is stored and handled. Neutralization supplies and equipment should also be available.

**EXPOSURE GUIDELINES** (Guidelines exist for the following ingredients)

<u>INGREDIENT NAME</u>	<u>ACGIH TLV</u>	<u>OSHA PEL</u>	<u>OTHER LIMIT</u>
Sulfuric Acid	0.2 mg/m <sup>3</sup> TWA	1 mg/m <sup>3</sup> TWA; Vapor:	None

- \* = Limit established by Honeywell for internal use.
- \*\* = Workplace Environmental Exposure Level (AIHA).
- \*\*\* = Biological Exposure Index (ACGIH).

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## Material Safety Data Sheet

### Sulfuric Acid

Other exposure limits for the decomposition products normally associated with product use are as follows:

None.

#### 9. PHYSICAL AND CHEMICAL PROPERTIES

**APPEARANCE:** Oily, colorless to slightly yellow, clear to turbid liquid.

**PHYSICAL STATE:** Liquid.

**MOLECULAR WEIGHT:** 98.08

**CHEMICAL FORMULA:** H<sub>2</sub>SO<sub>4</sub>.

**ODOR:** Odorless.

**SPECIFIC GRAVITY:** (Water = 1.0) 1.8354 (93.19%)  
1.8407 (95.0%)

**SOLUBILITY IN WATER:** (Weight %) Complete.

**PH:** 0.9 (1% solution).

**BOILING POINT:** 279.4°C (93.19%)

296.7°C (95.0%)

**MELTING POINT:** -29.4°C (95.0%)

-22.2°C (95.0%)

**VAPOR PRESSURE:** Negligible @ ambient.

**VAPOR DENSITY:** (Air = 1.0) Not applicable.

**EVAPORATION RATE:** Not applicable. Compared to: Not applicable.

**% VOLATILES:** Not applicable.

**FLASH POINT:** Not flammable.

(Flash point method and additional flammability data are found in section 5.)

#### 10. STABILITY AND REACTIVITY

##### NORMALLY STABLE? (CONDITIONS TO AVOID):

Stable under normal conditions. Avoid temperatures of 300°C or higher: yields sulfur trioxide gas, which is toxic, corrosive, and an oxidizer.

**INCOMPATIBILITIES:** Nitro compounds, carbides, dienes, alcohols (when heated): cause explosions. Oxidizing agents, such as chlorates and permanganates: cause fires and possibly explosions. Allyl compounds and aldehydes: undergo polymerization, possibly violent. Alkalis, amines, water, hydrated salts, carboxylic acid anhydrides, nitriles, olefinic organics, glycols, aqueous acids: cause strong exothermic reactions. Carbonates, cyanides, sulfides, sulfites, metals such as copper: yield toxic gases.

**HAZARDOUS DECOMPOSITION PRODUCTS:** Sulfur trioxide gas. This is also fire risk if in contact with organic materials.

**HAZARDOUS POLYMERIZATION:** Will not occur.



## Material Safety Data Sheet

### Sulfuric Acid

#### 11. TOXICOLOGICAL INFORMATION

**IMMEDIATE (ACUTE) EFFECTS:**

LD<sub>50</sub> (rat): 510 mg/kg  
Eye (rabbit); Severe; 1300 ug

**DELAYED (SUBCHRONIC AND CHRONIC) EFFECTS:** LARC has classified workplace exposure to sulfuric acid mist as a Group 1 carcinogen (known human carcinogen).

**OTHER DATA:**

None.

#### 12. ECOLOGICAL INFORMATION

24.5 ppm/24 hr./bluegill/lethal/fresh water  
42.5 ppm/48 hr./prawn/LC<sub>50</sub>/salt water

#### 13. DISPOSAL CONSIDERATIONS

RCRA

Is the unused product a RCRA hazardous waste if discarded? Yes.  
If yes, the RCRA ID number is: D002

**OTHER DISPOSAL CONSIDERATIONS:** Waste sulfuric acid should be cautiously diluted with water and neutralized with an alkali. Neutralized waste must be disposed of in accordance with applicable disposal regulations. Waste may have to be disposed of by an approved contractor. (EPA corrosive waste -- D002 applicable to the unneutralized acid).

The information offered here is for the product as shipped. Use and/or alterations to the product such as mixing with other materials may significantly change the characteristics of the material and alter the RCRA classification and the proper disposal method.

#### 14. TRANSPORT INFORMATION

**US DOT HAZARD CLASS:** PROPER DOT SHIPPING DESC.: Sulfuric acid, 8, UN1830, PGII  
US DOT HAZARD CLASS: 8, Corrosive  
US DOT ID NUMBER: UN1830  
ERG NUMBER (2004 Edition): Guide No. 137

**UN ID NUMBER:** UN 1830  
UN 1832 (spent sulfuric acid)

For additional information on shipping regulations affecting this material, contact the information number found on the first page.

## Material Safety Data Sheet

### Sulfuric Acid

#### 15. REGULATORY INFORMATION

##### TOXIC SUBSTANCES CONTROL ACT (TSCA)

TSCA INVENTORY STATUS: Material is on the TSCA Inventory.

OTHER TSCA ISSUES: None.

##### SARA TITLE III/CERCLA

###### RQs & TPQs:

"Reportable Quantities" (RQs) and/or "Threshold Planning Quantities" (TPQs) exist for the following ingredients.

<u>INGREDIENT NAME</u>	<u>SARA/CERCLA RQ (lb)</u>	<u>SARA EHS TPQ (lb)</u>
Sulfuric Acid	1000	1000

Spills or releases resulting in the loss of any ingredient at or above its RQ requires immediate notification to the National Response Center [(800) 424-8802] and to your Local Emergency Planning Committee.

SECTION 311 HAZARD CLASS: Immediate.

##### SARA 313 TOXIC CHEMICALS:

The following ingredients are SARA 313 "Toxic Chemicals". CAS numbers and weight percents are found in Section # 2.

<u>INGREDIENT</u>	<u>COMMENT</u>
Sulfuric Acid	None

##### STATE RIGHT-TO-KNOW

\*No addition to the ingredients found in section 2, the following are listed for state right-to-know purposes.

<u>INGREDIENT</u>	<u>WEIGHT %</u>	<u>COMMENT</u>
*No ingredients listed in this section*		

##### ADDITIONAL REGULATORY INFORMATION:

Sulfuric acid is considered a DEA Precursor and Essential Chemical (21 CFR Parts 1310 and 1313).

##### WHMIS CLASSIFICATION (CANADA):

Class E.

##### FOREIGN INVENTORY STATUS:

Canadian DSL (Domestic Substances List)

EINECS (European Inventory of Existing Commercial Chemical Substances)

## **Material Safety Data Sheet**

### **Sulfuric Acid**

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#### **16. OTHER INFORMATION**

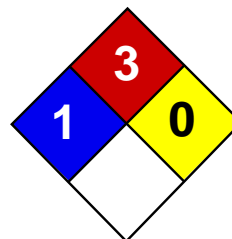
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**CURRENT ISSUE DATE:** January 2, 2007  
**PREVIOUS ISSUE DATE:** April 21, 2006

**CHANGES TO MSDS FROM PREVIOUS ISSUE DATE ARE DUE TO THE FOLLOWING:**

Change name AlliedSignal to Honeywell  
Section 14 technical corrections.  
Updated ACGIH TLV values.

**OTHER INFORMATION:** None.



Health	2
Fire	3
Reactivity	0
Personal Protection	H

## Material Safety Data Sheet

### Methyl alcohol MSDS

#### Section 1: Chemical Product and Company Identification

**Product Name:** Methyl alcohol

**Catalog Codes:** SLM3064, SLM3952

**CAS#:** 67-56-1

**RTECS:** PC1400000

**TSCA:** TSCA 8(b) inventory: Methyl alcohol

**CI#:** Not applicable.

**Synonym:** Wood alcohol, Methanol; Methylol; Wood Spirit; Carbinol

**Chemical Name:** Methanol

**Chemical Formula:** CH<sub>3</sub>OH

**Contact Information:**

**Sciencelab.com, Inc.**

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: [ScienceLab.com](http://ScienceLab.com)

**CHEMTREC (24HR Emergency Telephone), call:**

1-800-424-9300

**International CHEMTREC, call:** 1-703-527-3887

**For non-emergency assistance, call:** 1-281-441-4400

#### Section 2: Composition and Information on Ingredients

**Composition:**

Name	CAS #	% by Weight
Methyl alcohol	67-56-1	100

**Toxicological Data on Ingredients:** Methyl alcohol: ORAL (LD50): Acute: 5628 mg/kg [Rat]. DERMAL (LD50): Acute: 15800 mg/kg [Rabbit]. VAPOR (LC50): Acute: 64000 ppm 4 hours [Rat].

#### Section 3: Hazards Identification

**Potential Acute Health Effects:**

Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator). Severe over-exposure can result in death.

**Potential Chronic Health Effects:**

Slightly hazardous in case of skin contact (sensitizer). CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Classified POSSIBLE for human. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to eyes. The substance may be toxic to blood, kidneys, liver, brain, peripheral nervous system, upper respiratory tract, skin, central nervous system (CNS), optic nerve. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

#### Section 4: First Aid Measures

**Eye Contact:**

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention.

**Skin Contact:**

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

**Serious Skin Contact:**

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

**Inhalation:**

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

**Serious Inhalation:**

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

**Ingestion:**

If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

**Flammability of the Product:** Flammable.

**Auto-Ignition Temperature:** 464°C (867.2°F)

**Flash Points:** CLOSED CUP: 12°C (53.6°F). OPEN CUP: 16°C (60.8°F).

**Flammable Limits:** LOWER: 6% UPPER: 36.5%

**Products of Combustion:** These products are carbon oxides (CO, CO<sub>2</sub>).

**Fire Hazards in Presence of Various Substances:**

Highly flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

**Explosion Hazards in Presence of Various Substances:**

Risks of explosion of the product in presence of mechanical impact: Not available. Explosive in presence of open flames and sparks, of heat.

**Fire Fighting Media and Instructions:**

Flammable liquid, soluble or dispersed in water. **SMALL FIRE:** Use DRY chemical powder. **LARGE FIRE:** Use alcohol foam, water spray or fog.

**Special Remarks on Fire Hazards:**

Explosive in the form of vapor when exposed to heat or flame. Vapor may travel considerable distance to source of ignition and flash back. When heated to decomposition, it emits acrid smoke and irritating fumes. **CAUTION: MAY BURN WITH NEAR INVISIBLE FLAME**

**Special Remarks on Explosion Hazards:**

Forms an explosive mixture with air due to its low flash point. Explosive when mixed with Chloroform + sodium methoxide and diethyl zinc. It boils violently and explodes.

## Section 6: Accidental Release Measures

**Small Spill:**

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

**Large Spill:**

Flammable liquid. Poisonous liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

## Section 7: Handling and Storage

**Precautions:**

Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, metals, acids.

**Storage:**

Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

## Section 8: Exposure Controls/Personal Protection

**Engineering Controls:**

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

**Personal Protection:**

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

**Personal Protection in Case of a Large Spill:**

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

**Exposure Limits:**

TWA: 200 from OSHA (PEL) [United States] TWA: 200 STEL: 250 (ppm) from ACGIH (TLV) [United States] [1999] STEL: 250 from NIOSH [United States] TWA: 200 STEL: 250 (ppm) from NIOSH SKIN TWA: 200 STEL: 250 (ppm) [Canada] Consult local authorities for acceptable exposure limits.

## Section 9: Physical and Chemical Properties

**Physical state and appearance:** Liquid.

**Odor:** Alcohol like. Pungent when crude.

**Taste:** Not available.

**Molecular Weight:** 32.04 g/mole

**Color:** Colorless.

**pH (1% soln/water):** Not available.

**Boiling Point:** 64.5°C (148.1°F)

**Melting Point:** -97.8°C (-144°F)

**Critical Temperature:** 240°C (464°F)

**Specific Gravity:** 0.7915 (Water = 1)

**Vapor Pressure:** 12.3 kPa (@ 20°C)

**Vapor Density:** 1.11 (Air = 1)

**Volatility:** Not available.

**Odor Threshold:** 100 ppm

**Water/Oil Dist. Coeff.:** The product is more soluble in water;  $\log(\text{oil/water}) = -0.8$

**Ionicity (in Water):** Non-ionic.

**Dispersion Properties:** See solubility in water.

**Solubility:** Easily soluble in cold water, hot water.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Heat, ignition sources, incompatible materials

**Incompatibility with various substances:** Reactive with oxidizing agents, metals, acids.

**Corrosivity:** Non-corrosive in presence of glass.

### Special Remarks on Reactivity:

Can react vigorously with oxidizers. Violent reaction with alkyl aluminum salts, acetyl bromide, chloroform + sodium methoxide, chromic anhydride, cyanuric chloride, lead perchlorate, phosphorous trioxide, nitric acid. Exothermic reaction with sodium hydroxide + chloroform. Incompatible with beryllium dihydride, metals (potassium and magnesium), oxidants (barium perchlorate, bromine, sodium hypochlorite, chlorine, hydrogen peroxide), potassium tert-butoxide, carbon tetrachloride, alkali metals, metals (aluminum, potassium magnesium, zinc), and dichloromethane. Rapid autocatalytic dissolution of aluminum, magnesium or zinc in 9:1 methanol + carbon tetrachloride - sufficiently vigorous to be rated as potentially hazardous. May attack some plastics, rubber, and coatings.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** Will not occur.

## Section 11: Toxicological Information

**Routes of Entry:** Absorbed through skin. Eye contact. Inhalation. Ingestion.

### Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 5628 mg/kg [Rat]. Acute dermal toxicity (LD50): 15800 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 64000 4 hours [Rat].

### Chronic Effects on Humans:

MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Classified POSSIBLE for human. Causes damage to the following organs: eyes. May cause damage to the following organs: blood, kidneys, liver, brain, peripheral nervous system, upper respiratory tract, skin, central nervous system (CNS), optic nerve.

### Other Toxic Effects on Humans:

Hazardous in case of skin contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:**

Passes through the placental barrier. May affect genetic material. May cause birth defects and adverse reproductive effects(paternal and maternal effects and fetotoxicity ) based on animal studies.

**Special Remarks on other Toxic Effects on Humans:**

## Section 12: Ecological Information

**Ecotoxicity:** Ecotoxicity in water (LC50): 29400 mg/l 96 hours [Fathead Minnow].

**BOD5 and COD:** Not available.

**Products of Biodegradation:**

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

**Toxicity of the Products of Biodegradation:** The products of degradation are less toxic than the product itself.

**Special Remarks on the Products of Biodegradation:**

Methanol in water is rapidly biodegraded and volatilized. Aquatic hydrolysis, oxidation, photolysis, adsorption to sediment, and bioconcentration are not significant fate processes. The half-life of methanol in surfact water ranges from 24 hrs. to 168 hrs. Based on its vapor pressure, methanol exists almost entirely in the vapor phase in the ambient atmosphere. It is degraded by reaction with photochemically produced hydroxyl radicals and has an estimated half-life of 17.8 days. Methanol is physically removed from air by rain due to its solubility. Methanol can react with NO<sub>2</sub> in polluted to form methyl nitrate. The half-life of methanol in air ranges from 71 hrs. (3 days) to 713 hrs. (29.7 days) based on photooxidation half-life in air.

## Section 13: Disposal Considerations

**Waste Disposal:**

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

## Section 14: Transport Information

**DOT Classification:** CLASS 3: Flammable liquid.

**Identification:** : Methyl alcohol UNNA: 1230 PG: II

**Special Provisions for Transport:** Not available.

## Section 15: Other Regulatory Information

**Federal and State Regulations:**

Connecticut hazardous material survey.: Methyl alcohol Illinois toxic substances disclosure to employee act: Methyl alcohol Illinois chemical safety act: Methyl alcohol New York release reporting list: Methyl alcohol Rhode Island RTK hazardous substances: Methyl alcohol Pennsylvania RTK: Methyl alcohol Minnesota: Methyl alcohol Massachusetts RTK: Methyl alcohol Massachusetts spill list: Methyl alcohol New Jersey: Methyl alcohol New Jersey spill list: Methyl alcohol Louisiana spill reporting: Methyl alcohol California Directors List of Hazardous Substances (8CCR 339): Methyl alcohol Tennessee Hazardous Right to Know : Methyl alcohol TSCA 8(b) inventory: Methyl alcohol SARA 313 toxic chemical notification and release reporting: Methyl alcohol CERCLA: Hazardous substances.: Methyl alcohol: 5000 lbs. (2268 kg)

**Other Regulations:**

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

**Other Classifications:**

**WHMIS (Canada):**

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC). Class D-2B: Material causing other toxic effects (TOXIC).



**DSCL (EEC):**

R11- Highly flammable. R23/24/25- Toxic by inhalation, in contact with skin and if swallowed. R39- Danger of very serious irreversible effects. R39/23/24/25- Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed. S7- Keep container tightly closed. S16- Keep away from sources of ignition - No smoking. S36/37- Wear suitable protective clothing and gloves. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

**HMIS (U.S.A.):**

**Health Hazard:** 2

**Fire Hazard:** 3

**Reactivity:** 0

**Personal Protection:** h

**National Fire Protection Association (U.S.A.):**

**Health:** 1

**Flammability:** 3

**Reactivity:** 0

**Specific hazard:**

**Protective Equipment:**

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

**Section 16: Other Information****References:**

-SAX, N.I. Dangerous Properties of Industrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec. -Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. LOLI, HSDB, RTECS, HAZARDTEXT, REPROTOX databases

**Other Special Considerations:** Not available.

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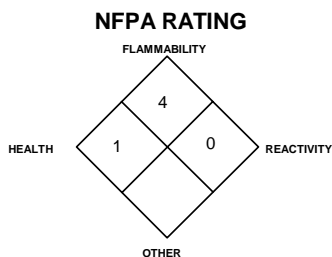
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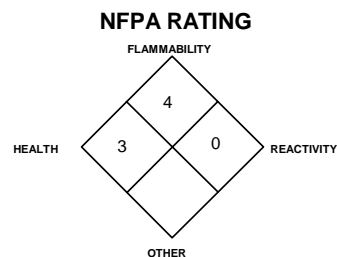


# MATERIAL SAFETY DATA SHEET

## METHANE GAS



## LIQUID METHANE



Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

## **PART I** *What is the material and what do I need to know in an emergency?*

### 1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS:

**METHANE - CH<sub>4</sub>, Gaseous**  
**Including CH<sub>4</sub> with impurities**

Document Number: Methane  
For general analytic/synthetic chemical uses.

PRODUCT USE:

SUPPLIER/MANUFACTURER'S NAME:

MESA Specialty Gases & Equipment

ADDRESS:

3619 Pendleton Avenue, Suite C  
Santa Ana, CA 92704

BUSINESS PHONE:

1-714-434-7102

EMERGENCY PHONE:

INFOTRAC: 1-800-535-5053

### 2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA		IDLH ppm	OTHER
			TLV Ppm	STEL ppm	PEL ppm	STEL ppm		
Methane	74-82-8	> 98.0%	There are no specific exposure limits for Methane. Methane is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.					
Maximum Impurities Including Carbon Monoxide, Carbon Dioxide, Hydrogen, Hydrogen Sulfide		< 2.0%	None of the trace impurities in this mixture contribute significantly to the hazards associated with the product. All hazard information pertinent to this product has been provided in this Material Safety Data Sheet, per the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200) and State equivalent standards.					

NE = Not Established

C = Ceiling Limit

See Section 16 for Definitions of Terms Used

NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

### 3. HAZARD IDENTIFICATION

**EMERGENCY OVERVIEW:** Methane is an odorless, colorless gas, or a colorless, odorless liquid in its cryogenic form. Both the liquid and the gas pose a serious fire hazard when accidentally released. The liquid will rapidly boil to the gas at standard temperatures and pressures. As a gas, it will act as a simple asphyxiant and present a significant health hazard by displacing the oxygen in the atmosphere. The gas is lighter than air and may spread long distances. Distant ignition and flashback are possible. The liquefied gas can cause frostbite to any contaminated tissue. Rapid evaporation of the liquid from the cylinder may cause frostbite. Flame or high temperature impinging on a localized area of the cylinder of Methane can cause the cylinder to rupture without activating the cylinder's relief devices. Provide adequate fire protection during emergency response situations. Allow the released gas to dissipate in the atmosphere.

**SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE:** The most significant route of overexposure for this gas is by inhalation. The following paragraphs describe symptoms of exposure by route of exposure.

**INHALATION:** High concentrations of this gas can cause an oxygen-deficient environment. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. Under some circumstances of overexposure, death may occur. Isobutylene also has some degree of anesthetic action and can be mildly irritating to the mucous membranes. The effects associated with various levels of oxygen are as follows:

<b>CONCENTRATION</b>	<b>SYMPTOMS OF EXPOSURE</b>
12-16% Oxygen:	Breathing and pulse rate increased, muscular coordination slightly disturbed.
10-14% Oxygen:	Emotional upset, abnormal fatigue, disturbed respiration.
6-10% Oxygen:	Nausea and vomiting, collapse or loss of consciousness.
Below 6%:	Convulsive movements, possible respiratory collapse, and death.



**OTHER POTENTIAL HEALTH EFFECTS:** Contact with cryogenic liquid or rapidly expanding gases (which are released under high pressure) may cause frostbite. Symptoms of frostbite include change in skin color to white or grayish-yellow. The pain after contact with the liquid can quickly subside.

**HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms.** Overexposure to Methane may cause the following health effects:

**ACUTE:** The most significant hazard associated with this gas is inhalation of oxygen-deficient atmospheres. Symptoms of oxygen deficiency include respiratory difficulty, headache, dizziness, and nausea. At high concentrations, unconsciousness or death may occur. Contact with cryogenic liquid or rapidly expanding gases may cause frostbite.

**CHRONIC:** There are currently no known adverse health effects associated with chronic exposure to Methane.

**TARGET ORGANS:** Respiratory system.

<b>HAZARDOUS MATERIAL INFORMATION SYSTEM</b>			
<b>HEALTH</b>		(BLUE)	1
<b>FLAMMABILITY</b>		(RED)	4
<b>REACTIVITY</b>		(YELLOW)	0
<b>PROTECTIVE EQUIPMENT</b>			B
EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8
For routine industrial applications			

**See Section 16 for Definition of Ratings**

## PART II *What should I do if a hazardous situation occurs?*

### 4. FIRST-AID MEASURES

**RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO METHANE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT.** At a minimum, Self-Contained Breathing Apparatus and Fire-Retardant Personal Protective equipment should be worn. Adequate fire protection must be provided during rescue situations.

## 4. FIRST-AID MEASURES (Continued)

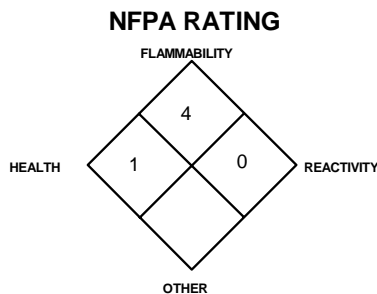
Remove victim(s) to fresh air as quickly as possible. Trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary. Only trained personnel should administer supplemental oxygen.

In case of frostbite, place the frostbitten part in warm water. DO NOT USE HOT WATER. If warm water is not available, or is impractical to use, wrap the affected parts gently in blankets. Alternatively, if the fingers or hands are frostbitten, place the affected area in the armpit. Encourage victim to gently exercise the affected part while being warmed. Seek immediate medical attention. Victim(s) must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to physician or other health professional with victim(s).

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## 5. FIRE-FIGHTING MEASURES

### METHANE GAS



FLASH POINT (Closed Cup):  
-187°C (-306°F)

AUTOIGNITION TEMPERATURE:  
650°C (1202°F)

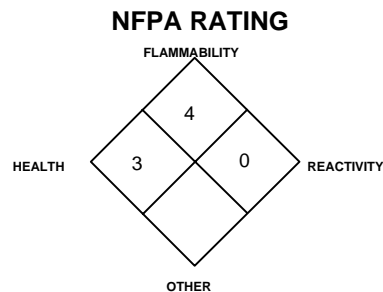
FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): 5.0%

Upper (UEL): 15.0%

**See Section 16 for Definition of Ratings**

### LIQUID METHANE



FIRE EXTINGUISHING MATERIALS: Extinguish fires of this gas by shutting off the source of the gas. Use water spray to cool fire-exposed containers, structures, and equipment.

UNUSUAL FIRE AND EXPLOSION HAZARDS: When involved in a fire, this gas will ignite and produce toxic gases including carbon monoxide and carbon dioxide. An extreme explosion hazard exists in areas in which the gas has been released, but the material has not yet ignited.

**DANGER!** Fires impinging (direct flame) on the outside surface of unprotected pressure storage vessels of Methane can be very dangerous. Direct flame exposure on the cylinder wall can cause an explosion either by BLEVE (Boiling Liquid Expanding Vapor Explosion) or by exothermic decomposition. This is a catastrophic failure of the vessel releasing the contents into a massive fireball and explosion. The resulting fire and explosion can result in severe equipment damage and personnel injury or death over a large area around the vessel. For massive fires in large areas, use unmanned hose holder or monitor nozzles; if this is not possible, withdraw from area and allow fire to burn.

**RESPONSE TO FIRE INVOLVING CRYOGEN:** Cryogenic liquids can be particularly dangerous during fires because of their potential to rapidly freeze water. Careless use of water may cause heavy icing. Furthermore, relatively warm water greatly increases the evaporation rate of Methane. If large concentrations of Methane gas are present, the water vapor in the surrounding air will condense, creating a dense fog that may make it difficult to find fire exits or equipment. Liquid Methane, when exposed to the atmosphere, will produce a cloud of ice/fog in the air upon its release. A flammable mixture will exist within the vapor cloud and it is advisable that personnel keep well outside the area of visible moisture.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Static discharge may cause Methane to ignite explosively.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural fire-fighters must wear Self-Contained Breathing Apparatus and full protective equipment. The best fire-fighting technique may be simply to let the burning gas escape from the pressurized cylinder, tank car, or pipeline. Stop the leak before extinguishing fire. If the fire is extinguished before the leak is sealed, the still-leaking gas could explosively re-ignite without warning and cause extensive damage, injury, or fatality. In this case, increase ventilation (in enclosed areas) to prevent flammable or explosive mixture formation. For large releases, consider evacuation. Refer to the North American Emergency Response Guidebook for additional information.

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## 6. ACCIDENTAL RELEASE MEASURES

**SPILL AND LEAK RESPONSE:** Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a release, clear the affected area, protect people, and respond with trained personnel. Adequate fire protection must be provided. Minimum Personal Protective Equipment should be **Level B: fire-retardant protective clothing, gloves resistant to tears, and Self-Contained Breathing Apparatus.**

Use only non-sparking tools and equipment. Locate and seal the source of the leaking gas. Protect personnel attempting the shut-off with water-spray. Allow the gas, which is lighter than air, to dissipate. Liquid Methane, when exposed to the atmosphere, will produce a cloud of ice/fog in the air upon its release. A flammable mixture will exist within the vapor cloud, and it is advisable that personnel keep well outside the area of visible moisture. If cryogenic liquid is released, keep area clear and allow the liquid to evaporate. The gas that is then formed should be allowed to dissipate.

Monitor the surrounding area for combustible gas levels and oxygen. The atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus. Combustible gas concentration must be below 10% of the LEL (LEL = 5.0%) prior to entry. Attempt to close the main source valve prior to entering the area. If this does not stop the release (or if it is not possible to reach the valve), allow the gas to release in-place or remove it to a safe area and allow the gas to be released there.

**RESPONSE TO CRYOGENIC RELEASE:** Clear the affected area and allow the liquid to evaporate and the gas to dissipate. After the gas is formed, follow the instructions provided in the previous paragraphs. If the area must be entered by emergency personnel, SCBA, Kevlar gloves, and appropriate foot and leg protection must be worn.

**THIS IS AN EXTREMELY FLAMMABLE GAS.** Protection of all personnel and the area must be maintained.

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## **PART III** *How can I prevent hazardous situations from occurring?*

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### 7. HANDLING and STORAGE

**WORK PRACTICES AND HYGIENE PRACTICES:** As with all chemicals, avoid getting Methane IN YOU. Do not eat or drink while handling chemicals. Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of Methane could occur without any significant warning symptoms.

**STORAGE AND HANDLING PRACTICES:** Cylinders should be stored in dry, well-ventilated areas away from sources of heat. Compressed gases can present significant safety hazards. Store containers away from heavily trafficked areas and emergency exits. Post "No Smoking or Open Flames" signs in storage or use areas.

**SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS:** Protect cylinders against physical damage. Store in cool, dry, well-ventilated area, away from sources of heat, ignition and direct sunlight. Do not allow area where cylinders are stored to exceed 52°C (125°F). Isolate from oxidizers such as oxygen, chlorine, or fluorine. Use a check valve or trap in the discharge line to prevent hazardous backflow. Post "No Smoking or Open Flame" signs in storage and use areas. Cylinders should be stored upright and be firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Never tamper with pressure relief devices in valves and cylinders. Electrical equipment should be non-sparking or explosion proof. The following rules are applicable to work situations in which cylinders are being used:

**Before Use:** Move cylinders with a suitable hand truck. Do not drag, slide, or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap, if provided, in place until cylinder is ready for use.

**During Use:** Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Use check valve or trap in discharge line to prevent hazardous backflow into the cylinder. Do not use oils or grease on gas-handling fittings or equipment.

**After Use:** Close main cylinder valve. Replace valve protection cap, if provided. Mark empty cylinders "EMPTY".

**NOTE:** Use only DOT or ASME code containers. Earth-ground and bond all lines and equipment associated with Methane. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information refer to the Compressed Gas Association Pamphlet P-1, *Safe Handling of Compressed Gases in Containers*. Additionally, refer to CGA Bulletin SB-2 "Oxygen Deficient Atmospheres".

**PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT:** Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely. Purge gas handling equipment with inert gas (e.g., nitrogen) before attempting repairs.

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## 8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. Local exhaust ventilation is preferred, because it prevents Methane dispersion into the work place by eliminating it at its source. If appropriate, install automatic monitoring equipment to detect the presence of potentially explosive air-gas mixtures and the level of oxygen. Monitoring devices should be installed near the ceiling.

RESPIRATORY PROTECTION: Maintain oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection if oxygen levels are below 19.5% or during emergency response to a release of Methane. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134) or equivalent State standards.

EYE PROTECTION: Splash goggles or safety glasses, for protection from rapidly expanding gases and splashes of liquid Methane.

HAND PROTECTION: Wear gloves resistant to tears when handling cylinders of Methane. Use low-temperature protective gloves (e.g., Kevlar) when working with containers of liquid Methane.

BODY PROTECTION: Use body protection appropriate for task. Transfer of large quantities under pressure may require protective equipment appropriate to protect employees from splashes of liquefied product, as well as fire retardant items.

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## 9. PHYSICAL and CHEMICAL PROPERTIES

VAPOR DENSITY: 0.6784 kg/m<sup>3</sup> (0.042 35 lb/ft<sup>3</sup>)

SPECIFIC GRAVITY (air = 1): 0.555

SOLUBILITY IN WATER: Very slight.

EXPANSION RATIO: 626 (cryogenic liquid)

ODOR THRESHOLD: Not applicable. Odorless.

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable. pH: Not applicable.

SPECIFIC VOLUME: 23.7

FREEZING POINT: -182.2°C (-296°F)

BOILING POINT @ 1 atm: -161°C (-258.7°F)

EVAPORATION RATE (n-BuAc): Not applicable.

VAPOR PRESSURE (psia): Not applicable.

APPEARANCE AND COLOR: Colorless, odorless gas, or colorless, odorless, cryogenic liquid.

HOW TO DETECT THIS SUBSTANCE (warning properties): There are no distinct warning properties. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation.

NOTE: This gas is lighter than air and must not be allowed to accumulate in elevated locations.

---

## 10. STABILITY and REACTIVITY

STABILITY: Stable.

DECOMPOSITION PRODUCTS: When ignited in the presence of oxygen, this gas will burn to produce carbon monoxide, carbon dioxide.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Strong oxidizers (e.g., chlorine, bromine pentafluoride, oxygen, oxygen difluoride, and nitrogen trifluoride).

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials and exposure to heat, sparks, and other sources of ignition. Cylinders exposed to high temperatures or direct flame can rupture or burst.

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## **PART IV** *Is there any other useful information about this material?*

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## 11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: There are no specific toxicology data for Methane. Methane is a simple asphyxiant, which acts to displace oxygen in the environment.

SUSPECTED CANCER AGENT: Methane is not found on the following lists: FEDERAL OSHA Z LIST, NTP, IARC, CAL/OSHA, and therefore, is neither considered to be nor suspected to be a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: Methane is not irritating; however, contact with rapidly expanding gases can cause frostbite to exposed tissue.

SENSITIZATION TO THE PRODUCT: Methane does not cause sensitization with prolonged or repeated contact.

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## 11. TOXICOLOGICAL INFORMATION (Continued)

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Methane on the human reproductive system.

Mutagenicity: No mutagenicity effects have been described for Methane.

Embryotoxicity: No embryotoxic effects have been described for Methane.

Teratogenicity: No teratogenicity effects have been described for Methane.

Reproductive Toxicity: No reproductive toxicity effects have been described for Methane.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e., within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Acute or chronic respiratory conditions may be aggravated by overexposure to the components of Methane.

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen if necessary. Treat symptoms and eliminate exposure.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) are not applicable for Methane.

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## 12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: Methane occurs naturally in the atmosphere. This gas will be dissipated rapidly in well-ventilated areas.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Any adverse effect on animals would be related to oxygen-deficient environments. No adverse effect is anticipated to occur to plant-life, except for frost produced in the presence of rapidly expanding gases.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on the effects of Methane on aquatic life.

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## 13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with residual product to MESA International Inc. Do not dispose of locally.

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## 14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

**For Methane Gas:**

<u>PROPER SHIPPING NAME:</u>	Methane, compressed
<u>HAZARD CLASS NUMBER and DESCRIPTION:</u>	2.1 (Flammable Gas)
<u>UN IDENTIFICATION NUMBER:</u>	UN 1971
<u>PACKING GROUP:</u>	Not Applicable
<u>DOT LABEL(S) REQUIRED:</u>	Flammable Gas
<u>NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996):</u>	115

**For Liquefied Methane:**

<u>PROPER SHIPPING NAME:</u>	Methane, refrigerated liquid
<u>HAZARD CLASS NUMBER and DESCRIPTION:</u>	2.1 (Flammable Gas)
<u>UN IDENTIFICATION NUMBER:</u>	UN 1972
<u>PACKING GROUP:</u>	Not Applicable
<u>DOT LABEL(S) REQUIRED:</u>	Flammable Gas
<u>NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996):</u>	115

MARINE POLLUTANT: Methane is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

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## 15. REGULATORY INFORMATION

U.S. SARA REPORTING REQUIREMENTS: Methane is not subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act.

U.S. SARA THRESHOLD PLANNING QUANTITY: Not applicable.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Not applicable.

CANADIAN DSL/NDSL INVENTORY STATUS: Methane is on the DSL Inventory.

U.S. TSCA INVENTORY STATUS: Methane is listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS: Methane is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for this gas is 10,000 lb. Depending on specific operations involving the use of Isobutylene, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Under this regulation Methane is not listed in Appendix A; however, any process that involves a flammable gas on-site, in one location, in quantities of 10,000 lb (4,553 kg) or greater is covered under this regulation unless it is used as a fuel.

U.S. STATE REGULATORY INFORMATION: Methane is covered under specific State regulations, as denoted below:

**Alaska - Designated Toxic and Hazardous Substances:** Methane.

**California - Permissible Exposure Limits for Chemical Contaminants:** Methane.

**Florida - Substance List:** No.

**Illinois - Toxic Substance List:** Methane.

**Kansas - Section 302/313 List:** No.

**Massachusetts - Substance List:** Methane.

**Michigan - Critical Materials Register:** No.

**Minnesota - List of Hazardous Substances:** Methane.

**Missouri - Employer Information/Toxic Substance List:** Methane.

**New Jersey - Right to Know Hazardous Substance List:** Methane.

**North Dakota - List of Hazardous Chemicals, Reportable Quantities:** No.

**Pennsylvania - Hazardous Substance List:** Methane.

**Rhode Island - Hazardous Substance List:** Methane.

**Texas - Hazardous Substance List:** No.

**West Virginia - Hazardous Substance List:** No.

**Wisconsin - Toxic and Hazardous Substances:** No.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): Methane is not on the California Proposition 65 lists.

LABELING:

**DANGER:**

FLAMMABLE HIGH PRESSURE GAS.  
CAN FORM EXPLOSIVE MIXTURES WITH AIR.

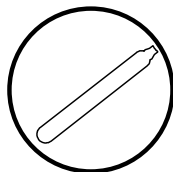
Keep away from heat, flames, and sparks.  
Store and use with adequate ventilation.  
Use equipment rated for cylinder pressure.  
Close valve after each use and when empty.  
Use in accordance with the Material Safety Data Sheet.

DO NOT REMOVE THIS PRODUCT LABEL

CANADIAN WHMIS SYMBOLS:

**Class A:** Compressed Gas

**Class B1:** Flammable Gas





## 16. OTHER INFORMATION

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. MESA Specialty Gases & Equipment assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, MESA Specialty Gases & Equipment assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

### DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

**CAS #:** This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used for computer-related searching.

#### EXPOSURE LIMITS IN AIR:

**ACGIH** - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV** - Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average (**TWA**), the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level (**C**). Skin absorption effects must also be considered.

**OSHA** - U.S. Occupational Safety and Health Administration. **PEL** - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order.

**IDLH** - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. **The DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (**OSHA**). NIOSH issues exposure guidelines called **Recommended Exposure Levels (RELs)**. When no exposure guidelines are established, an entry of **NE** is made for reference.

#### HAZARD RATINGS:

**HAZARDOUS MATERIALS IDENTIFICATION SYSTEM:** Health Hazard: **0** (minimal acute or chronic exposure hazard); **1** (slight acute or chronic exposure hazard); **2** (moderate acute or significant chronic exposure hazard); **3** (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); **4** (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: **0** (minimal hazard); **1** (materials that require substantial pre-heating before burning); **2** (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); **3** (Class IB and IC flammable liquids with flash points below 38°C [100°F]); **4** (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]. Reactivity Hazard: **0** (normally stable); **1** (material that can become unstable at elevated temperatures or which can react slightly with water); **2** (materials that are unstable but do not detonate or which can react violently with water); **3** (materials that can detonate when initiated or which can react explosively with water); **4** (materials that can detonate at normal temperatures or pressures).

**NATIONAL FIRE PROTECTION ASSOCIATION:** Health Hazard: **0** (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury); **2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure causes death or major residual injury).

**NATIONAL FIRE PROTECTION ASSOCIATION (Continued):** Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

#### FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association (**NFPA**). Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

#### TOXICOLOGICAL INFORMATION:

Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD<sub>50</sub>** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC<sub>50</sub>** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m<sup>3</sup>** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TD<sub>01</sub>**, **LDLo**, and **LD<sub>01</sub>**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. Ecological Information: **EC** is the effect concentration in water.

#### REGULATORY INFORMATION:

This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act (**SARA**); the Canadian Domestic/Non-Domestic Substances List (**DSL/NDL**); the U.S. Toxic Substance Control Act (**TSCA**); Marine Pollutant status according to the **DOT**; the Comprehensive Environmental Response, Compensation, and Liability Act (**CERCLA** or **Superfund**); and various state regulations.

### 1. PRODUCT AND COMPANY IDENTIFICATION

#### 1.1 Product identifiers

Product name : Naphthalene

Product Number : 147141

Brand : Aldrich

Index-No. : 601-052-00-2

CAS-No. : 91-20-3

#### 1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

#### 1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich  
3050 Spruce Street  
SAINT LOUIS MO 63103  
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

#### 1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

### 2. HAZARDS IDENTIFICATION

#### 2.1 Classification of the substance or mixture

##### GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable solids (Category 1), H228  
Acute toxicity, Oral (Category 4), H302  
Carcinogenicity (Category 2), H351  
Acute aquatic toxicity (Category 1), H400  
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

#### 2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H228 Flammable solid.  
H302 Harmful if swallowed.  
H351 Suspected of causing cancer.  
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P201 Obtain special instructions before use.  
P202 Do not handle until all safety precautions have been read and understood.  
P210 Keep away from heat/sparks/open flames/hot surfaces. - No smoking.

P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312	IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P330	Rinse mouth.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

### 2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

## 3. COMPOSITION/INFORMATION ON INGREDIENTS

### 3.1 Substances

Formula	: C <sub>10</sub> H <sub>8</sub>
Molecular Weight	: 128.17 g/mol
CAS-No.	: 91-20-3
EC-No.	: 202-049-5
Index-No.	: 601-052-00-2

#### Hazardous components

Component	Classification	Concentration
<b>Naphthalene</b>	Flam. Sol. 1; Acute Tox. 4; Carc. 2; Aquatic Acute 1; Aquatic Chronic 1; H228, H302, H351, H410	90 - 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

## 4. FIRST AID MEASURES

### 4.1 Description of first aid measures

#### General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

#### If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

#### In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

#### In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

#### If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

### 4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

### 4.3 Indication of any immediate medical attention and special treatment needed

no data available

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## 5. FIREFIGHTING MEASURES

### 5.1 Extinguishing media

#### Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

### 5.2 Special hazards arising from the substance or mixture

Carbon oxides

### 5.3 Advice for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

### 5.4 Further information

Use water spray to cool unopened containers.

---

## 6. ACCIDENTAL RELEASE MEASURES

### 6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Avoid breathing dust.

For personal protection see section 8.

### 6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

### 6.3 Methods and materials for containment and cleaning up

Sweep up and shovel. Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13). Keep in suitable, closed containers for disposal. Contain spillage, pick up with an electrically protected vacuum cleaner or by wet-brushing and transfer to a container for disposal according to local regulations (see section 13).

### 6.4 Reference to other sections

For disposal see section 13.

---

## 7. HANDLING AND STORAGE

### 7.1 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. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

For precautions see section 2.2.

### 7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.

### 7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

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## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

### 8.1 Control parameters

#### Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Naphthalene	91-20-3	TWA	10 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Eye & Upper Respiratory Tract irritation Hematologic effects Eye damage Not classifiable as a human carcinogen Danger of cutaneous absorption		

		STEL	15 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Eye & Upper Respiratory Tract irritation Hematologic effects Eye damage Not classifiable as a human carcinogen Danger of cutaneous absorption		
		TWA	10 ppm 50 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		STEL	15 ppm 75 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	10 ppm 50 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		The value in mg/m3 is approximate.		
		TWA	10 ppm 50 mg/m3	USA. NIOSH Recommended Exposure Limits
		ST	15 ppm 75 mg/m3	USA. NIOSH Recommended Exposure Limits

## 8.2 Exposure controls

### Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

### Personal protective equipment

#### Eye/face protection

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

#### Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

#### Full contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

#### Splash contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

#### Body Protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

#### Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the

sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

#### **Control of environmental exposure**

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

---

## **9. PHYSICAL AND CHEMICAL PROPERTIES**

### **9.1 Information on basic physical and chemical properties**

- |   |   |
|---|---|
| a) Appearance                                   | Form: solid   |
| b) Odour  | no data available   |
| c) Odour Threshold                              | no data available   |
| d) pH   | no data available   |
| e) Melting point/freezing point                 | Melting point/range: 80 - 82 °C (176 - 180 °F) - lit.                                 |
| f) Initial boiling point and boiling range      | 218 °C (424 °F) - lit.  |
| g) Flash point                                  | 80.0 °C (176.0 °F) - closed cup   |
| h) Evapouration rate                            | no data available   |
| i) Flammability (solid, gas)                    | The substance or mixture is a flammable solid with the category 1.                    |
| j) Upper/lower flammability or explosive limits | Upper explosion limit: 5.9 %(V)<br>Lower explosion limit: 0.9 %(V)                    |
| k) Vapour pressure                              | 1.3 hPa (1.0 mmHg) at 53.0 °C (127.4 °F)<br>0.04 hPa (0.03 mmHg) at 25.0 °C (77.0 °F) |
| l) Vapour density                               | no data available   |
| m) Relative density                             | no data available   |
| n) Water solubility                             | no data available   |
| o) Partition coefficient: n-octanol/water       | log Pow: 3.30   |
| p) Auto-ignition temperature                    | 526.0 °C (978.8 °F)   |
| q) Decomposition temperature                    | no data available   |
| r) Viscosity                                    | no data available   |
| s) Explosive properties                         | no data available   |
| t) Oxidizing properties                         | no data available   |

### **9.2 Other safety information**

- |                 |                                  |
|-----------------|----------------------------------|
| Surface tension | 31.8 mN/m at 100.0 °C (212.0 °F) |
|-----------------|----------------------------------|

---

## **10. STABILITY AND REACTIVITY**

### **10.1 Reactivity**

no data available

### **10.2 Chemical stability**

Stable under recommended storage conditions.

### **10.3 Possibility of hazardous reactions**

no data available

#### 10.4 Conditions to avoid

Heat, flames and sparks. Extremes of temperature and direct sunlight.

#### 10.5 Incompatible materials

Strong oxidizing agents

#### 10.6 Hazardous decomposition products

Other decomposition products - no data available  
In the event of fire: see section 5

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### 11. TOXICOLOGICAL INFORMATION

#### 11.1 Information on toxicological effects

##### Acute toxicity

LD50 Oral - rat - 490.0 mg/kg

LC50 Inhalation - rat - 1 h - > 340 mg/m<sup>3</sup>

Remarks: Sense Organs and Special Senses (Nose, Eye, Ear, and Taste):Eye:Lacrimation. Behavioral:Somnolence (general depressed activity).

LD50 Dermal - rabbit - 20,000 mg/kg

no data available

##### Skin corrosion/irritation

no data available

##### Serious eye damage/eye irritation

Eyes - rabbit

Result: Mild eye irritation

##### Respiratory or skin sensitisation

no data available

##### Germ cell mutagenicity

no data available

##### Carcinogenicity

This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

Limited evidence of carcinogenicity in animal studies

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Naphthalene)

NTP: Reasonably anticipated to be a human carcinogen (Naphthalene)

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

##### Reproductive toxicity

no data available

no data available

##### Specific target organ toxicity - single exposure

no data available

##### Specific target organ toxicity - repeated exposure

no data available

##### Aspiration hazard

no data available

##### Additional Information

RTECS: QJ0525000

Absorption into the body leads to the formation of methemoglobin which in sufficient concentration causes cyanosis. Onset may be delayed 2 to 4 hours or longer., Naphthalene is retinotoxic and systemic absorption of its vapors above 15ppm, may result in:, cataracts, optic neuritis, corneal injury, Eye irritation, Ingestion may provoke the following symptoms:, hemolytic anemia, hemoglobinuria, Nausea, Headache, Vomiting, Gastrointestinal disturbance, Convulsions, anemia, Kidney injury may occur., Seizures., Coma.

Heart -

---

## 12. ECOLOGICAL INFORMATION

### 12.1 Toxicity

Toxicity to fish	LC50 - Oncorhynchus mykiss (rainbow trout) - 0.9 - 9.8 mg/l - 96.0 h LC50 - Pimephales promelas (fathead minnow) - 1 - 6.5 mg/l - 96.0 h NOEC - other fish - 1.8 mg/l - 3.0 d LOEC - other fish - 3.2 mg/l - 3.0 d
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 1.00 - 3.40 mg/l - 48 h
Toxicity to algae	EC50 - No information available. - 33.00 mg/l - 24 h

### 12.2 Persistence and degradability

Biodegradability	Result: - According to the results of tests of biodegradability this product is not readily biodegradable.
no data available	

### 12.3 Bioaccumulative potential

Bioaccumulation	Fish  Bioconcentration factor (BCF): 427 - 1,158
-----------------	--

### 12.4 Mobility in soil

no data available

### 12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

### 12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life with long lasting effects.

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life with long lasting effects.

---

## 13. DISPOSAL CONSIDERATIONS

### 13.1 Waste treatment methods

#### Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. 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.

---

## 14. TRANSPORT INFORMATION

### DOT (US)

UN number: 1334	Class: 4.1	Packing group: III
Proper shipping name: Naphthalene, refined		
Reportable Quantity (RQ): 100 lbs		
Marine pollutant: No		
Poison Inhalation Hazard: No		



**IMDG**

UN number: 1334      Class: 4.1      Packing group: III      EMS-No: F-A, S-G  
 Proper shipping name: NAPHTHALENE, REFINED  
 Marine pollutant: No

**IATA**

UN number: 1334      Class: 4.1      Packing group: III  
 Proper shipping name: Naphthalene, refined

**15. REGULATORY INFORMATION****SARA 302 Components**

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

**SARA 313 Components**

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Naphthalene	91-20-3	2007-07-01

**SARA 311/312 Hazards**

Fire Hazard, Acute Health Hazard, Chronic Health Hazard

**Massachusetts Right To Know Components**

	CAS-No.	Revision Date
Naphthalene	91-20-3	2007-07-01

**Pennsylvania Right To Know Components**

	CAS-No.	Revision Date
Naphthalene	91-20-3	2007-07-01

**New Jersey Right To Know Components**

	CAS-No.	Revision Date
Naphthalene	91-20-3	2007-07-01

**California Prop. 65 Components**

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer. Naphthalene	91-20-3	1990-01-01

**16. OTHER INFORMATION****Full text of H-Statements referred to under sections 2 and 3.**

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
Flam. Sol.	Flammable solids
H228	Flammable solid.
H302	Harmful if swallowed.
H351	Suspected of causing cancer.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

**HMIS Rating**

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	2
Physical Hazard	2

**NFPA Rating**

Health hazard:	2
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Fire Hazard: 2  
Reactivity Hazard: 2

**Further information**

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**Preparation Information**

Sigma-Aldrich Corporation  
Product Safety – Americas Region  
1-800-521-8956

Version: 5.4

Revision Date: 06/29/2014

Print Date: 12/11/2014

## SAFETY DATA SHEET

Version 5.2  
Revision Date 06/23/2014  
Print Date 12/11/2014

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**1. PRODUCT AND COMPANY IDENTIFICATION****1.1 Product identifiers**

Product name : Benzene  
  
Product Number : 12540  
Brand : Fluka  
Index-No. : 601-020-00-8  
  
CAS-No. : 71-43-2

**1.2 Relevant identified uses of the substance or mixture and uses advised against**

Identified uses : Laboratory chemicals, Manufacture of substances

**1.3 Details of the supplier of the safety data sheet**

Company : Sigma-Aldrich  
3050 Spruce Street  
SAINT LOUIS MO 63103  
USA  
  
Telephone : +1 800-325-5832  
Fax : +1 800-325-5052

**1.4 Emergency telephone number**

Emergency Phone # : (314) 776-6555

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**2. HAZARDS IDENTIFICATION****2.1 Classification of the substance or mixture****GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)**

Flammable liquids (Category 2), H225  
Skin irritation (Category 2), H315  
Eye irritation (Category 2A), H319  
Germ cell mutagenicity (Category 1B), H340  
Carcinogenicity (Category 1A), H350  
Aspiration hazard (Category 1), H304  
Acute aquatic toxicity (Category 2), H401

For the full text of the H-Statements mentioned in this Section, see Section 16.

**2.2 GHS Label elements, including precautionary statements**

Pictogram



Signal word

Danger

Hazard statement(s)

H225 Highly flammable liquid and vapour.  
H304 May be fatal if swallowed and enters airways.  
H315 Causes skin irritation.  
H319 Causes serious eye irritation.  
H340 May cause genetic defects.  
H350 May cause cancer.  
H401 Toxic to aquatic life.

Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P210	Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P264	Wash skin thoroughly after handling.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P321	Specific treatment (see supplemental first aid instructions on this label).
P331	Do NOT induce vomiting.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

### 2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

## 3. COMPOSITION/INFORMATION ON INGREDIENTS

### 3.1 Substances

Formula	: C <sub>6</sub> H <sub>6</sub>
Molecular Weight	: 78.11 g/mol
CAS-No.	: 71-43-2
EC-No.	: 200-753-7
Index-No.	: 601-020-00-8
Registration number	: 01-2119447106-44-XXXX

#### Hazardous components

Component	Classification	Concentration
<b>Benzene</b>	Flam. Liq. 2; Skin Irrit. 2; Eye Irrit. 2A; Muta. 1B; Carc. 1A; STOT RE 1; Asp. Tox. 1; Aquatic Acute 2; H225, H304, H315, H319, H340, H350, H372, H401	90 - 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

## 4. FIRST AID MEASURES

### 4.1 Description of first aid measures

#### General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

**If inhaled**

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

**In case of skin contact**

Wash off with soap and plenty of water. Consult a physician.

**In case of eye contact**

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

**If swallowed**

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

**4.2 Most important symptoms and effects, both acute and delayed**

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

**4.3 Indication of any immediate medical attention and special treatment needed**

no data available

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**5. FIREFIGHTING MEASURES****5.1 Extinguishing media****Suitable extinguishing media**

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

**5.2 Special hazards arising from the substance or mixture**

Carbon oxides

Flash back possible over considerable distance., Container explosion may occur under fire conditions.

**5.3 Advice for firefighters**

Wear self contained breathing apparatus for fire fighting if necessary.

**5.4 Further information**

Use water spray to cool unopened containers.

---

**6. ACCIDENTAL RELEASE MEASURES****6.1 Personal precautions, protective equipment and emergency procedures**

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

For personal protection see section 8.

**6.2 Environmental precautions**

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

**6.3 Methods and materials for containment and cleaning up**

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

**6.4 Reference to other sections**

For disposal see section 13.

---

**7. HANDLING AND STORAGE****7.1 Precautions for safe handling**

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.

Use explosion-proof equipment. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

For precautions see section 2.2.

**7.2 Conditions for safe storage, including any incompatibilities**

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

**7.3 Specific end use(s)**

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

### 8.1 Control parameters

#### Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Benzene	71-43-2	TWA	0.5 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Leukemia Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed human carcinogen Danger of cutaneous absorption		
		STEL	2.5 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Leukemia Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed human carcinogen Danger of cutaneous absorption		
		TWA	10 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z2
		Z37.40-1969		
		CEIL	25 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z2
		Z37.40-1969		
		Peak	50 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z2
		Z37.40-1969		
		See 1910.1028. See Table Z-2 for the limits applicable in the operations or sectors excluded in 1910.1028 The final benzene standard in 1910.1028 applies to all occupational exposures to benzene except some subsegments of industry where exposures are consistently under the action level (i.e., distribution and sale of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures); for the excepted subsegments, the benzene limits in Table Z-2 apply.		
		TWA	0.1 ppm	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A		
		ST	1 ppm	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A		

#### Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Benzene	71-43-2	S-Phenylmercapturic acid	0.03 mg/g	In urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift (As soon as possible after exposure ceases)			
		t,t-Muconic acid	0.5 mg/g	In urine	ACGIH - Biological Exposure Indices (BEI)
		End of shift (As soon as possible after exposure ceases)			

## 8.2 Exposure controls

### Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

### Personal protective equipment

#### Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

#### Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

#### Full contact

Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm

Break through time: 480 min

Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

#### Splash contact

Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm

Break through time: 480 min

Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

#### Body Protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

#### Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

#### Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

---

## 9. PHYSICAL AND CHEMICAL PROPERTIES

### 9.1 Information on basic physical and chemical properties

- |  |                                       |
|--|---------------------------------------|
| a) Appearance                              | Form: liquid<br>Colour: colourless    |
| b) Odour                                   | no data available                     |
| c) Odour Threshold                         | no data available                     |
| d) pH                                      | no data available                     |
| e) Melting point/freezing point            | Melting point/range: 5.5 °C (41.9 °F) |
| f) Initial boiling point and boiling range | 80 °C (176 °F)                        |

- |   |  |
|---|--|
| g) Flash point                                  | -11.0 °C (12.2 °F) - closed cup  |
| h) Evaporation rate                             | no data available  |
| i) Flammability (solid, gas)                    | no data available  |
| j) Upper/lower flammability or explosive limits | Upper explosion limit: 8 %(V)<br>Lower explosion limit: 1.3 %(V)                         |
| k) Vapour pressure                              | 221.3 hPa (166.0 mmHg) at 37.7 °C (99.9 °F)<br>99.5 hPa (74.6 mmHg) at 20.0 °C (68.0 °F) |
| l) Vapour density                               | no data available  |
| m) Relative density                             | 0.874 g/mL at 25 °C (77 °F)  |
| n) Water solubility                             | no data available  |
| o) Partition coefficient: n-octanol/water       | no data available  |
| p) Auto-ignition temperature                    | 562.0 °C (1,043.6 °F)  |
| q) Decomposition temperature                    | no data available  |
| r) Viscosity                                    | no data available  |
| s) Explosive properties                         | no data available  |
| t) Oxidizing properties                         | no data available  |

## 9.2 Other safety information

no data available

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## 10. STABILITY AND REACTIVITY

### 10.1 Reactivity

no data available

### 10.2 Chemical stability

Stable under recommended storage conditions.

### 10.3 Possibility of hazardous reactions

Vapours may form explosive mixture with air.

### 10.4 Conditions to avoid

Heat, flames and sparks. Extremes of temperature and direct sunlight.

### 10.5 Incompatible materials

acids, Bases, Halogens, Strong oxidizing agents, Metallic salts

### 10.6 Hazardous decomposition products

Other decomposition products - no data available

In the event of fire: see section 5

---

## 11. TOXICOLOGICAL INFORMATION

### 11.1 Information on toxicological effects

#### Acute toxicity

LD50 Oral - rat - 2,990 mg/kg

LC50 Inhalation - rat - female - 4 h - 44,700 mg/m<sup>3</sup>

LD50 Dermal - rabbit - 8,263 mg/kg

no data available



**Skin corrosion/irritation**

Skin - rabbit

Result: Skin irritation

**Serious eye damage/eye irritation**

Eyes - rabbit

Result: Eye irritation

**Respiratory or skin sensitisation**

no data available

**Germ cell mutagenicity**

Laboratory experiments have shown mutagenic effects.

In vivo tests showed mutagenic effects

Human

lymphocyte

Sister chromatid exchange

mouse

lymphocyte

Mutation in mammalian somatic cells.

mouse

Sister chromatid exchange

**Carcinogenicity**

Carcinogenicity - Human - male - Inhalation

Tumorigenic: Carcinogenic by RTECS criteria. Leukaemia Blood: Thrombocytopenia.

Carcinogenicity - rat - Oral

Tumorigenic: Carcinogenic by RTECS criteria. Endocrine: Tumors. Leukaemia

This is or contains a component that has been reported to be carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Human carcinogen.

IARC: 1 - Group 1: Carcinogenic to humans (Benzene)

NTP: Known to be human carcinogen (Benzene)

OSHA: OSHA specifically regulated carcinogen (Benzene)

**Reproductive toxicity**

Reproductive toxicity - mouse - Intraperitoneal

Effects on Fertility: Pre-implantation mortality (e.g., reduction in number of implants per female; total number of implants per corpora lutea). Effects on Embryo or Fetus: Fetal death.

Developmental Toxicity - rat - Inhalation

Effects on Embryo or Fetus: Extra embryonic structures (e.g., placenta, umbilical cord). Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus).

Developmental Toxicity - mouse - Inhalation

Effects on Embryo or Fetus: Cytological changes (including somatic cell genetic material). Specific Developmental Abnormalities: Blood and lymphatic system (including spleen and marrow).

**Specific target organ toxicity - single exposure**

no data available

**Specific target organ toxicity - repeated exposure**

no data available

**Aspiration hazard**

May be fatal if swallowed and enters airways.

**Additional Information**

RTECS: CY1400000

Nausea, Dizziness, Headache, narcosis, Inhalation of high concentrations of benzene may have an initial stimulatory effect on the central nervous system characterized by exhilaration, nervous excitation and/or giddiness, depression, drowsiness, or fatigue. The victim may experience tightness in the chest, breathlessness, and loss of consciousness. Tremors, convulsions, and death due to respiratory paralysis or circulatory collapse can occur in a few minutes to several hours following severe exposures. Aspiration of small amounts of liquid immediately causes pulmonary edema and hemorrhage of pulmonary tissue. Direct skin contact may cause erythema. Repeated or prolonged skin contact may result in drying, scaling dermatitis, or development of secondary skin infections. The chief target organ is the hematopoietic system. Bleeding from the nose, gums, or mucous membranes and the development of purpuric spots, pancytopenia, leukopenia, thrombocytopenia, aplastic anemia, and leukemia may occur as the condition progresses. The bone marrow may appear normal, aplastic or hyperplastic, and may not correlate with peripheral blood-forming tissues. The onset of effects of prolonged benzene exposure may be delayed for many months or years after the actual exposure has ceased., Blood disorders

Stomach - Irregularities - Based on Human Evidence

Stomach - Irregularities - Based on Human Evidence

---

## 12. ECOLOGICAL INFORMATION

### 12.1 Toxicity

Toxicity to fish	LC50 - <i>Oncorhynchus mykiss</i> (rainbow trout) - 5.90 mg/l - 96 h
	LC50 - <i>Pimephales promelas</i> (fathead minnow) - 15.00 - 32.00 mg/l - 96 h
	LC50 - <i>Lepomis macrochirus</i> (Bluegill) - 230.00 mg/l - 96 h
	NOEC - <i>Pimephales promelas</i> (fathead minnow) - 10.2 mg/l - 7 d
	LOEC - <i>Pimephales promelas</i> (fathead minnow) - 17.2 mg/l - 7 d
Toxicity to daphnia and other aquatic invertebrates	EC50 - <i>Daphnia magna</i> (Water flea) - 22.00 mg/l - 48 h
	EC50 - <i>Daphnia magna</i> (Water flea) - 9.20 mg/l - 48 h
Toxicity to algae	EC50 - <i>Pseudokirchneriella subcapitata</i> (green algae) - 29.00 mg/l - 72 h

### 12.2 Persistence and degradability

Biodegradability Result: - Readily biodegradable.

### 12.3 Bioaccumulative potential

Bioaccumulation *Leuciscus idus* (Golden orfe) - 3 d  
- 0.05 mg/l

Bioconcentration factor (BCF): 10

### 12.4 Mobility in soil

no data available

### 12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

### 12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.  
Toxic to aquatic life.

---

## 13. DISPOSAL CONSIDERATIONS

### 13.1 Waste treatment methods

#### Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. 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.

---

## 14. TRANSPORT INFORMATION

### DOT (US)

UN number: 1114      Class: 3      Packing group: II  
Proper shipping name: Benzene  
Reportable Quantity (RQ): 10 lbs  
Marine pollutant: No  
Poison Inhalation Hazard: No

### IMDG

UN number: 1114      Class: 3      Packing group: II      EMS-No: F-E, S-D  
Proper shipping name: BENZENE  
Marine pollutant: No

### IATA

UN number: 1114      Class: 3      Packing group: II  
Proper shipping name: Benzene

---

## 15. REGULATORY INFORMATION

### SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

### SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Benzene	71-43-2	2007-07-01

### SARA 311/312 Hazards

Fire Hazard, Acute Health Hazard, Chronic Health Hazard

### Massachusetts Right To Know Components

	CAS-No.	Revision Date
Benzene	71-43-2	2007-07-01

### Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Benzene	71-43-2	2007-07-01

### New Jersey Right To Know Components

	CAS-No.	Revision Date
Benzene	71-43-2	2007-07-01

### California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.

	CAS-No.	Revision Date
Benzene	71-43-2	2009-02-01

WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.

	CAS-No.	Revision Date
Benzene	71-43-2	2009-02-01

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## 16. OTHER INFORMATION

### Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Asp. Tox.	Aspiration hazard
Carc.	Carcinogenicity

Eye Irrit.	Eye irritation
Flam. Liq.	Flammable liquids
H225	Highly flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H340	May cause genetic defects.
H350	May cause cancer.
H372	Causes damage to organs through prolonged or repeated exposure.
H401	Toxic to aquatic life.

#### HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	3
Physical Hazard	0

#### NFPA Rating

Health hazard:	2
Fire Hazard:	3
Reactivity Hazard:	0

#### Further information

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#### Preparation Information

Sigma-Aldrich Corporation  
Product Safety – Americas Region  
1-800-521-8956

Version: 5.2

Revision Date: 06/23/2014

Print Date: 12/11/2014

## SAFETY DATA SHEET

Version 3.9  
Revision Date 07/01/2014  
Print Date 12/11/2014

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**1. PRODUCT AND COMPANY IDENTIFICATION****1.1 Product identifiers**

Product name : Cadmium  
  
Product Number : 00623  
Brand : Fluka  
Index-No. : 048-002-00-0  
  
CAS-No. : 7440-43-9

**1.2 Relevant identified uses of the substance or mixture and uses advised against**

Identified uses : Laboratory chemicals, Manufacture of substances

**1.3 Details of the supplier of the safety data sheet**

Company : Sigma-Aldrich  
3050 Spruce Street  
SAINT LOUIS MO 63103  
USA  
  
Telephone : +1 800-325-5832  
Fax : +1 800-325-5052

**1.4 Emergency telephone number**

Emergency Phone # : (314) 776-6555

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**2. HAZARDS IDENTIFICATION****2.1 Classification of the substance or mixture****GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)**

Acute toxicity, Oral (Category 3), H301  
Acute toxicity, Inhalation (Category 2), H330  
Germ cell mutagenicity (Category 2), H341  
Carcinogenicity (Category 1B), H350  
Reproductive toxicity (Category 2), H361  
Specific target organ toxicity - repeated exposure (Category 1), H372  
Acute aquatic toxicity (Category 1), H400  
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

**2.2 GHS Label elements, including precautionary statements**

Pictogram



Signal word

Danger

Hazard statement(s)

H301 Toxic if swallowed.  
H330 Fatal if inhaled.  
H341 Suspected of causing genetic defects.  
H350 May cause cancer.  
H361 Suspected of damaging fertility or the unborn child.  
H372 Causes damage to organs through prolonged or repeated exposure.  
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P281	Use personal protective equipment as required.
P284	Wear respiratory protection.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P310	Immediately call a POISON CENTER or doctor/ physician.
P320	Specific treatment is urgent (see supplemental first aid instructions on this label).
P330	Rinse mouth.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

### 2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

## 3. COMPOSITION/INFORMATION ON INGREDIENTS

### 3.1 Substances

Formula	: Cd
Molecular Weight	: 112.41 g/mol
CAS-No.	: 7440-43-9
EC-No.	: 231-152-8
Index-No.	: 048-002-00-0

#### Hazardous components

Component	Classification	Concentration
<b>Cadmium</b> Included in the Candidate List of Substances of Very High Concern (SVHC) according to Regulation (EC) No. 1907/2006 (REACH)		
	Acute Tox. 3; Acute Tox. 2; Muta. 2; Carc. 1B; Repr. 2; STOT RE 1; Aquatic Acute 1; Aquatic Chronic 1; H301, H330, H341, H350, H361, H372, H410	-

For the full text of the H-Statements mentioned in this Section, see Section 16.

## 4. FIRST AID MEASURES

### 4.1 Description of first aid measures

#### General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

#### If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

#### In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

#### In case of eye contact

Flush eyes with water as a precaution.

**If swallowed**

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

**4.2 Most important symptoms and effects, both acute and delayed**

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

**4.3 Indication of any immediate medical attention and special treatment needed**

no data available

**5. FIREFIGHTING MEASURES****5.1 Extinguishing media****Suitable extinguishing media**

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

**5.2 Special hazards arising from the substance or mixture**

Cadmium/cadmium oxides

**5.3 Advice for firefighters**

Wear self contained breathing apparatus for fire fighting if necessary.

**5.4 Further information**

no data available

**6. ACCIDENTAL RELEASE MEASURES****6.1 Personal precautions, protective equipment and emergency procedures**

Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

**6.2 Environmental precautions**

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

**6.3 Methods and materials for containment and cleaning up**

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

**6.4 Reference to other sections**

For disposal see section 13.

**7. HANDLING AND STORAGE****7.1 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 2.2.

**7.2 Conditions for safe storage, including any incompatibilities**

Keep container tightly closed in a dry and well-ventilated place.

Keep in a dry place.

**7.3 Specific end use(s)**

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

**8. EXPOSURE CONTROLS/PERSONAL PROTECTION****8.1 Control parameters****Components with workplace control parameters**

Component	CAS-No.	Value	Control parameters	Basis
Cadmium	7440-43-9	TWA	0.01 mg/m <sup>3</sup>	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Kidney damage		

		Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Suspected human carcinogen		
		TWA	0.002 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Suspected human carcinogen		
		Substance listed; for more information see OSHA document 1910.1027		
		TWA	0.1 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		TWA	0.2 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		CEIL	0.3 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		CEIL	0.6 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		See 1910.1027. See Table Z-2 for the exposure limits for any operations or sectors where the exposure limits in 1910.1027 are stayed or are otherwise not in effect.		
		Potential Occupational Carcinogen See Appendix A		
		PEL	0.005 mg/m3	OSHA Specifically Regulated Chemicals/Carcinogens
		1910.1027 This standard applies to all occupational exposures to cadmium and cadmium compounds, in all forms, and in all industries covered by the Occupational Safety and Health Act, except the construction-related industries, which are covered under 29 CFR 1926.63. OSHA specifically regulated carcinogen		

#### Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Cadmium	7440-43-9	cadmium	0.005 mg/g	Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	Not critical			
		cadmium	5 µg/l	In blood	ACGIH - Biological Exposure Indices (BEI)
		Not critical			



## 8.2 Exposure controls

### Appropriate engineering controls

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

### Personal protective equipment

#### Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

#### Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

#### Full contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

#### Splash contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

#### Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

#### Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

#### Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

---

## 9. PHYSICAL AND CHEMICAL PROPERTIES

### 9.1 Information on basic physical and chemical properties

- |  |   |
|--|---|
| a) Appearance                              | Form: powder<br>Colour: light grey        |
| b) Odour                                   | no data available                         |
| c) Odour Threshold                         | no data available                         |
| d) pH                                      | no data available                         |
| e) Melting point/freezing point            | Melting point/range: 320.9 °C (609.6 °F)  |
| f) Initial boiling point and boiling range | 765 °C (1,409 °F) at 1,013 hPa (760 mmHg) |
| g) Flash point                             | not applicable                            |

- |   |                         |
|---|-------------------------|
| h) Evaporation rate                             | no data available       |
| i) Flammability (solid, gas)                    | no data available       |
| j) Upper/lower flammability or explosive limits | no data available       |
| k) Vapour pressure                              | no data available       |
| l) Vapour density                               | no data available       |
| m) Relative density                             | 8.650 g/cm <sup>3</sup> |
| n) Water solubility                             | no data available       |
| o) Partition coefficient: n-octanol/water       | no data available       |
| p) Auto-ignition temperature                    | no data available       |
| q) Decomposition temperature                    | no data available       |
| r) Viscosity                                    | no data available       |
| s) Explosive properties                         | no data available       |
| t) Oxidizing properties                         | no data available       |

## 9.2 Other safety information

no data available

---

## 10. STABILITY AND REACTIVITY

### 10.1 Reactivity

no data available

### 10.2 Chemical stability

Stable under recommended storage conditions.

### 10.3 Possibility of hazardous reactions

no data available

### 10.4 Conditions to avoid

no data available

### 10.5 Incompatible materials

Oxidizing agents, acids

### 10.6 Hazardous decomposition products

Other decomposition products - no data available

In the event of fire: see section 5

---

## 11. TOXICOLOGICAL INFORMATION

### 11.1 Information on toxicological effects

#### Acute toxicity

LD50 Oral - rat - 225 mg/kg

LC50 Inhalation - rat - 30 h - 25 mg/m<sup>3</sup>

Remarks: Lungs, Thorax, or Respiration:Dyspnea.

Dermal: no data available

no data available

#### Skin corrosion/irritation

no data available

**Serious eye damage/eye irritation**

no data available

**Respiratory or skin sensitisation**

no data available

**Germ cell mutagenicity**

In vitro tests showed mutagenic effects

**Carcinogenicity**

Possible human carcinogen

IARC: 1 - Group 1: Carcinogenic to humans (Cadmium)

NTP: Known to be human carcinogen The reference note has been added by TD based on the background information of the NTP. (Cadmium)

OSHA: OSHA specifically regulated carcinogen (Cadmium)

**Reproductive toxicity**

no data available

Suspected human reproductive toxicant

**Specific target organ toxicity - single exposure**

no data available

**Specific target organ toxicity - repeated exposure**

Causes damage to organs through prolonged or repeated exposure.

**Aspiration hazard**

no data available

**Additional Information**

RTECS: EU9800000

Damage to the lungs., Kidney injury may occur., prolonged or repeated exposure can cause:, Vomiting, Diarrhoea, Lung irritation

Stomach - Irregularities - Based on Human Evidence

Stomach - Irregularities - Based on Human Evidence

---

**12. ECOLOGICAL INFORMATION****12.1 Toxicity**

Toxicity to fish mortality LOEC - *Oncorhynchus mykiss* (rainbow trout) - 0.0015 mg/l - 96 h

LC50 - *Pimephales promelas* (fathead minnow) - 1.0 µg/l - 96 h

Toxicity to daphnia and other aquatic mortality NOEC - *Daphnia* - 0.019 mg/l - 24 h

invertebrates

mortality LOEC - *Daphnia* - 0.039 mg/l - 24 h

EC50 - *Daphnia magna* (Water flea) - 0.024 mg/l - 48 h

Toxicity to algae Growth inhibition IC50 - *Chaetoceros* sp. - 0.028 mg/l - 48 h

**12.2 Persistence and degradability**

no data available

**12.3 Bioaccumulative potential**

Bioaccumulation *Oncorhynchus mykiss* (rainbow trout) - 72 d  
- 1.27 µg/l

Bioconcentration factor (BCF): 55

**12.4 Mobility in soil**  
no data available

**12.5 Results of PBT and vPvB assessment**  
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

**12.6 Other adverse effects**  
Very toxic to aquatic life with long lasting effects.  
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

---

## 13. DISPOSAL CONSIDERATIONS

### 13.1 Waste treatment methods

#### Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

#### Contaminated packaging

Dispose of as unused product.

---

## 14. TRANSPORT INFORMATION

### DOT (US)

UN number: 3288      Class: 6.1      Packing group: II  
Proper shipping name: Toxic solid, inorganic, n.o.s. (Cadmium)  
Reportable Quantity (RQ): 10 lbs  
Marine pollutant: No  
Poison Inhalation Hazard: No

### IMDG

UN number: 3288      Class: 6.1      Packing group: II      EMS-No: F-A, S-A  
Proper shipping name: TOXIC SOLID, INORGANIC, N.O.S. (Cadmium)  
Marine pollutant: No

### IATA

UN number: 3288      Class: 6.1      Packing group: II  
Proper shipping name: Toxic solid, inorganic, n.o.s. (Cadmium)

---

## 15. REGULATORY INFORMATION

### SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

### SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Cadmium	7440-43-9	2007-07-01

### SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

### Massachusetts Right To Know Components

	CAS-No.	Revision Date
Cadmium	7440-43-9	2007-07-01

### Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Cadmium	7440-43-9	2007-07-01

### New Jersey Right To Know Components

	CAS-No.	Revision Date
Cadmium	7440-43-9	2007-07-01

### California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the		

State of California to cause cancer.  
Cadmium

7440-43-9

2009-02-01

WARNING: This product contains a chemical known to the  
State of California to cause birth defects or other reproductive  
harm.  
Cadmium

CAS-No.  
7440-43-9

Revision Date  
2009-02-01

---

## 16. OTHER INFORMATION

### Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
H301	Toxic if swallowed.
H330	Fatal if inhaled.
H341	Suspected of causing genetic defects.
H350	May cause cancer.
H361	Suspected of damaging fertility or the unborn child.
H372	Causes damage to organs through prolonged or repeated exposure.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

### HMIS Rating

Health hazard:	3
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

### NFPA Rating

Health hazard:	4
Fire Hazard:	0
Reactivity Hazard:	0

### Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See [www.sigma-aldrich.com](http://www.sigma-aldrich.com) and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

### Preparation Information

Sigma-Aldrich Corporation  
Product Safety – Americas Region  
1-800-521-8956

Version: 3.9

Revision Date: 07/01/2014

Print Date: 12/11/2014

## SAFETY DATA SHEET

Version 5.6  
Revision Date 08/13/2014  
Print Date 12/11/2014

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**1. PRODUCT AND COMPANY IDENTIFICATION****1.1 Product identifiers**

Product name : Zinc  
  
Product Number : 96454  
Brand : Fluka  
Index-No. : 030-001-01-9  
  
CAS-No. : 7440-66-6

**1.2 Relevant identified uses of the substance or mixture and uses advised against**

Identified uses : Laboratory chemicals, Manufacture of substances

**1.3 Details of the supplier of the safety data sheet**

Company : Sigma-Aldrich  
3050 Spruce Street  
SAINT LOUIS MO 63103  
USA  
  
Telephone : +1 800-325-5832  
Fax : +1 800-325-5052

**1.4 Emergency telephone number**

Emergency Phone # : (314) 776-6555

---

**2. HAZARDS IDENTIFICATION****2.1 Classification of the substance or mixture****GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)**

Acute aquatic toxicity (Category 1), H400  
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

**2.2 GHS Label elements, including precautionary statements**

Pictogram



Signal word : Warning

Hazard statement(s)  
H410 : Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)  
P273 : Avoid release to the environment.  
P391 : Collect spillage.  
P501 : Dispose of contents/ container to an approved waste disposal plant.

**2.3 Hazards not otherwise classified (HNOC) or not covered by GHS**

Combustible dust

---

**3. COMPOSITION/INFORMATION ON INGREDIENTS****3.1 Substances**

Formula : Zn

Molecular weight : 65.39 g/mol  
CAS-No. : 7440-66-6  
EC-No. : 231-175-3  
Index-No. : 030-001-01-9

No components need to be disclosed according to the applicable regulations.  
For the full text of the H-Statements mentioned in this Section, see Section 16.

---

## 4. FIRST AID MEASURES

### 4.1 Description of first aid measures

#### General advice

Consult a physician. Show this safety data sheet to the doctor in attendance.

#### If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

#### In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

#### In case of eye contact

Flush eyes with water as a precaution.

#### If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

### 4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

### 4.3 Indication of any immediate medical attention and special treatment needed

No data available

---

## 5. FIREFIGHTING MEASURES

### 5.1 Extinguishing media

#### Suitable extinguishing media

Special powder against metal fire Dry sand Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

#### Unsuitable extinguishing media

Water

### 5.2 Special hazards arising from the substance or mixture

Zinc/zinc oxides

### 5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

### 5.4 Further information

No data available

---

## 6. ACCIDENTAL RELEASE MEASURES

### 6.1 Personal precautions, protective equipment and emergency procedures

Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation.  
For personal protection see section 8.

### 6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

### 6.3 Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

### 6.4 Reference to other sections

For disposal see section 13.

---

## 7. HANDLING AND STORAGE

### 7.1 Precautions for safe handling

Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs. Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

### 7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.

Keep in a dry place.

### 7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

---

## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

### 8.1 Control parameters

#### Components with workplace control parameters

Contains no substances with occupational exposure limit values.

### 8.2 Exposure controls

#### Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

#### Personal protective equipment

##### Eye/face protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

##### Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

##### Full contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: Dermatrill® (KCL 740 / Aldrich Z677272, Size M)

##### Splash contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: Dermatrill® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

##### Body Protection

Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.



### Respiratory protection

Respiratory protection is not required. Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) dust masks. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

### Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

---

## 9. PHYSICAL AND CHEMICAL PROPERTIES

### 9.1 Information on basic physical and chemical properties

- |   |  |
|---|--|
| a) Appearance                                   | Form: powder<br>Colour: grey                               |
| b) Odour  | odourless  |
| c) Odour Threshold                              | No data available  |
| d) pH   | Not applicable   |
| e) Melting point/freezing point                 | Melting point/range: 420 °C (788 °F) - lit.                |
| f) Initial boiling point and boiling range      | 907 °C (1,665 °F) - lit.                                   |
| g) Flash point                                  | Not applicable   |
| h) Evaporation rate                             | No data available  |
| i) Flammability (solid, gas)                    | May form combustible dust concentrations in air            |
| j) Upper/lower flammability or explosive limits | No data available  |
| k) Vapour pressure                              | Not applicable   |
| l) Vapour density                               | No data available  |
| m) Relative density                             | 7.133 g/mL at 25 °C (77 °F)                                |
| n) Water solubility                             | insoluble  |
| o) Partition coefficient: n-octanol/water       | Not applicable   |
| p) Auto-ignition temperature                    | does not ignite  |
| q) Decomposition temperature                    | No data available  |
| r) Viscosity                                    | No data available  |
| s) Explosive properties                         | During processing, dust may form explosive mixture in air. |
| t) Oxidizing properties                         | No data available  |

### 9.2 Other safety information

- |              |                             |
|--------------|-----------------------------|
| Bulk density | 1.8 - 3.2 kg/m <sup>3</sup> |
|--------------|-----------------------------|

---

## 10. STABILITY AND REACTIVITY

### 10.1 Reactivity

No data available

### 10.2 Chemical stability

Stable under recommended storage conditions.

### 10.3 Possibility of hazardous reactions

Dust may form explosive mixture in air.

#### 10.4 Conditions to avoid

No data available

#### 10.5 Incompatible materials

Strong oxidizing agents, Acids and bases

#### 10.6 Hazardous decomposition products

Other decomposition products - No data available  
In the event of fire: see section 5

---

### 11. TOXICOLOGICAL INFORMATION

#### 11.1 Information on toxicological effects

##### Acute toxicity

No data available

Inhalation: No data available

Dermal: No data available

No data available

##### Skin corrosion/irritation

No data available

##### Serious eye damage/eye irritation

No data available

##### Respiratory or skin sensitisation

Did not cause sensitisation on laboratory animals.

##### Germ cell mutagenicity

No data available

##### Carcinogenicity

IARC: 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.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

##### Reproductive toxicity

No data available

No data available

##### Specific target organ toxicity - single exposure

No data available

##### Specific target organ toxicity - repeated exposure

No data available

##### Aspiration hazard

No data available

##### Additional Information

RTECS: ZG8600000

Effects due to ingestion may include:; chills, dry throat, sweet taste, Fever, Cough, Nausea, Vomiting, Weakness,  
Contact with eyes or skin may cause:; Irritation

---

## 12. ECOLOGICAL INFORMATION

### 12.1 Toxicity

Toxicity to fish	LC50 - Cyprinus carpio (Carp) - 450 µg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	LC50 - Daphnia magna (Water flea) - 0.068 mg/l - 48 h
	mortality NOEC - Daphnia (water flea) - 0.101 - 0.14 mg/l - 7 d

### 12.2 Persistence and degradability

The methods for determining the biological degradability are not applicable to inorganic substances.

### 12.3 Bioaccumulative potential

Bioaccumulation	Algae - 7 d at 16 °C - 5 µg/l
	Bioconcentration factor (BCF): 466

### 12.4 Mobility in soil

No data available

### 12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

### 12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.  
Very toxic to aquatic life with long lasting effects.

No data available

---

## 13. DISPOSAL CONSIDERATIONS

### 13.1 Waste treatment methods

#### Product

Offer surplus and non-recyclable solutions to a licensed disposal company.

#### Contaminated packaging

Dispose of as unused product.

---

## 14. TRANSPORT INFORMATION

### DOT (US)

UN number: 3077      Class: 9      Packing group: III  
Proper shipping name: Environmentally hazardous substance, solid, n.o.s.  
Reportable Quantity (RQ): 1000 lbs  
Marine pollutant:  
Poison Inhalation Hazard: No

### IMDG

UN number: 3077      Class: 9      Packing group: III      EMS-No: F-A, S-F  
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Zinc powder (stabilized))  
Marine pollutant: No

### IATA

UN number: 3077      Class: 9      Packing group: III  
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Zinc powder (stabilized))

### Further information

EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

---

## 15. REGULATORY INFORMATION

### SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

### SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Zinc powder (stabilized)	7440-66-6	1993-04-24

### SARA 311/312 Hazards

No SARA Hazards

### Massachusetts Right To Know Components

	CAS-No.	Revision Date
Zinc powder (stabilized)	7440-66-6	1993-04-24

### Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Zinc powder (stabilized)	7440-66-6	1993-04-24

### New Jersey Right To Know Components

	CAS-No.	Revision Date
Zinc powder (stabilized)	7440-66-6	1993-04-24

### California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

---

## 16. OTHER INFORMATION

### Full text of H-Statements referred to under sections 2 and 3.

H400 Very toxic to aquatic life.  
H410 Very toxic to aquatic life with long lasting effects.

### HMIS Rating

Health hazard: 0  
Chronic Health Hazard:  
Flammability: 0  
Physical Hazard 0

### NFPA Rating

Health hazard: 0  
Fire Hazard: 0  
Reactivity Hazard: 0

### Further information

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### Preparation Information

Sigma-Aldrich Corporation  
Product Safety – Americas Region  
1-800-521-8956

Version: 5.6

Revision Date: 08/13/2014

Print Date: 12/11/2014



## SAFETY DATA SHEET

Version 4.6  
Revision Date 07/03/2014  
Print Date 12/11/2014

---

**1. PRODUCT AND COMPANY IDENTIFICATION****1.1 Product identifiers**

Product name : Nitric acid  
  
Product Number : 309079  
Brand : Sigma-Aldrich  
  
CAS-No. : 7697-37-2

**1.2 Relevant identified uses of the substance or mixture and uses advised against**

Identified uses : Laboratory chemicals, Manufacture of substances

**1.3 Details of the supplier of the safety data sheet**

Company : Sigma-Aldrich  
3050 Spruce Street  
SAINT LOUIS MO 63103  
USA  
  
Telephone : +1 800-325-5832  
Fax : +1 800-325-5052

**1.4 Emergency telephone number**

Emergency Phone # : (314) 776-6555

---

**2. HAZARDS IDENTIFICATION****2.1 Classification of the substance or mixture****GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)**

Oxidizing liquids (Category 3), H272  
Acute toxicity, Inhalation (Category 3), H331  
Acute toxicity, Dermal (Category 3), H311  
Skin corrosion (Category 1A), H314  
Serious eye damage (Category 1), H318

For the full text of the H-Statements mentioned in this Section, see Section 16.

**2.2 GHS Label elements, including precautionary statements**

Pictogram



Signal word

Danger

Hazard statement(s)

H272

May intensify fire; oxidiser.

H311 + H331

Toxic in contact with skin or if inhaled

H314

Causes severe skin burns and eye damage.

Precautionary statement(s)

P210

Keep away from heat.

P220

Keep/Store away from clothing/ combustible materials.

P221

Take any precaution to avoid mixing with combustibles.

P261

Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.

P264

Wash skin thoroughly after handling.

P271

Use only outdoors or in a well-ventilated area.

P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P330 + P331 P303 + P361 + P353	IF SWALLOWED: rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310	Immediately call a POISON CENTER or doctor/ physician.
P322	Specific measures (see supplemental first aid instructions on this label).
P361	Remove/Take off immediately all contaminated clothing.
P363	Wash contaminated clothing before reuse.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

### 2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

## 3. COMPOSITION/INFORMATION ON INGREDIENTS

### 3.2 Mixtures

Formula	:	HNO <sub>3</sub>
Molecular Weight	:	63.01 g/mol

#### Hazardous components

Component	Classification	Concentration
<b>Nitric acid</b>		
CAS-No.	7697-37-2	Ox. Liq. 3; Skin Corr. 1A; Eye Dam. 1; H272, H314
EC-No.	231-714-2	
Index-No.	007-004-00-1	
<b>Dinitrogen trioxide</b>		
CAS-No.	10544-73-7	Ox. Gas 1; Press. Gas ; Acute Tox. 1; Acute Tox. 2; Skin Corr. 1B; Eye Dam. 1; H270, H280, H310 + H330, H314
EC-No.	234-128-5	
		10 - 20 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

## 4. FIRST AID MEASURES

### 4.1 Description of first aid measures

#### General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

#### If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

#### In case of skin contact

Take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

#### In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician. Continue rinsing eyes during transport to hospital.

#### If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

#### 4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

#### 4.3 Indication of any immediate medical attention and special treatment needed

no data available

---

### 5. FIREFIGHTING MEASURES

#### 5.1 Extinguishing media

##### Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

#### 5.2 Special hazards arising from the substance or mixture

nitrogen oxides (NO<sub>x</sub>)

#### 5.3 Advice for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

#### 5.4 Further information

Use water spray to cool unopened containers.

---

### 6. ACCIDENTAL RELEASE MEASURES

#### 6.1 Personal precautions, protective equipment and emergency procedures

Wear respiratory protection. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.

For personal protection see section 8.

#### 6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

#### 6.3 Methods and materials for containment and cleaning up

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

#### 6.4 Reference to other sections

For disposal see section 13.

---

### 7. HANDLING AND STORAGE

#### 7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.

Keep away from sources of ignition - No smoking. Keep away from heat and sources of ignition.

For precautions see section 2.2.

#### 7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

#### 7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

---

### 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

#### 8.1 Control parameters

##### Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Nitric acid	7697-37-2	TWA	2 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Eye & Upper Respiratory Tract irritation Dental erosion		
		STEL	4 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Eye & Upper Respiratory Tract irritation		



		Dental erosion		
		ST	4 ppm 10 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	2 ppm 5 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	2 ppm 5 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		The value in mg/m3 is approximate.		
		TWA	2 ppm 5 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		STEL	4 ppm 10 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000

## 8.2 Exposure controls

### Appropriate engineering controls

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

### Personal protective equipment

#### Eye/face protection

Tightly fitting safety goggles. Faceshield (8-inch minimum). Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

#### Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

#### Full contact

Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm

Break through time: 480 min

Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

#### Splash contact

Material: Nature latex/chloroprene

Minimum layer thickness: 0.6 mm

Break through time: 120 min

Material tested: Lapren® (KCL 706 / Aldrich Z677558, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

#### Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

#### Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

#### Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

## 9. PHYSICAL AND CHEMICAL PROPERTIES

### 9.1 Information on basic physical and chemical properties

a) Appearance

Form: clear, liquid

	Colour: colourless
b) Odour	no data available
c) Odour Threshold	no data available
d) pH	< 1 at 20 °C (68 °F)
e) Melting point/freezing point	no data available
f) Initial boiling point and boiling range	100 °C (212 °F) at 1,013 hPa (760 mmHg)
g) Flash point	no data available
h) Evaporation rate	no data available
i) Flammability (solid, gas)	no data available
j) Upper/lower flammability or explosive limits	no data available
k) Vapour pressure	11 hPa (8 mmHg) at 20 °C (68 °F)
l) Vapour density	no data available
m) Relative density	1.48 g/cm <sup>3</sup> at 20 °C (68 °F)
n) Water solubility	completely miscible
o) Partition coefficient: n-octanol/water	no data available
p) Auto-ignition temperature	no data available
q) Decomposition temperature	no data available
r) Viscosity	no data available
s) Explosive properties	no data available
t) Oxidizing properties	no data available

**9.2 Other safety information**  
no data available

---

**10. STABILITY AND REACTIVITY**

**10.1 Reactivity**

no data available

**10.2 Chemical stability**

Stable under recommended storage conditions.

**10.3 Possibility of hazardous reactions**

no data available

**10.4 Conditions to avoid**

no data available

**10.5 Incompatible materials**

Acids, Reducing agents, Alcohols, Acetic anhydride, Acrylonitrile, Acetonitrile, Organic materials, Alkali metals

**10.6 Hazardous decomposition products**

Other decomposition products - no data available

In the event of fire: see section 5

---

## 11. TOXICOLOGICAL INFORMATION

### 11.1 Information on toxicological effects

**Acute toxicity**

no data available

Inhalation: no data available

Dermal: no data available

no data available

**Skin corrosion/irritation**

no data available

**Serious eye damage/eye irritation**

no data available

**Respiratory or skin sensitisation**

no data available

**Germ cell mutagenicity**

no data available

**Carcinogenicity**

IARC: 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.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

**Reproductive toxicity**

no data available

no data available

**Specific target organ toxicity - single exposure**

no data available

**Specific target organ toxicity - repeated exposure**

no data available

**Aspiration hazard**

no data available

**Additional Information**

RTECS: QU5900000

burning sensation, Cough, wheezing, laryngitis, Shortness of breath, spasm, inflammation and edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema, Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin.

Liver - Irregularities - Based on Human Evidence

Liver - Irregularities - Based on Human Evidence

---

## 12. ECOLOGICAL INFORMATION

### 12.1 Toxicity

no data available

### 12.2 Persistence and degradability

no data available

**12.3 Bioaccumulative potential**

no data available

**12.4 Mobility in soil**

no data available

**12.5 Results of PBT and vPvB assessment**

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

**12.6 Other adverse effects**

no data available

**13. DISPOSAL CONSIDERATIONS****13.1 Waste treatment methods****Product**

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

**Contaminated packaging**

Dispose of as unused product.

**14. TRANSPORT INFORMATION****DOT (US)**

UN number: 2032      Class: 8 (5.1, 6.1)      Packing group: I

Proper shipping name: Nitric acid, red fuming

Reportable Quantity (RQ): 1000 lbs

Marine pollutant: No

Poison Inhalation Hazard: Hazard zone B

**IMDG**

UN number: 2032      Class: 8 (5.1, 6.1)      Packing group: I      EMS-No: F-A, S-Q

Proper shipping name: NITRIC ACID, RED FUMING

Marine pollutant: No

**IATA**

UN number: 2032      Class: 8 (5.1, 6.1)

Proper shipping name: Nitric acid, red fuming

IATA Passenger: Not permitted for transport

IATA Cargo: Not permitted for transport

**15. REGULATORY INFORMATION****SARA 302 Components**

The following components are subject to reporting levels established by SARA Title III, Section 302:

	CAS-No.	Revision Date
Nitric acid	7697-37-2	2007-07-01

**SARA 313 Components**

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Nitric acid	7697-37-2	2007-07-01

**SARA 311/312 Hazards**

Acute Health Hazard, Chronic Health Hazard

**Massachusetts Right To Know Components**

	CAS-No.	Revision Date
Nitric acid	7697-37-2	2007-07-01
Dinitrogen trioxide	10544-73-7	1993-04-24

**Pennsylvania Right To Know Components**

Nitric acid	CAS-No. 7697-37-2	Revision Date 2007-07-01
Water	7732-18-5	
Dinitrogen trioxide	10544-73-7	1993-04-24

#### New Jersey Right To Know Components

Nitric acid	CAS-No. 7697-37-2	Revision Date 2007-07-01
Water	7732-18-5	
Dinitrogen trioxide	10544-73-7	1993-04-24

#### California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

## 16. OTHER INFORMATION

### Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Eye Dam.	Serious eye damage
H270	May cause or intensify fire; oxidiser.
H272	May intensify fire; oxidiser.
H280	Contains gas under pressure; may explode if heated.
H310 + H330	Fatal in contact with skin or if inhaled
H311	Toxic in contact with skin.
H314	Causes severe skin burns and eye damage.
H318	Causes serious eye damage.
H331	Toxic if inhaled.
Ox. Gas	Oxidising gases
Ox. Liq.	Oxidizing liquids
Press. Gas	Gases under pressure
Skin Corr.	Skin corrosion

### HMIS Rating

Health hazard:	4
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	3

### NFPA Rating

Health hazard:	4
Fire Hazard:	0
Reactivity Hazard:	3
Special hazard.I:	OX

### Further information

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### Preparation Information

Sigma-Aldrich Corporation  
Product Safety – Americas Region  
1-800-521-8956

Version: 4.6

Revision Date: 07/03/2014

Print Date: 12/11/2014



## SAFETY DATA SHEET

Version 6.10  
Revision Date 08/20/2014  
Print Date 12/11/2014

**1. PRODUCT AND COMPANY IDENTIFICATION****1.1 Product identifiers**

Product name : Hydrochloric acid

Product Number : 320331  
Brand : Sigma-Aldrich  
Index-No. : 017-002-01-X

CAS-No. : 7647-01-0

**1.2 Relevant identified uses of the substance or mixture and uses advised against**

Identified uses : Laboratory chemicals, Manufacture of substances

**1.3 Details of the supplier of the safety data sheet**

Company : Sigma-Aldrich  
3050 Spruce Street  
SAINT LOUIS MO 63103  
USA

Telephone : +1 800-325-5832  
Fax : +1 800-325-5052

**1.4 Emergency telephone number**

Emergency Phone # : (314) 776-6555

**2. HAZARDS IDENTIFICATION****2.1 Classification of the substance or mixture****GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)**

Corrosive to metals (Category 1), H290  
Skin corrosion (Category 1B), H314  
Serious eye damage (Category 1), H318  
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335

For the full text of the H-Statements mentioned in this Section, see Section 16.

**2.2 GHS Label elements, including precautionary statements**

Pictogram



Signal word

Danger

Hazard statement(s)

H290  
H314  
H335

May be corrosive to metals.  
Causes severe skin burns and eye damage.  
May cause respiratory irritation.

Precautionary statement(s)

P234  
P261  
P264  
P271  
P280

Keep only in original container.  
Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.  
Wash skin thoroughly after handling.  
Use only outdoors or in a well-ventilated area.  
Wear protective gloves/ protective clothing/ eye protection/ face protection.

P301 + P330 + P331 P303 + P361 + P353	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310	Immediately call a POISON CENTER or doctor/ physician.
P321	Specific treatment (see supplemental first aid instructions on this label).
P363	Wash contaminated clothing before reuse.
P390	Absorb spillage to prevent material damage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P406	Store in corrosive resistant stainless steel container with a resistant inner liner.
P501	Dispose of contents/ container to an approved waste disposal plant.

### 2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

## 3. COMPOSITION/INFORMATION ON INGREDIENTS

### 3.2 Mixtures

Formula	:	HCl
Molecular weight	:	36.46 g/mol

#### Hazardous components

Component	Classification	Concentration
<b>Hydrochloric acid</b>		
CAS-No.	7647-01-0	30 - 50 %
EC-No.	231-595-7	
Index-No.	017-002-01-X	
Registration number	01-2119484862-27-XXXX	

For the full text of the H-Statements mentioned in this Section, see Section 16.

## 4. FIRST AID MEASURES

### 4.1 Description of first aid measures

#### General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

#### If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

#### In case of skin contact

Take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water. Consult a physician.

#### In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician. Continue rinsing eyes during transport to hospital.

#### If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

### 4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

### 4.3 Indication of any immediate medical attention and special treatment needed

No data available



---

## 5. FIREFIGHTING MEASURES

### 5.1 Extinguishing media

#### Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

### 5.2 Special hazards arising from the substance or mixture

Hydrogen chloride gas

### 5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

### 5.4 Further information

No data available

---

## 6. ACCIDENTAL RELEASE MEASURES

### 6.1 Personal precautions, protective equipment and emergency procedures

Wear respiratory protection. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.

For personal protection see section 8.

### 6.2 Environmental precautions

Do not let product enter drains.

### 6.3 Methods and materials for containment and cleaning up

Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal. Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

### 6.4 Reference to other sections

For disposal see section 13.

---

## 7. HANDLING AND STORAGE

### 7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.

For precautions see section 2.2.

### 7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

### 7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

---

## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

### 8.1 Control parameters

#### Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Hydrochloric acid	7647-01-0	C	2 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Upper Respiratory Tract irritation Not classifiable as a human carcinogen		
		C	5 ppm 7 mg/m <sup>3</sup>	USA. NIOSH Recommended Exposure Limits
		Often used in an aqueous solution.		
		C	5 ppm 7 mg/m <sup>3</sup>	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		The value in mg/m <sup>3</sup> is approximate. Ceiling limit is to be determined from breathing-zone air samples.		

		C	5 ppm 7 mg/m <sup>3</sup>	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
--	--	---	------------------------------	--

## 8.2 Exposure controls

### Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

### Personal protective equipment

#### Eye/face protection

Tightly fitting safety goggles. Faceshield (8-inch minimum). Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

#### Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

#### Full contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: Dermatrill® (KCL 740 / Aldrich Z677272, Size M)

#### Splash contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: Dermatrill® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

#### Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

#### Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

#### Control of environmental exposure

Do not let product enter drains.

---

## 9. PHYSICAL AND CHEMICAL PROPERTIES

### 9.1 Information on basic physical and chemical properties

- |  |                                      |
|--|--------------------------------------|
| a) Appearance                              | Form: liquid<br>Colour: light yellow |
| b) Odour                                   | pungent                              |
| c) Odour Threshold                         | No data available                    |
| d) pH                                      | No data available                    |
| e) Melting point/freezing point            | -30 °C (-22 °F)                      |
| f) Initial boiling point and boiling range | > 100 °C (> 212 °F)                  |

- |   |  |
|---|--|
| g) Flash point                                  | Not applicable   |
| h) Evaporation rate                             | No data available  |
| i) Flammability (solid, gas)                    | No data available  |
| j) Upper/lower flammability or explosive limits | No data available  |
| k) Vapour pressure                              | 226.636 hPa (169.991 mmHg) at 21.1 °C (70.0 °F)<br>546.596 hPa (409.981 mmHg) at 37.7 °C (99.9 °F) |
| l) Vapour density                               | No data available  |
| m) Relative density                             | 1.18 g/mL at 25 °C (77 °F)   |
| n) Water solubility                             | soluble  |
| o) Partition coefficient: n-octanol/water       | No data available  |
| p) Auto-ignition temperature                    | No data available  |
| q) Decomposition temperature                    | No data available  |
| r) Viscosity                                    | No data available  |
| s) Explosive properties                         | No data available  |
| t) Oxidizing properties                         | No data available  |

## 9.2 Other safety information

No data available

---

## 10. STABILITY AND REACTIVITY

### 10.1 Reactivity

No data available

### 10.2 Chemical stability

Stable under recommended storage conditions.

### 10.3 Possibility of hazardous reactions

No data available

### 10.4 Conditions to avoid

No data available

### 10.5 Incompatible materials

Bases, Amines, Alkali metals, Metals, permanganates, e.g. potassium permanganate, Fluorine, metal acetylides, hexalithium disilicide

### 10.6 Hazardous decomposition products

Other decomposition products - No data available  
In the event of fire: see section 5

---

## 11. TOXICOLOGICAL INFORMATION

### 11.1 Information on toxicological effects

#### Acute toxicity

No data available (Hydrochloric acid)

Inhalation: No data available (Hydrochloric acid)

Dermal: No data available (Hydrochloric acid)

No data available (Hydrochloric acid)

**Skin corrosion/irritation**

Skin - Rabbit (Hydrochloric acid)

Result: Causes burns.

**Serious eye damage/eye irritation**

Eyes - Rabbit (Hydrochloric acid)

Result: Corrosive to eyes

**Respiratory or skin sensitisation**

No data available (Hydrochloric acid)

**Germ cell mutagenicity**

No data available (Hydrochloric acid)

**Carcinogenicity**

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification. (Hydrochloric acid)

(Hydrochloric acid)

(Hydrochloric acid)

IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (Hydrochloric acid)

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

**Reproductive toxicity**

No data available (Hydrochloric acid)

No data available (Hydrochloric acid)

**Specific target organ toxicity - single exposure**

The substance or mixture is classified as specific target organ toxicant, single exposure, category 3 with respiratory tract irritation. (Hydrochloric acid)

**Specific target organ toxicity - repeated exposure**

No data available

**Aspiration hazard**

No data available (Hydrochloric acid)

**Additional Information**

RTECS: MW4025000

burning sensation, Cough, wheezing, laryngitis, Shortness of breath, spasm, inflammation and edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema, Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin. (Hydrochloric acid)

---

**12. ECOLOGICAL INFORMATION****12.1 Toxicity**

Toxicity to fish LC50 - Gambusia affinis (Mosquito fish) - 282 mg/l - 96 h (Hydrochloric acid)

**12.2 Persistence and degradability**

No data available

**12.3 Bioaccumulative potential**

No data available

**12.4 Mobility in soil**

No data available (Hydrochloric acid)

**12.5 Results of PBT and vPvB assessment**

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

## 12.6 Other adverse effects

No data available

---

## 13. DISPOSAL CONSIDERATIONS

### 13.1 Waste treatment methods

#### Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

#### Contaminated packaging

Dispose of as unused product.

---

## 14. TRANSPORT INFORMATION

### DOT (US)

UN number: 1789      Class: 8      Packing group: II  
Proper shipping name: Hydrochloric acid  
Reportable Quantity (RQ): 13514 lbs  
Marine pollutant: No  
Poison Inhalation Hazard: No

### IMDG

UN number: 1789      Class: 8      Packing group: II      EMS-No: F-A, S-B  
Proper shipping name: HYDROCHLORIC ACID  
Marine pollutant: No

### IATA

UN number: 1789      Class: 8      Packing group: II  
Proper shipping name: Hydrochloric acid

---

## 15. REGULATORY INFORMATION

### SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

### SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Hydrochloric acid	7647-01-0	1993-04-24

### SARA 311/312 Hazards

Acute Health Hazard

### Massachusetts Right To Know Components

	CAS-No.	Revision Date
Hydrochloric acid	7647-01-0	1993-04-24

### Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Water	7732-18-5	
Hydrochloric acid	7647-01-0	1993-04-24

### New Jersey Right To Know Components

	CAS-No.	Revision Date
Water	7732-18-5	
Hydrochloric acid	7647-01-0	1993-04-24

### California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

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## 16. OTHER INFORMATION

### Full text of H-Statements referred to under sections 2 and 3.

Eye Dam.	Serious eye damage
H290	May be corrosive to metals.
H314	Causes severe skin burns and eye damage.
H318	Causes serious eye damage.
H335	May cause respiratory irritation.
Met. Corr.	Corrosive to metals
Skin Corr.	Skin corrosion
STOT SE	Specific target organ toxicity - single exposure

### HMIS Rating

Health hazard:	3
Chronic Health Hazard:	
Flammability:	0
Physical Hazard	0

### NFPA Rating

Health hazard:	3
Fire Hazard:	0
Reactivity Hazard:	0

### Further information

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### Preparation Information

Sigma-Aldrich Corporation  
Product Safety – Americas Region  
1-800-521-8956

Version: 6.10

Revision Date: 08/20/2014

Print Date: 12/11/2014

## SAFETY DATA SHEET

Version 4.5  
Revision Date 06/26/2014  
Print Date 12/11/2014

---

**1. PRODUCT AND COMPANY IDENTIFICATION****1.1 Product identifiers**

Product name : 2-Methylpropene

Product Number : 295469  
Brand : Aldrich  
Index-No. : 601-012-00-4

CAS-No. : 115-11-7

**1.2 Relevant identified uses of the substance or mixture and uses advised against**

Identified uses : Laboratory chemicals, Manufacture of substances

**1.3 Details of the supplier of the safety data sheet**

Company : Sigma-Aldrich  
3050 Spruce Street  
SAINT LOUIS MO 63103  
USA

Telephone : +1 800-325-5832  
Fax : +1 800-325-5052

**1.4 Emergency telephone number**

Emergency Phone # : (314) 776-6555

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**2. HAZARDS IDENTIFICATION****2.1 Classification of the substance or mixture****GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)**

Flammable gases (Category 1), H220  
Gases under pressure (Liquefied gas), H280

For the full text of the H-Statements mentioned in this Section, see Section 16.

**2.2 GHS Label elements, including precautionary statements**

Pictogram



Signal word : Danger

Hazard statement(s)

H220 : Extremely flammable gas.  
H280 : Contains gas under pressure; may explode if heated.

Precautionary statement(s)

P210 : Keep away from heat/sparks/open flames/hot surfaces. - No smoking.  
P377 : Leaking gas fire: Do not extinguish, unless leak can be stopped safely.  
P381 : Eliminate all ignition sources if safe to do so.  
P410 + P403 : Protect from sunlight. Store in a well-ventilated place.

**2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none**

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**3. COMPOSITION/INFORMATION ON INGREDIENTS****3.1 Substances**

Aldrich - 295469

Synonyms : Isobutylene  
 Formula : C<sub>4</sub>H<sub>8</sub>  
 Molecular Weight : 56.11 g/mol  
 CAS-No. : 115-11-7  
 EC-No. : 204-066-3  
 Index-No. : 601-012-00-4

**Hazardous components**

Component	Classification	Concentration
<b>2-Methylpropene</b>		
	Flam. Gas 1; Press. Gas ; H220, H280	-

For the full text of the H-Statements mentioned in this Section, see Section 16.

**4. FIRST AID MEASURES**

**4.1 Description of first aid measures**

**General advice**

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

**If inhaled**

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

**In case of skin contact**

Wash off with soap and plenty of water. Consult a physician.

**In case of eye contact**

Flush eyes with water as a precaution.

**If swallowed**

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

**4.2 Most important symptoms and effects, both acute and delayed**

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

**4.3 Indication of any immediate medical attention and special treatment needed**

no data available

**5. FIREFIGHTING MEASURES**

**5.1 Extinguishing media**

**Suitable extinguishing media**

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

**5.2 Special hazards arising from the substance or mixture**

Carbon oxides

**5.3 Advice for firefighters**

Wear self contained breathing apparatus for fire fighting if necessary.

**5.4 Further information**

Use water spray to cool unopened containers.

**6. ACCIDENTAL RELEASE MEASURES**

**6.1 Personal precautions, protective equipment and emergency procedures**

Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

For personal protection see section 8.

**6.2 Environmental precautions**

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.



### 6.3 Methods and materials for containment and cleaning up

Clean up promptly by sweeping or vacuum.

### 6.4 Reference to other sections

For disposal see section 13.

---

## 7. HANDLING AND STORAGE

### 7.1 Precautions for safe handling

Avoid inhalation of vapour or mist.

Use explosion-proof equipment. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

For precautions see section 2.2.

### 7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.

### 7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

---

## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

### 8.1 Control parameters

#### Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
2-Methylpropene	115-11-7	TWA	250 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Upper Respiratory Tract irritation body weight effects Not classifiable as a human carcinogen		

### 8.2 Exposure controls

#### Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

#### Personal protective equipment

##### Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

##### Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

##### Full contact

Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm

Break through time: 480 min

Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

##### Splash contact

Material: Nitrile rubber

Minimum layer thickness: 0.4 mm

Break through time: 60 min

Material tested: Camatril® (KCL 730 / Aldrich Z677442, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an

industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

### **Body Protection**

impervious clothing, Flame retardant antistatic protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

### **Respiratory protection**

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

### **Control of environmental exposure**

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

---

## **9. PHYSICAL AND CHEMICAL PROPERTIES**

### **9.1 Information on basic physical and chemical properties**

- |   |  |
|---|--|
| a) Appearance                                   | Form: Liquefied gas  |
| b) Odour  | unpleasant   |
| c) Odour Threshold                              | no data available  |
| d) pH   | no data available  |
| e) Melting point/freezing point                 | Melting point/range: -140 °C (-220 °F)                             |
| f) Initial boiling point and boiling range      | -6.9 °C (19.6 °F) - lit.   |
| g) Flash point                                  | -80 °C (-112 °F) - closed cup                                      |
| h) Evaporation rate                             | no data available  |
| i) Flammability (solid, gas)                    | no data available  |
| j) Upper/lower flammability or explosive limits | Upper explosion limit: 9.6 %(V)<br>Lower explosion limit: 1.8 %(V) |
| k) Vapour pressure                              | 4,370 hPa (3,278 mmHg) at 37.7 °C (99.9 °F)                        |
| l) Vapour density                               | 2.25   |
| m) Relative density                             | no data available  |
| n) Water solubility                             | no data available  |
| o) Partition coefficient: n-octanol/water       | log Pow: 2.34  |
| p) Auto-ignition temperature                    | no data available  |
| q) Decomposition temperature                    | no data available  |
| r) Viscosity                                    | no data available  |
| s) Explosive properties                         | no data available  |
| t) Oxidizing properties                         | no data available  |

### **9.2 Other safety information**

Relative vapour density 2.25

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## 10. STABILITY AND REACTIVITY

### 10.1 Reactivity

no data available

### 10.2 Chemical stability

Stable under recommended storage conditions.

### 10.3 Possibility of hazardous reactions

no data available

### 10.4 Conditions to avoid

Heat, flames and sparks. Extremes of temperature and direct sunlight.

### 10.5 Incompatible materials

Strong oxidizing agents, Strong acids, Halogens

### 10.6 Hazardous decomposition products

Other decomposition products - no data available

In the event of fire: see section 5

---

## 11. TOXICOLOGICAL INFORMATION

### 11.1 Information on toxicological effects

#### Acute toxicity

LC50 Inhalation - rat - 4 h - 620,000 mg/m<sup>3</sup>

Dermal: no data available

no data available

#### Skin corrosion/irritation

no data available

#### Serious eye damage/eye irritation

no data available

#### Respiratory or skin sensitisation

no data available

#### Germ cell mutagenicity

no data available

#### Carcinogenicity

IARC: 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.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

#### Reproductive toxicity

no data available

no data available

#### Specific target organ toxicity - single exposure

no data available

#### Specific target organ toxicity - repeated exposure

no data available

#### Aspiration hazard

no data available

#### Additional Information

RTECS: UD0890000

Acts as a simple asphyxiant by displacing air., Dizziness, Disorientation, Headache, excitement, Central nervous system depression, To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

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## 12. ECOLOGICAL INFORMATION

### 12.1 Toxicity

no data available

### 12.2 Persistence and degradability

no data available

### 12.3 Bioaccumulative potential

no data available

### 12.4 Mobility in soil

no data available

### 12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

### 12.6 Other adverse effects

no data available

---

## 13. DISPOSAL CONSIDERATIONS

### 13.1 Waste treatment methods

#### Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. 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.

---

## 14. TRANSPORT INFORMATION

### DOT (US)

UN number: 1055 Class: 2.1

Proper shipping name: Isobutylene

Marine pollutant: No

Poison Inhalation Hazard: No

### IMDG

UN number: 1055 Class: 2.1

Proper shipping name: ISOBUTYLENE

Marine pollutant: No

EMS-No: F-D, S-U

### IATA

UN number: 1055 Class: 2.1

Proper shipping name: Isobutylene

IATA Passenger: Not permitted for transport

---

## 15. REGULATORY INFORMATION

### SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

### SARA 313 Components

SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

### SARA 311/312 Hazards

Fire Hazard, Sudden Release of Pressure Hazard

**Massachusetts Right To Know Components**

2-Methylpropene	CAS-No. 115-11-7	Revision Date 1993-04-24
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**Pennsylvania Right To Know Components**

2-Methylpropene	CAS-No. 115-11-7	Revision Date 1993-04-24
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**New Jersey Right To Know Components**

2-Methylpropene	CAS-No. 115-11-7	Revision Date 1993-04-24
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**California Prop. 65 Components**

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

---

**16. OTHER INFORMATION****Full text of H-Statements referred to under sections 2 and 3.**

Flam. Gas	Flammable gases
H220	Extremely flammable gas.
H280	Contains gas under pressure; may explode if heated.
Press. Gas	Gases under pressure

**HMIS Rating**

Health hazard:	1
Chronic Health Hazard:	*
Flammability:	4
Physical Hazard	0

**NFPA Rating**

Health hazard:	1
Fire Hazard:	4
Reactivity Hazard:	0
Health hazard:	0
Fire Hazard:	4
Reactivity Hazard:	0

**Further information**

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**Preparation Information**

Sigma-Aldrich Corporation  
Product Safety – Americas Region  
1-800-521-8956

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