PHASE II INVESTIGATION WORK PLAN

AREA A: PARCEL A15
TRADEPOINT ATLANTIC
SPARROWS POINT, MARYLAND

Prepared For:

TRADEPOINT ATLANTIC
6995 Bethlehem Boulevard
Sparrows Point, Maryland 21219

Prepared By:

ARM GROUP LLC
9175 Guilford Road
Suite 310
Columbia, Maryland 20146

ARM Project No. 21010115

Respectfully Submitted,
ARM Group LLC

Melissa A. Replogle, E.I.T.
Project Engineer

Eric S. Magdar, P.G.
Vice President

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1.0 INTRODUCTION

1.1. INTRODUCTION

ARM Group LLC (ARM), on behalf of Tradepoint Atlantic, has prepared the following Work Plan to complete a Phase II Investigation on a portion of the Tradepoint Atlantic property that has been designated as Area A: Parcel A15 (the Site). Parcel A15 is comprised of 61.3 acres of the approximately 3,100-acre former plant property located as shown on **Figure 1**. The Industrial (or High Head) Water Reservoir occupies most of the parcel (approximately 40.4 acres), with about 20.9 acres of land. There are two brick pumping stations within Parcel A15 at the southwest and southeastern sides of the tract, and an electrical substation is present just northwest of the southwestern pump station. The is also an above ground tank in a diked structure at the northeastern side of the reservoir along Reservoir Road.

Site characterization of Parcel A15 will be performed in compliance with requirements pursuant to the following:

- Administrative Consent Order (ACO) between Tradepoint Atlantic (formerly Sparrows Point Terminal, LLC) and the Maryland Department of the Environment (MDE), effective September 12, 2014; and
- Settlement Agreement and Covenant Not to Sue (SA) between Tradepoint Atlantic (formerly Sparrows Point Terminal, LLC) and the United States Environmental Protection Agency (USEPA) effective November 25, 2014.

An application to enter the full Tradepoint Atlantic property (3,100 acres) into the Maryland Department of the Environment Voluntary Cleanup Program (MDE-VCP) was submitted to the MDE and delivered on June 27, 2014. The property's current and anticipated future use is Tier 3 (Industrial), and plans for the property include demolition and redevelopment over the next several years.

Parcel A15 is part of the acreage that was removed (Carveout Area) from inclusion in the Multimedia Consent Decree between Bethlehem Steel Corporation, the USEPA, and the MDE (effective October 8, 1997) as documented in correspondence received from the USEPA on September 12, 2014. Based on this agreement, the USEPA has determined that no further investigation or corrective measures will be required under the terms of the Consent Decree for the Carveout Area. However, the SA reflects that the property within the Carveout Area will remain subject to USEPA's Resource Conservation and Recovery Act (RCRA) Corrective Action authorities.

Tradepoint Atlantic has developed an initial master plan that shows potential future development areas across the entire Tradepoint Atlantic property. This master plan is a working document, and it is expected to undergo subsequent revisions in the future. The most recent plan does not show any proposed development within Parcel A15.

The objective of this Phase II Investigation is to identify the presence or absence of any existing hazardous conditions for future tenants or personnel working on the Site. During the Phase II Investigation, in order to assess the presence or absence of contamination, samples will be collected for analysis from a total of 16 soil borings, five temporary groundwater collection points or monitoring wells, ten sediment sample locations, and eight surface water samples locations. Following the receipt of analytical data, a Phase II Investigation Report will be prepared to summarize the findings.

1.2. SITE BACKGROUND

From the late 1800s 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 steel making operations at the facility ceased in fall 2012.

Groundcover in Parcel A15 is comprised of approximately 60% natural soils based on the approximate shoreline of the Sparrows Point Peninsula in 1916, as shown on **Figure 2** (Adapted from Figure 2-20 on the Description of Current Conditions (DCC) Report prepared by Rust Environment and Infrastructure, dated January 1998).

1.2.1. Historical Operations – Industrial Water Reservoir

The Industrial Water Reservoir occupies approximately 66% of the 61.3 acres of Parcel A15. It appears the Reservoir was constructed between 1916 and 1952 by damming and expanding a bay formerly present on the northern side of Humphrey Creek. The Phase I Environmental Site Assessment (ESA) prepared by Weaver Boos Consultants dated May 19, 2014 identified one Recognized Environmental Conditions (RECs) on the adjacent Parcel A8. Finding 243, REC 11B identifies a discharge pipe leading from beneath the Air Production Facility to the Industrial Water Reservoir. According to the Phase I ESA (Weaver Boos), oily surface water was observed in the discharge area during a site visit. Booms were placed around the discharge pipe, although oil was observed on both sides of the booms. The Phase I ESA also identified one REC (Finding 281, REC 28A) to the northeast of Parcel A15. There were seven underground storage tanks (USTs) of unknown contents (listed as out of use) on the adjacent non-TPA property.

There are two pumping stations currently located within Parcel A15, along with an above ground storage tank in a concrete containment structure. The storage tank contained hypochlorite solution for treatment of water in the reservoir. Each pumping station has an associated sub-station. The oxygen plant/Air Products facility had been present west of Parcel A15 in Parcel A8 and has previously been assessed (refer to the Phase II Investigation Report for Parcel A8 by ARM Group LLC, Revision 1, dated November 11, 2017). Runoff from multiple properties, including TPA parcels A2, A8, A13, and A14, the non-TPA property along the northeast boundary, and I-695 to the south, appears to be collected in the Industrial Water Reservoir. The reservoir is fed by treated effluent from the Back River Wastewater Treatment Plant (BRWWTP) operated by Baltimore City. While the steel plant was operational, treated effluent stored in the reservoir was used as an industrial water source. The reservoir continues to receive effluent from the BRWWTP. The effluent is believed to enter the reservoir through a large pipe observed in the northeastern portion of the reservoir.

The Site's layout in 1952 is shown in the aerial imagery presented in **Figure 3**. Pumping Station #2 and the sub-station, which are visible in the recent aerial imagery shown on **Figure 5**, had not yet been constructed in 1952. The Industrial Water Reservoir appears to occupy the same area as was observed in the site walk. There is no evidence that iron and steel industrial processes were completed within the boundary of Parcel A15. The Phase I ESA prepared by Weaver Boos Consultants dated May 19, 2014, states generically that fly dumping was known to occur outside of the main facility along roads and mainly in vacant and unmonitored areas.

1.2.2. Current Site Conditions

A site walk of Parcel A15 was completed by ARM staff on June 27, 2022 in order to characterize current conditions at the Site, and to determine the presence and location of access restrictions which were likely to be encountered by drilling subcontractors and sampling personnel. Observations from a previous site walk conducted by ARM staff on June 6, 2019 were also considered. A photograph log from the June 27, 2022 site visit has been included as **Appendix A**. Parcel A15 is currently occupied primarily by the Industrial Water Reservoir and vegetative growth around the perimeter of the reservoir, including *Phragmites* reeds. Historic aerials appear to show a boom in place from approximately 2007 to 2018 in the vicinity of REC 11B. Historic aerial photographs obtained from Google Earth for the years 2008, 2014, and 2017 depicting the location of the boom are included in **Appendix B**. During the 2019 site walk, an oil boom was observed in the same area.

Observations during the site walk were generally consistent with what was observed in aerial imagery and historical drawings. Pumping Station #1 and Pumping Station #2 appeared to be operational and maintained. A standing tank with unknown contents in a concrete secondary containment structure was observed during the 2019 site walk on the eastern side of the reservoir. The standing tank historically held hypochlorite solution which was used for treatment of water in

the reservoir. Three valve vault structures were observed surrounding the reservoir. Debris and household garbage were discovered in various areas across the Site. The findings from the site visit were incorporated into the sampling plan.

1.2.3. Background Environmental Data

Groundwater samples from the subject Site and surrounding area were previously collected as described in the Site Wide Investigation Groundwater Study Report (Bethlehem Steel Corporation Sparrows Point Division 2001) and the Parcel A8 Phase II Investigation Report (Revision 1, dated 11/6/2017). The groundwater data obtained from this prior investigation are described below. There are no historical soil or soil gas sampling data available from Parcel A15.

Historical Groundwater Data

There were three historical groundwater wells within the boundary of Parcel A15: SG04-PDM008 (shallow hydrogeologic zone), SG04-PPM011 (shallow hydrogeologic zone), and SG03-PPM012 (shallow hydrogeologic zone). Monitoring well SG04-PDM008 was inspected by ARM on January 24, 2022 and found to be in good condition. Monitoring well SG04-PPM011 was previously located within the boundary of Parcel A15 but could not be located during ARM's inspection on January 24, 2022 and is presumed to be destroyed. Monitoring well SG03-PPM012 was previously located within the boundary of Parcel A15 but was abandoned on June 29, 2017. An additional shallow historical well, SG03-PDM007, is located just outside of the A15 boundary, on an industrial site outside of the overall Tradepoint Atlantic property boundary. The historical monitoring wells are shown on **Figure 4**, and the well inspection logs are included as **Appendix C**. Available analytical data from these wells were extracted from the Site Wide Investigation Groundwater Study Report prepared by the Bethlehem Steel Corporation Sparrows Point Division in 2001 and more recent Phase II investigations. The historical analytical results from these wells included groundwater quality parameters only (sulfate, chloride, bicarbonate, iron, magnesium, manganese, potassium, sodium, calcium, and total dissolved solids) and are summarized in **Appendix D**. Highlighted results indicate any exceedances of the aqueous PALs for individual constituents. The appendix also indicates the screen interval and the hydrogeologic zone for each of the historical wells. **Appendix D** also indicates the screened interval for each of the historic groundwater sample points, as well as the hydrogeologic zone.

Parcel A8 Phase II Investigation Groundwater Data

Three piezometers (A8-004-PZ, A8-007-PZ, and A8-017-PZ) were installed within 300 feet of the Parcel A15 boundary as part of the Parcel A8 Phase II Investigation. The locations of these piezometers are shown on **Figure 4**, and a summary of detections in groundwater samples is presented in **Appendix E**, with the aqueous PAL exceedances highlighted.

In accordance with standard protocols, each point was checked for the presence of non-aqueous phase liquid (NAPL) using an oil-water interface probe prior to sampling. NAPL was observed in A8-017-PZ, and delineations were completed surrounding the initial location to evaluate the extent of the NAPL in the subsurface. No sampling was completed at the A8-017-PZ delineation network piezometers. The results of this delineation were presented in the A8-017-PZ NAPL Delineation Completion Report dated March 26, 2019. Two permanent wells, SW-098-MWS and SW-099-MWS, were subsequently installed in the vicinity of A8-017-PZ for NAPL monitoring; only. Neither well has contained measurable NAPL during monitoring from 2015-2022.

An additional delineation was completed surrounding A8-007-PZ following detections of elevated chlorinated volatile organic compounds (CVOCs) in groundwater samples. The results of the delineation were presented in the Supplemental Investigation Report for CVOC Impacted Groundwater at A8-007-PZ dated January 22, 2020. The locations of these piezometers are shown on **Figure 4**, and a summary of detections in groundwater samples is presented in **Appendix F**, with the aqueous PAL exceedances highlighted.

Parcel A2 Phase II Investigation Groundwater Data

One piezometer, A2-022-PZ was installed near the Parcel A15 boundary as part of the Parcel A2 Phase II Investigation. The location of this piezometer is shown on **Figure 4**, and a summary of detections in groundwater samples is presented in **Appendix E**, with the aqueous PAL exceedances highlighted.

Sub-Parcel A8-2 Response and Development Work Plan (RADWP) Soil Data

Parcel A15 is bordered to the west by Parcel A8. The Sub-Parcel A8-2 RADWP (Rev. 1) was submitted on September 15, 2020. The Sub-Parcel A8-2 RADWP was modified by two subsequent RADWP Addenda. As part of the Sub-Parcel A8-2 RADWP (Rev. 1 dated September 15, 2020), the MDE requested that additional soil sampling be performed along the northeast access road for the sub-parcel, which lies primarily within Parcel A15. Three rounds of sampling were conducted, as proposed in the Supplemental Sampling Plans dated September 25, 2020; March 8, 2021; and August 11, 2021. The objective of the sampling was to characterize elevated metals and polynuclear aromatic hydrocarbon (PAH) impacts along this northeastern access road. The delineation sample locations from all three sampling rounds are shown on *Figure 1* in **Appendix G**. This figure also shows adjacent soil sample locations within Parcel A8. Elevated metals were observed at A15-003-SB as part of the first round of supplemental sampling, while elevated PAHs were observed at A15-002A-SB as part of the second round of supplemental sampling. The results of the first two delineations are summarized in the Sub-Parcel A8-2 RADWP Addendum Supplemental Sampling Plan – 3rd Round (dated August 11, 2021). The results of the third delineation are presented in the Sub-Parcel A8-2 RADWP SLRA Addendum (dated September 20, 2021), which addressed Composite Worker and Construction Worker risk

associated with the main area of the sub-parcel and the northeastern access road. Elevated surficial PAHs observed in soil boring A15-002A-SB, which was completed within the access road, have been delineated with supplemental soil boring collected on either side of the road. The soil boring location in the road has been patched, so surficial soil at this location does not pose a risk to future Workers at the Site since it lies beneath the roadway.

Based on the delineation sampling results, the RADWP SLRA Addendum proposed an excavation of the top 2 feet of soil from location A15-003-SB to address metals impacts, extending between the delineation samples A15-003D-SB and A15-003E-SB. Excavation was completed at this location to ensure that surficial soils would not exceed the dermal non-carcinogenic hazard index threshold for the Composite Worker for the Screening Level Risk Assessment as documented in the Sub-Parcel A8-2 Excavation Completion Report dated April 13, 2022. The completed excavation extents are shown on *Figure 2* in **Appendix G**.

1.3. SAMPLING DESIGN AND RATIONALE

1.3.1. Soil Sampling Targets

Parcel A15 contains a total of approximately 61.3 acres, of which 40.4 are covered by water and were excluded, leaving 20.9 acres of land. Due to the weathered condition of the existing pavement and concrete, the Site is considered as having no engineered barriers for boring density calculations for the Site. There are two brick pumping stations, each with an associated electrical substation, at the southwest and southeastern sides of the tract. An additional electrical substation is present just northwest of the southwestern pump station. There is also an above ground tank in a diked structure at the northeastern side of the reservoir along Reservoir Road. In accordance with the relevant sampling density requirements, a minimum of 15 soil borings are required to be completed at the Site. **Figure 5** shows the proposed borings on an aerial image to indicate locations of borings with regard to physical obstructions (wooded areas, standing water) and landmarks at the Site. This figure acts as a reference map and indicates the boring IDs assigned to each individual location. The soil boring IDs have been abbreviated on all subsequent soil sampling figures.

Across the whole Tradepoint Atlantic property, several buildings and facilities may have been historical sources of environmental contamination. These areas were identified as targets for sampling through a careful review of historical documents. Historical maps and drawings were geospatially referenced using Geographic Information Systems (GIS) software (ArcMap Version 10.6), and reviewed to determine the specific sampling locations. The first sampling targets to be reviewed were RECs, if present, that are located within the Site boundaries as shown on the REC Location Map provided in the Phase I ESA prepared by Weaver Boos dated May 19, 2014. Weaver Boos completed site visits of Sparrows Point from February 19 through 21, 2014, for the purpose of characterizing current conditions at the former steel plant. All RECs on the Tradepoint Atlantic

property are required to be targeted with at least three boring locations. There were no RECs identified at the Site based on the Phase I ESA; however two RECs were identified adjacent to the Site.

Oily Surface Water Discharge to High Head Reservoir (REC 11B, Finding 243):
Oil surface water was observed in the vicinity of a discharge pipe from the Air Products Facility. Booms were placed around the discharge pipe. Soil and groundwater in the vicinity of this REC was investigated as part of the A8 Phase II ESA.

Adjoining Property Underground Storage Tanks (USTs) (REC 28A, Finding 281):
According to the Phase I ESA, the following up-gradient adjoining properties are listed on the UST database:

- American National Can Company, 2010 Reservoir Rd. – seven USTs of unknown materials listed as permanently out of use, located east of the Site

The status of the USTs is unknown, and Weaver Boos recognized the potential for leaks or spills (although specific incidents are unknown) which could have the potential to negatively impact the environment.

In addition to the UST noted in the Phase I ESA, an additional historical UST was reported closed in the Closure of Underground Storage Tanks Report prepared by Geraghty and Miller, Inc. (dated June 1992). The report notes that a tank used for supplying fuel to the furnace in Pumping Station #2 was closed and removed in 1989. Subsequent soil, groundwater, and surface water samples of the surrounding area had no detection of hydrocarbons.

The DCC Report was also reviewed to identify additional sampling targets. This report included documentation from a previous Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) and a visual site inspection (VSI) prepared by A.T. Kearney, Inc. (dated August 1993). The purpose of the VSI was to identify Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) on the property. SWMUs and AOCs, if present, were identified from the DCC Report Figure 3-1. **Figure 6** shows the proposed borings overlain on the DCC figure, which shows the SWMUs, AOCs, and main facility areas within the parcel boundaries. There were no SWMUs or AOCs identified at the Site based on this figure, and no additional units were identified from the DCC Report Table 3-1.

Following the identification of all RECs, SWMUs, and AOCs, four 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), the 5500 Set (Plant Sewer Lines), and a set of drawings indicating coke oven gas distribution drip leg locations. 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. Drip

legs are points throughout the distribution system where coke oven gas condensate was removed from the gas pipelines. The condensate from the drip legs was typically discharged to drums, although it is possible some spilled out of the drums and on to the ground. There were no drip legs identified within the Site boundary. **Figure 7** through **Figure 9** show the proposed borings and the parcel boundary overlain on the 5000 Set, 5100 Set, and 5500 Set, respectively. A summary of the specific drawings covering the Site is presented in the table below:

Parcel A15 Historical Site Drawings Details

Set Name	Typical Features Shown	Drawing Number	Original Date Drawn	Latest Revision Date
Plant Arrangement	Roads, water bodies, building/ structure footprints, electric lines, above-ground pipelines (e.g.: steam, nitrogen, etc.)	5051	6/1/1960	3/19/1982
		5052	6/30/1959	3/11/1982
		5056	1/27/1959	3/11/1982
		5057	4/27/1959	3/11/1982
		5061	2/8/1962	3/11/1982
		5062	2/8/1962	3/11/1982
Plant Index	Roads, water bodies, demolished buildings/structures, electric lines, above-ground pipelines	5151	*unknown*	2/21/2008
		5152	*unknown*	2/25/2008
		5156	*unknown*	11/10/2008
		5157	*unknown*	11/10/2008
		5161	*unknown*	3/6/2008
		5162	*unknown*	3/6/2008
Plant Sewer Lines	Same as above plus trenches, sumps, underground piping (includes pipe materials)	5551	9/16/1959	3/5/1976
		5552	9/16/1959	3/9/1976
		5556	4/5/1961	2/41/76
		5557	*unknown*	2/2/1976
		5561	2/5/1976	2/5/1976
		5562	3/15/1976	3/15/1976

A list and figure of former polychlorinated biphenyls (PCB)-containing transformer equipment was also reviewed for inclusion as additional targets. There were no possible PCB-contaminated equipment areas identified in the parcel based on this information.

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. A careful review of the geospatially referenced figures and other historical documents (as previously discussed) yielded the proposed boring locations. Additional sample locations were added to fill in areas with insufficient coverage (large spatial gaps between borings) within the Site and to meet the sample

density requirements set forth in the QAPP Worksheet 17 – Sampling Design and Rationale. The sample IDs, along with the specific rationale for sampling at the Site, are provided in **Appendix H**. The 17 proposed soil boring locations are shown on **Figure 6**.

Tradepoint Atlantic will coordinate with ARM to remove trees/brush with the use of heavy equipment to provide an access pathway for the drill rig where necessary. Some boring locations within Parcel A15 may be inaccessible to the drill rig and/or heavy equipment due to soft surface conditions and/or standing water. In the event that some locations are unable to be accessed due to soft ground, borings at these locations will be completed to the water table (which is expected to be relatively shallow below the existing ground surface) by the use of a hand auger. The soil sampling plan for conditions involving soft ground or standing water is further described in Section 3.3.

1.3.2. Groundwater Investigation

Groundwater will be investigated at the Site using three proposed temporary groundwater sample collection points (commonly referred to as piezometers) and three existing wells (SG03-PDM007, SG04-PDM008, and SW-098-MWS). Sample locations where piezometers are proposed to be installed within Parcel A15 include: A15-012-PZ, A15-014-PZ, and A15-016-PZ. **Figure 10** shows an aerial view of the piezometers that are proposed to be sampled to characterize groundwater conditions in Parcel A15, along with the historical wells.

1.3.3. Sediment Sampling Targets

Sediment samples will be collected from 12 locations in the Industrial Water Reservoir. The proposed locations are shown on **Figure 11**. One proposed sediment location is directly offshore from REC 11B. Two proposed sediment locations are directly offshore from effluent locations indicated on the 5500 Drawing Set (Plant Sewer Lines). Two proposed sediment sample locations are offshore from the two pumping stations. The remaining proposed sample locations are distributed across the Industrial Water Reservoir for spatial coverage.

1.3.4. Surface Water Sampling Targets

Surface water samples will be collected from eight locations in the Industrial Water Reservoir. The selected sampling points are collocated with sediment sampling points. The proposed locations are shown on **Figure 11**. One proposed surface water location is directly offshore from REC 11B. Two proposed surface water locations are directly offshore from effluent pipes. The remaining proposed sample locations are distributed across the Industrial Water Reservoir for spatial coverage.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

2.1. PROJECT PERSONNEL

The site characterization of Area A: Parcel A15 will be conducted by ARM under a contract with Tradepoint Atlantic. ARM will provide project planning, field sampling, and reporting services. The required drilling and laboratory services will be contracted directly by Tradepoint Atlantic. The management, field, and laboratory responsibilities of key project personnel are defined in this section.

The ARM Project Manager, Mr. Eric Magdar, is responsible for ensuring that all activities are conducted in accordance with this Work Plan and the contract requirements. Mr. Magdar will provide technical coordination with the MDE, USEPA, and Tradepoint Atlantic. The ARM Project Manager is responsible for managing all operations conducted for this project including:

- Ensure all personnel assigned to this project review the technical project plans before initiation of all tasks associated with the project.
- Review of project plans in a timely manner.
- Ensure proper methods/procedures are implemented to collect representative samples.
- Monitor the project budget and schedule and ensure the availability of necessary personnel, equipment, subcontractors, and other necessary services.

The lead ARM Geologist, Mr. Joshua Barna, will be responsible for coordinating field activities including the collection, preservation, documentation, and shipment of samples. Mr. Barna will directly communicate with the ARM Project Manager and Laboratory Project Manager on issues pertaining to sample shipments, schedules, container requirements, and other necessary issues. Mr. Barna is also responsible for ensuring the accuracy of sample documentation including the completion of the Chain of Custody (COC) forms.

Alpha Analytical, Inc. (Alpha) will provide the analytical services for this project. The address for the laboratory is as follows:

Alpha Analytical
8 Walkup Drive
Westborough, MA 01581

During the field activities, the Laboratory Project Manager will coordinate directly with the ARM Project Manager on issues regarding sample shipments, schedules, container requirements, and other field-laboratory logistics. The Laboratory Project Manager will monitor the daily activities of the laboratory, coordinate all production activities, and ensure that work is being conducted as

specified in this document. Mr. Mitchell Ostrowski will be the Laboratory Project Manager for Alpha on this project.

2.2. HEALTH AND SAFETY ISSUES

Because of the potential presence of hazardous constituents in the soil, sediment, and groundwater at the Site, the investigation will be conducted under the TPA Facility Wide Health and Safety Plan (HASP) to protect investigation workers from possible exposure to contaminated materials. The TPA HASP to be used during the field investigation of Parcel A15 is included as **Appendix I**.

Based on information provided to ARM, the planned site activities will be conducted under modified Level D personal protection. The requirements of the modified Level D protection are defined in the attached HASP. 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.

3.0 FIELD ACTIVITIES AND PROCEDURES

3.1. UTILITY CLEARANCE

ARM will take appropriate precautions to avoid subsurface utilities and structures during the site investigation. Prior to initiating any subsurface investigations, ARM will attempt to determine the location of utilities in the project area using the Miss Utility system. Additionally, any required state or local permits will be acquired prior to the commencement of site activities.

In addition to the Miss Utility system, Tradepoint Atlantic will clear each proposed sample location with utility personnel currently working on the property. To facilitate this, ARM will locate and mark out all proposed locations in the field with a GPS. ARM will coordinate the staking of sample locations in the field with Tradepoint Atlantic utility personnel to avoid conflicts. Historical utility drawings which may be relevant include the 5600 Set (Plant Water Lines) and 5800 Set (Plant Gas Lines).

3.2. SAMPLING PLAN

The purpose of this site characterization is to identify any existing hazardous conditions across the entire Site. A summary of the investigation plan, along with the proposed boring identification numbers and the analyses being performed, has been provided as **Appendix H**.

This Work Plan presents the methods and protocols to be used to complete the site characterization. These methods and procedures follow the MDE-VCP and USEPA 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, and reporting requirements are described in detail in the QAPP that has been developed to support the investigation and remediation of the Tradepoint Atlantic property (Quality Assurance Project Plan, ARM Group Inc., April 5, 2016).

The proposed schedule of this investigation is contained in this Work Plan (Section 8.0). All site characterization activities will be conducted under the HASP (**Appendix I**).

3.3. SOIL INVESTIGATION

Soil samples collected from the locations identified on **Figure 3** and **Figure 5** through **Figure 9** will be screened and analyzed in accordance with procedures referenced in the QAPP Worksheet 21 – Field SOPs (Standard Operating Procedures), SOP No. 009 – Sub-Surface Soil Sampling. Soil sample locations will begin with ID number A15-004-SB due to the previous Sub-Parcel A8-2 delineation investigation work performed within Parcel A15. Regarding soil sampling depth, a

shallow sample will be collected from the 0 to 2 foot depth interval, and a deeper sample will be collected from the 4 to 5 foot depth interval. Soil samples will be analyzed for semivolatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), Target Analyte List (TAL)-Metals, Oil & Grease, total petroleum hydrocarbon (TPH) – diesel range organics (DRO), TPH-gasoline range organics (GRO), hexavalent chromium, and cyanide. Samples from any depth interval with a sustained photoionization detector (PID) reading of greater than 10 ppm will also be analyzed for volatile organic compounds (VOCs). Additionally, the soil sample collected from the shallow interval (0 to 2 foot below ground surface [bgs]) will be analyzed for PCBs. If the PID or other field observations indicate contamination to exist at a depth greater than 3 feet bgs but less than 9 feet bgs, and above the water table, the sample from the deeper 4 to 5 foot interval may be shifted to the depth interval indicated by the PID response. One additional sample will also be collected from the 9 to 10 foot depth interval if groundwater has not been encountered. It should be noted that no soil samples will be collected from a depth that is below the water table.

If the PID reading from the 9 to 10 foot depth interval is less than 10 ppm, all parameters will be held by the laboratory pending the analysis of the 0 to 2 and 4 to 5 foot depth interval samples. If this depth interval exhibits a sustained PID reading of 10 ppm, it will be analyzed for VOCs, SVOCs, TPH-DRO, TPH-GRO, and Oil & Grease. However, the samples for metals and cyanide will be held by the laboratory pending the analysis of the 0 to 2 and 4 to 5 foot depth interval samples. If the analyses from the 4 to 5 foot depth interval show exceedances of PALs for any constituent, the held sample from the 9 to 10 foot depth interval will be analyzed for those constituents that exhibited PAL exceedances in the overlying 4 to 5 foot sample.

If drill rig access is restricted by vegetation, heavy equipment will be provided to clear a path to the proposed sample locations. If the drill rig is unable to access any of the proposed sample locations within Parcel A15 due to standing water or soft ground conditions, a hand auger will be used to complete the boring to a depth of 5 feet bgs or groundwater, and no sample will be collected from the deep sample interval (9 to 10 feet bgs). If refusal is encountered while using the hand auger prior to reaching 5 feet bgs or groundwater, the 4 to 5 foot bgs sample will be adjusted to the deepest possible interval. There is also reason to suspect that standing water may be encountered at the surface in some locations in the Site. In this case, the ponded water will be treated as the water table, and no soil samples will be collected. A nearby location will be selected as close as possible to replace the boring where ponded water was present.

After soil sampling has been concluded at a location, down-hole soil sampling equipment will be decontaminated according to procedures referenced in the QAPP Worksheet 21 – Field SOPs, SOP No. 016 – 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 Measurement Devices & Monitoring Equipment (Section 3.7), Decontamination of Subsurface Drilling

Equipment (Section 3.8), and Document and Record Keeping (Section 5). 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.

3.4. GROUNDWATER INVESTIGATION

A total of three temporary piezometers will be installed at the locations identified on **Figure 10** in accordance with the procedures referenced in the QAPP Worksheet 21 – Field SOPs, SOP No. 028 – Direct Push Installation and Construction of Temporary Groundwater Sample Collection Points. Sample locations where piezometers will be installed include A15-012-PZ, A15-014-PZ, and A15-016-PZ. If the drill rig is unable to access any of the proposed locations due to physical obstructions or other conditions at the Site, alternate installation locations will be selected on a case-by-case basis.

Groundwater samples will be collected from the temporary piezometers and three existing wells (SG03-PDM007, SW-098-MWS, and SG04-PDM008) in accordance with the procedures referenced in the QAPP Worksheet 21 – Field SOPs, SOP No. 006 – Groundwater Sampling. All groundwater samples will be analyzed for VOCs, SVOCs, PAHs, TAL-Dissolved Metals, Oil & Grease, TPH-DRO, TPH-GRO, dissolved hexavalent chromium, total cyanide, and available cyanide. 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.

Prior to sample collection, ARM will check each groundwater sample collection point for the presence of NAPL using an oil-water interface probe, in accordance with methods referenced in the QAPP Worksheet 21 – Field SOPs, SOP No. 019 – Depth to Groundwater and NAPL Measurements. The groundwater sampling points will also be surveyed to obtain groundwater elevation data. The elevation data from these temporary points will be used to create a groundwater contour map indicating localized groundwater flow directions. Once each PVC temporary groundwater sample collection point has been sampled, surveyed, and/or checked for NAPL, it will be emptied, removed, and discarded. If no NAPL is observed, the boreholes will then be abandoned in accordance with Maryland abandonment standards as stated in COMAR 26.04.04.34 through 36. Section 3.7 presents additional details regarding procedures in the event that NAPL is observed.

3.5. SEDIMENT INVESTIGATION

A total of 12 sediment samples will be collected from the approximate locations proposed on **Figure 11**. Samples will be collected in accordance with the procedures referenced in the QAPP Worksheet 21 – Field SOPs, SOP No. 3 – Sediment Sampling. Samples will be collected from the

top six inches of the bed of the Industrial Water Reservoir with a Ponar dredge as described in Section 4.2.3 of SOP No. 3.

Sediment samples will be analyzed for VOCs, SVOCs, PAHs, TAL-Metals, Oil & Grease, TPH-DRO, TPH-GRO, hexavalent chromium, cyanide, and PCBs. 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.

3.6. SURFACE WATER INVESTIGATION

A total of eight surface water samples will be collected from the approximate locations proposed on **Figure 11**. Samples will be collected in accordance with the procedures referenced in the QAPP Worksheet 21 – Field SOPs, SOP No. 4 – Surface Water Sampling. Samples will be collected from the middle of the water column at each proposed location.

All surface water samples will be analyzed for VOCs, SVOCs, PAHs, TAL-Dissolved Metals, Oil & Grease, TPH-DRO, TPH-GRO, dissolved hexavalent chromium, total cyanide, and available cyanide. 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.

3.7. NAPL DELINEATION

The MDE will be notified of any initial observation of NAPL bearing soils identified in a soil boring within 2 hours of the field observation. This notification will be provided in email format to appropriate MDE representatives. Subsequent observations of NAPL bearing soils in the same immediate area will not require redundant notifications. For the purposes of this notification, NAPL bearing soil is defined as soil containing free oil (i.e., liquid oil which could potentially be drained or otherwise extracted from the soil). If minor indications of NAPL (globules or a sheen) are identified in the soil core, it will be delineated in accordance with the procedures listed below, but the initial 2-hour MDE notification will not be required (unless NAPL bearing soils are identified during the subsequent delineation). If the MDE has not previously been notified due to the presence of NAPL bearing soils, the presence of measurable NAPL in a temporary piezometer will warrant the same 2-hour MDE notification and subsequent delineation. If the evidence of NAPL is limited to a trace detection, the potential impacts will be delineated but the initial 2-hour MDE notification will not be required.

In the event that NAPL and/or a sheen is identified in a soil boring, a temporary piezometer will be installed according to the specifications identified in SOP No. 028 – Direct Push Installation and Construction of Temporary Groundwater Sample Collection Points. ARM will immediately check the piezometer for the presence of NAPL using an oil-water interface probe in accordance

with methods referenced in the SOP No. 019 – Depth to Groundwater and NAPL Measurements. Each piezometer installed to delineate the presence or absence of NAPL will be checked with an oil-water interface probe immediately after installation, 48 hours after installation, and 30 days after installation. If NAPL is not detected after 30 days of equilibration time, the screening piezometer will be emptied, removed, and discarded, and the borehole will be abandoned in accordance with Maryland abandonment standards as stated in COMAR 26.04.04.34 through 36.

If measurable NAPL or sheen is present in the initial delineation piezometer, ARM will remobilize (following utility clearance) to install and inspect additional soil borings and delineation piezometers in a triangular pattern from the detection point at distances of approximately 25 feet. Delineation piezometers will extend into adjacent parcels (if applicable) but will not be installed off of Tradepoint Atlantic property and will only be installed up to the edge of existing buildings. At each location, the continuous soil cores will be screened with a hand-held PID and inspected for evidence of NAPL, and the additional temporary piezometers will be installed to a final depth determined by ARM personnel.

Each additional piezometer installed to delineate the NAPL will be checked for the presence of product with an oil-water interface probe immediately after installation, 48 hours after installation, and again after a 30-day equilibration period. If NAPL is present within any of the piezometers, additional borings/piezometers will be added as necessary to complete the delineation. Once the MDE has given approval to abandon the delineation piezometers, each piezometer will be emptied, removed, and discarded. All boreholes will be abandoned in accordance with COMAR 26.04.04.34 through 36. A full report documenting the results of the delineation, including NAPL thickness, will be submitted to the MDE.

3.8. SAMPLE DOCUMENTATION

3.8.1. Sample Numbering

Samples will be numbered in accordance with the QAPP Appendix C – Data Management Plan.

3.8.2. Sample Labels & Chain of Custody Forms

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.

3.9. LABORATORY ANALYSIS

Tradepoint Atlantic has contracted Alpha Analytical to perform the laboratory analysis for this project. All sample analyses to be performed are listed in **Appendix H**. The samples will be submitted for analysis with a standard turnaround time (approximately 5 work days). The specific list of compounds and analytes that the soil and groundwater samples will be analyzed for, as well

as the quantitation limits and PALs, is provided in QAPP Worksheet 15 – Project Action Limits and Laboratory-Specific Detection/Quantitation Limits.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES

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

Quality assurance and quality control (QA/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 QA/QC samples will be submitted for analysis to support the data validation:

- Trip Blank – at a rate of one per cooler with VOC samples
  - Soil – VOCs only
  - Water – VOCs only
- Blind Field Duplicate – at a rate of one duplicate per twenty samples
  - Soil – VOCs, SVOCs, Metals, Oil & Grease, TPH-DRO, TPH-GRO, PCBs, hexavalent chromium, and cyanide
  - Water – VOCs, SVOCs, Metals, Oil & Grease, TPH-DRO, TPH-GRO, hexavalent chromium, and cyanide
- Matrix Spike/Matrix Spike Duplicate – at a rate of one per twenty samples
  - Soil – VOCs, SVOCs, Metals, Oil & Grease, TPH-DRO, TPH-GRO, PCBs, and hexavalent chromium
  - Water – VOCs, SVOCs, Metals, Oil & Grease, TPH-DRO, TPH-GRO, and hexavalent chromium
- Field Blank and Equipment Blank
  - Soil – VOCs, SVOCs, Metals, Oil & Grease, TPH-DRO, TPH-GRO, hexavalent chromium, and cyanide
  - Water – VOCs, SVOCs, Metals, Oil & Grease, TPH-DRO, TPH-GRO, hexavalent chromium, and cyanide

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

5.0 MANAGEMENT OF INVESTIGATION-DERIVED WASTE

All investigation derived waste (IDW) procedures will be carried out in accordance with methods referenced in the QAPP Worksheet 21 – Field SOPs, SOP No. 005 – Investigation-Derived Wastes Management.

6.0 DATA VALIDATION

For this Phase II Investigation of Parcel A15, a representative 30% of the complete analytical dataset will undergo data validation. Samples will be selected in groups according to the Alpha project number assigned to each set of samples. Each Alpha project number will be assigned a sequential number (from 1, 2, 3 … n) in the order received by the laboratory until all sample groups for the Site have been received by the laboratory. The random number function will be used to randomly order the project numbers and project numbers will then be selected from top to bottom until 30% or more of the total number of samples at the Site have been identified for validation.

All data validation procedures will be carried out in accordance with the QAPP Worksheet 34 – Data Verification and Validation Inputs, QAPP Worksheet 35 – Data Verification Procedures, and QAPP Worksheet 36 – Data Validation Procedures.

7.0 REPORTING

Following the receipt of all sampling results and the designated 30% of validated data from Area A: Parcel A15, a Phase II Investigation Report will be prepared that will document the sample collection procedures and supporting rationale, and present and interpret the analytical results. Results will be presented in tabular and graphical formats as appropriate to best summarize the data for future use. The sample results will be compared against the PALs specified in the QAPP (or other direct guidance from the MDE), considering appropriate land use factors and institutional controls, to identify contaminants and exposure pathways of potential concern. The Phase II Investigation Report will include figures indicating PAL exceedances.

Lead, PCBs, and TPH/Oil & Grease are subject to special requirements as designated by the agencies: lead results above 10,000 mg/kg are subject to additional delineation (and possible excavation), PCB results above 50 mg/kg are subject to delineation and excavation, and TPH/Oil & Grease results above 6,200 mg/kg should be evaluated for the potential presence and mobility of NAPL in any future development planning. ARM will also present recommendations for any additional site investigation activities if warranted.

8.0 SCHEDULE

The field activities below (including sampling analysis and data validation) are planned so that they may be completed within 6 months of agency approval of this Work Plan. In addition, the investigation report will be submitted to the regulatory authorities within 2 months of completion of the field activities in accordance with these approximate timeframes:

- the sample collection activities will take approximately 3 weeks to complete (including mobilization activities) once approval of the Work Plan is received;
- the sample analysis, data validation, and review are expected to require an additional 6 weeks to complete; and
- the preparation of the investigation report, including an internal QA review cycle, will require another 8 weeks.

FIGURES


LEGEND
Parcel Boundary
Site Boundary
Parcel Boundaries
Private Property
Parcel A9
Parcel A13
Parcel A5
Parcel A7
Parcel A14
Parcel A11
Parcel A8
Parcel A12
Parcel A2
Parcel A15
Parcel A17
Parcel A18
Parcel A16
Parcel A6
Parcel A4
Parcel A10
Parcel A3
Parcel A1
Parcel B6
Parcel B8
Parcel B14
Parcel B21
Parcel B22
Parcel B16
Parcel B24
Parcel B15
Parcel B23
Parcel B7
Parcel B25
Parcel B1
Parcel B2
Parcel B3
Parcel B17
Parcel B19
Parcel B4
Parcel B5
Parcel B9
Parcel B18
Parcel B10
Parcel B13
Parcel B20
Parcel B11
Parcel B12
0 500 1,000 2,000
Feet
ARM Group LLC
Engineers and Scientists
Tradepoint Atlantic Property
Area A and Area B Parcel Boundaries
July 18, 2022
Figure
1
Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
Area A: Project 210101
Area B: Project 210102
P:\EnviroAnalytics Group\150298M EAG_Sparrows Point Area A\GIS\Site-wide Figures.mxd

Site Boundary

Parcel Boundaries

1916 Shoreline:

Land

Marsh

Water

Parcel A9

Parcel A5

Parcel A13

Parcel A7

Parcel A14

Greys Creek

Bear Creek

Parcel A11

Parcel A8

Parcel A12

Parcel A2

Parcel A15

Parcel A17

Parcel A18

Parcel A16

Parcel A6

Parcel A3

Parcel A4

Parcel A10

Parcel A1

Parcel B6

Humphrey Creek

Parcel B8

Parcel B14

Parcel B21

Parcel B22

Parcel B16

Parcel B15

Parcel B24

Parcel B23

Parcel B25

Old Road Bay

Block House Cove

Parcel B7

Jones Creek

Parcel B1

Parcel B2

Parcel B3

Parcel B17

Parcel B19

Parcel B4

Parcel B5

Parcel B9

Parcel B18

Parcel B10

Parcel B13

Parcel B20

Parcel B11

Parcel B12

Patapsco River

Approximate Shoreline 1916

June 20, 2022

Adapted from Figure 2-20 of the Description of Current Conditions Report prepared by Rust Environmental and Infrastructure, dated January 1998

Figure 2

ARM Group LLC

Engineers and Scientists

0 500 1,000 2,000 Feet

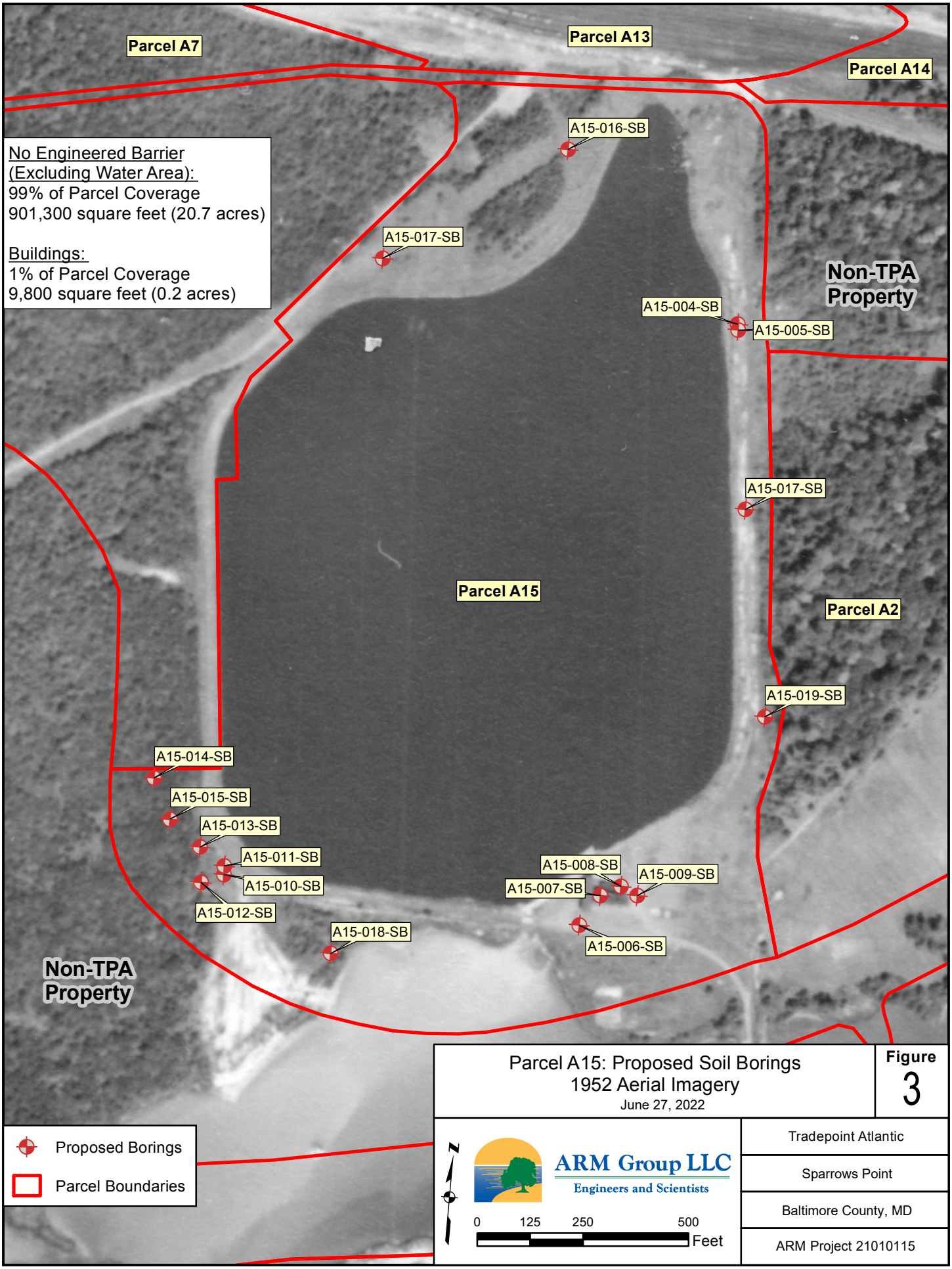
Tradepoint Atlantic

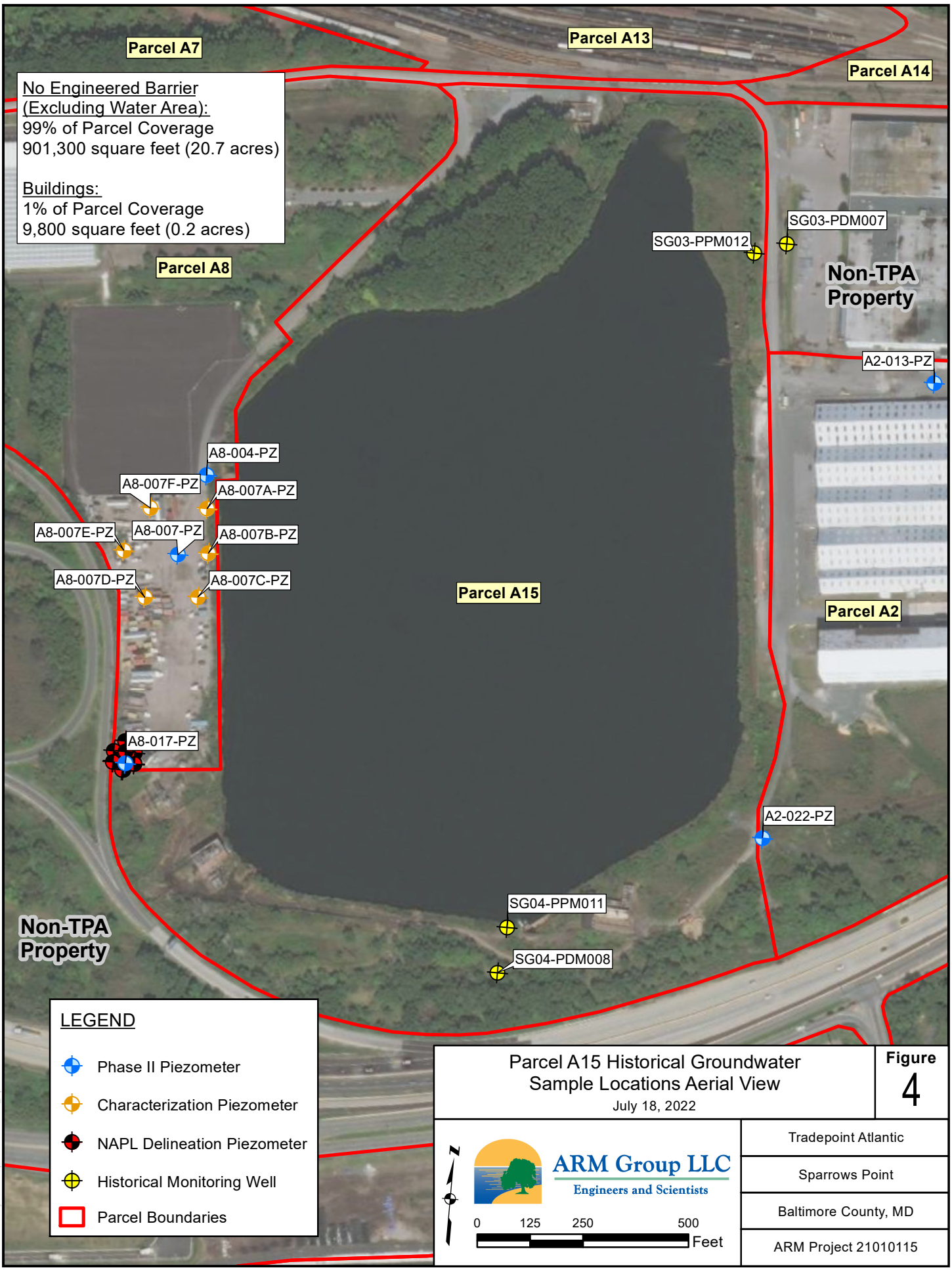
Sparrows Point

Baltimore County, MD

Area A: Project 210101

Area B: Project 210102


Parcel A7
Parcel A13
Parcel A14
No Engineered Barrier
(Excluding Water Area):
99% of Parcel Coverage
901,300 square feet (20.7 acres)
Buildings:
1% of Parcel Coverage
9,800 square feet (0.2 acres)
A15-016-SB
A15-017-SB
Non-TPA
Property
A15-004-SB
A15-005-SB
A15-017-SB
Parcel A15
Parcel A2
A15-019-SB
A15-014-SB
A15-015-SB
A15-013-SB
A15-011-SB
A15-010-SB
A15-012-SB
A15-018-SB
A15-008-SB
A15-009-SB
A15-007-SB
A15-006-SB
Non-TPA
Property
Proposed Borings
Parcel Boundaries
Parcel A15: Proposed Soil Borings
1952 Aerial Imagery
June 27, 2022
Figure
3
ARM Group LLC
Engineers and Scientists
0
125
250
500
Feet
Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 21010115



Parcel A15 Historical Groundwater Sample Locations Aerial View

July 18, 2022

Figure 4

ARM Group LLC
Engineers and Scientists

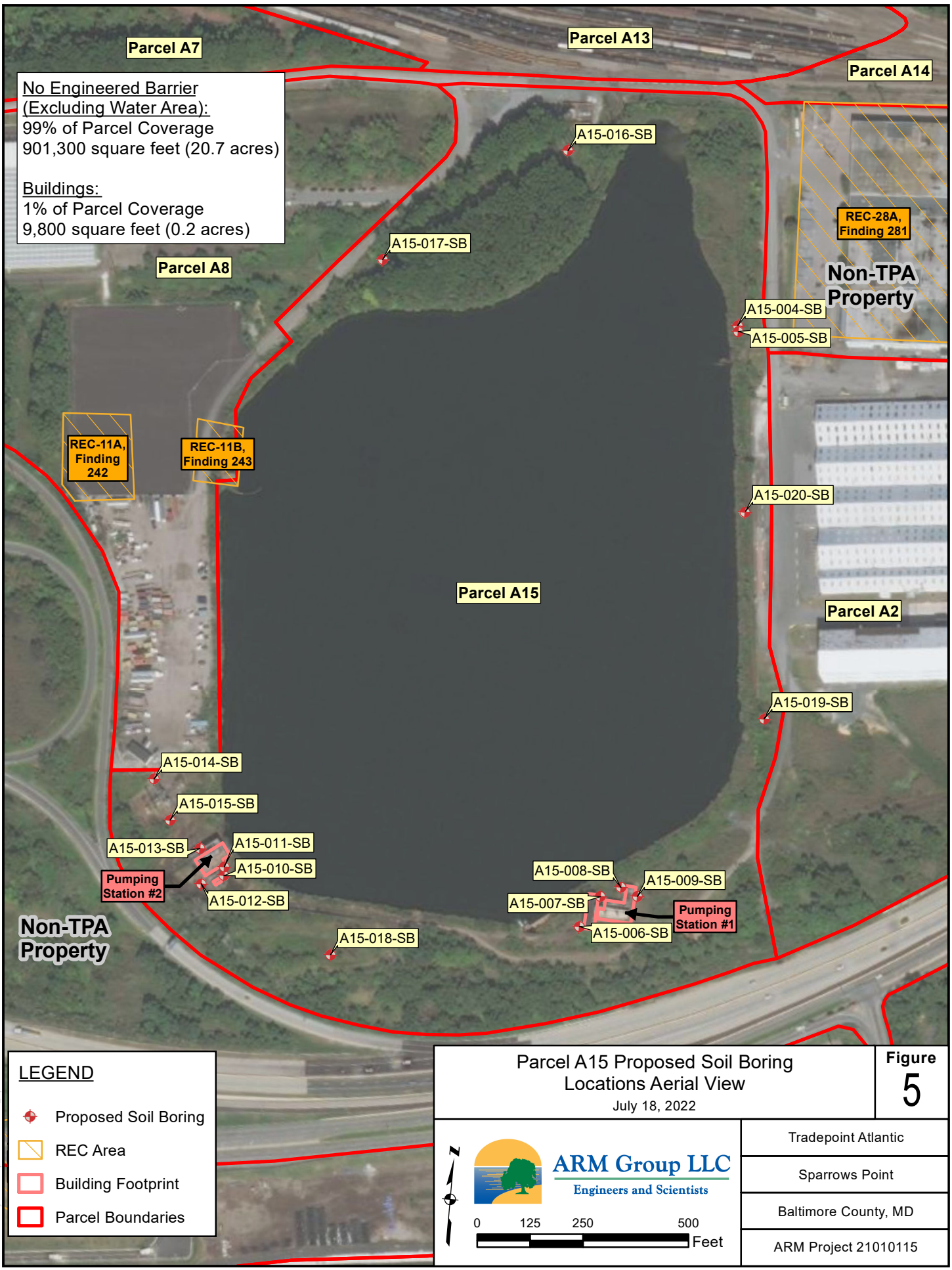
Tradepoint Atlantic

Sparrows Point

Baltimore County, MD

ARM Project 21010115

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Parcel A15 Proposed Soil Boring Locations Aerial View

July 18, 2022

Figure 5

ARM Group LLC
Engineers and Scientists

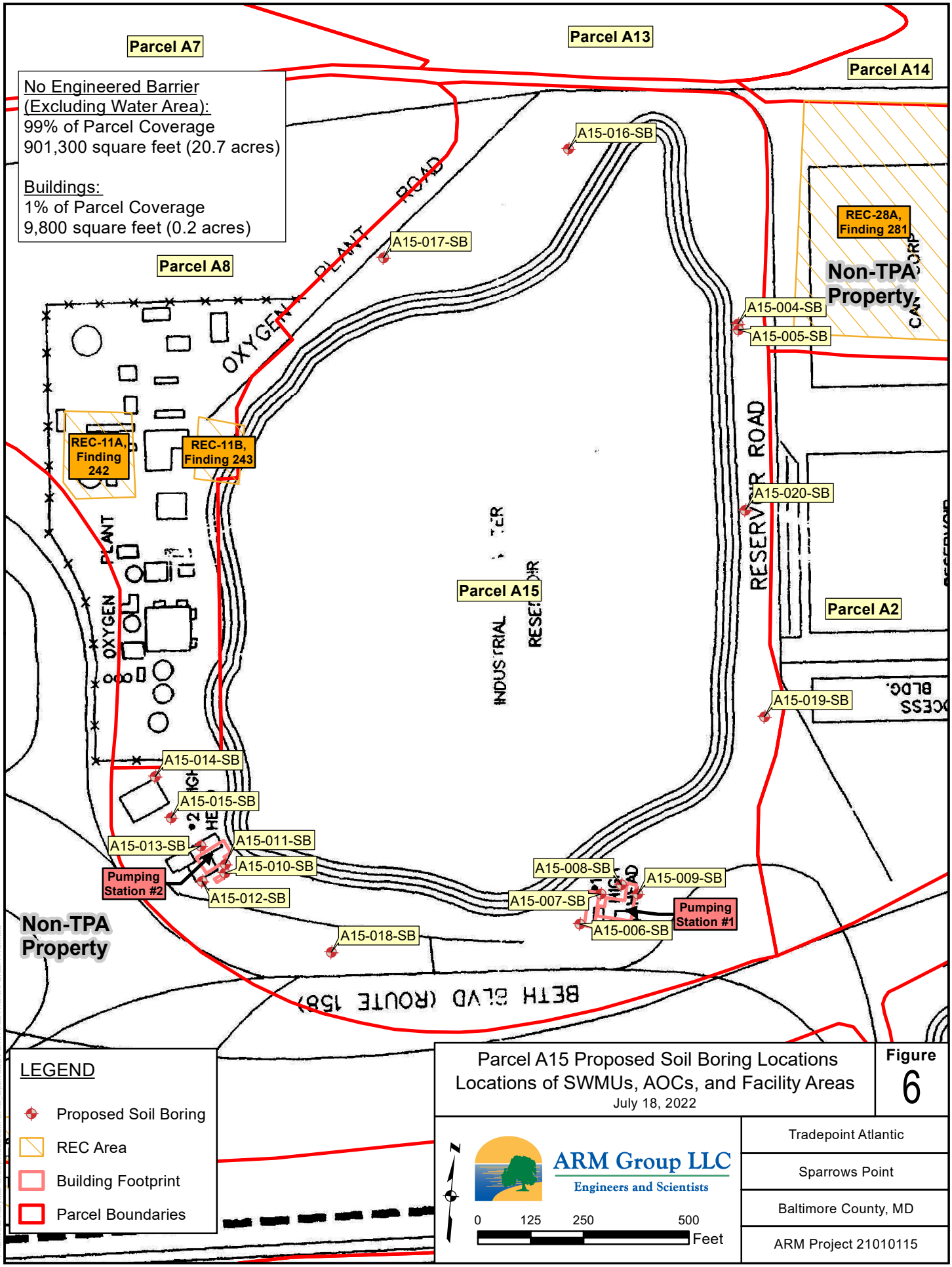
Tradepoint Atlantic

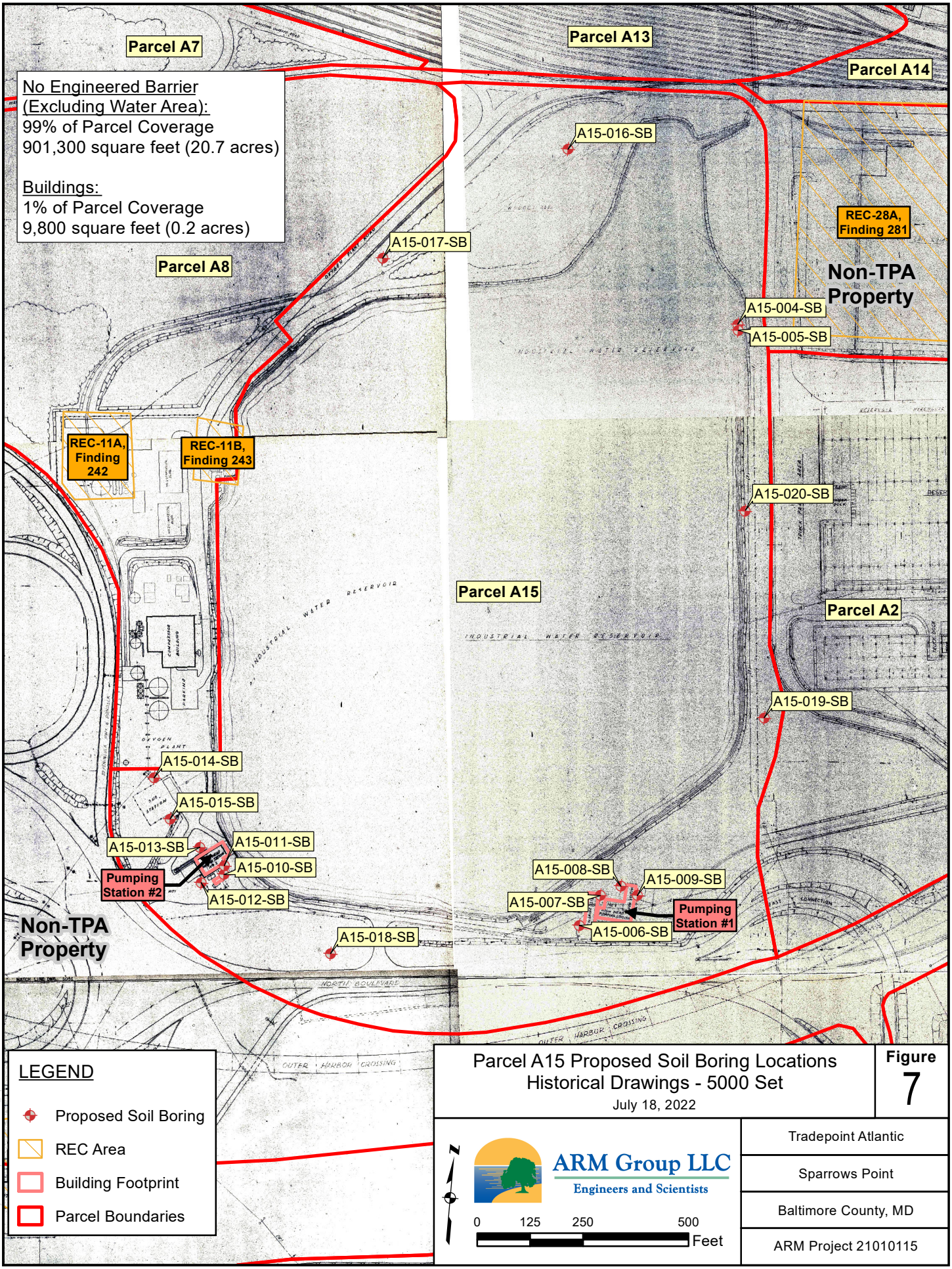
Sparrows Point

Baltimore County, MD

ARM Project 21010115

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Parcel A7
Parcel A13
Parcel A14
No Engineered Barrier
(Excluding Water Area):
99% of Parcel Coverage
901,300 square feet (20.7 acres)
Buildings:
1% of Parcel Coverage
9,800 square feet (0.2 acres)
A15-016-SB
A15-017-SB
REC-28A, Finding 281
Non-TPA Property
Parcel A8
A15-004-SB
A15-005-SB
REC-11A, Finding 242
REC-11B, Finding 243
RESERVOIR ROAD
A15-020-SB
Parcel A15
Parcel A2
A15-019-SB
A15-014-SB
A15-015-SB
A15-013-SB
A15-011-SB
A15-010-SB
Pumping Station #2
A15-012-SB
A15-008-SB
A15-009-SB
A15-007-SB
Pumping Station #1
A15-006-SB
A15-018-SB
Non-TPA Property
BETH BLVD (ROUTE 158)
LEGEND
Proposed Soil Boring
REC Area
Building Footprint
Parcel Boundaries
Parcel A15 Proposed Soil Boring Locations
Locations of SWMUs, AOCs, and Facility Areas
July 18, 2022
Figure 6
ARM Group LLC
Engineers and Scientists
0 125 250 500 Feet
Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 21010115

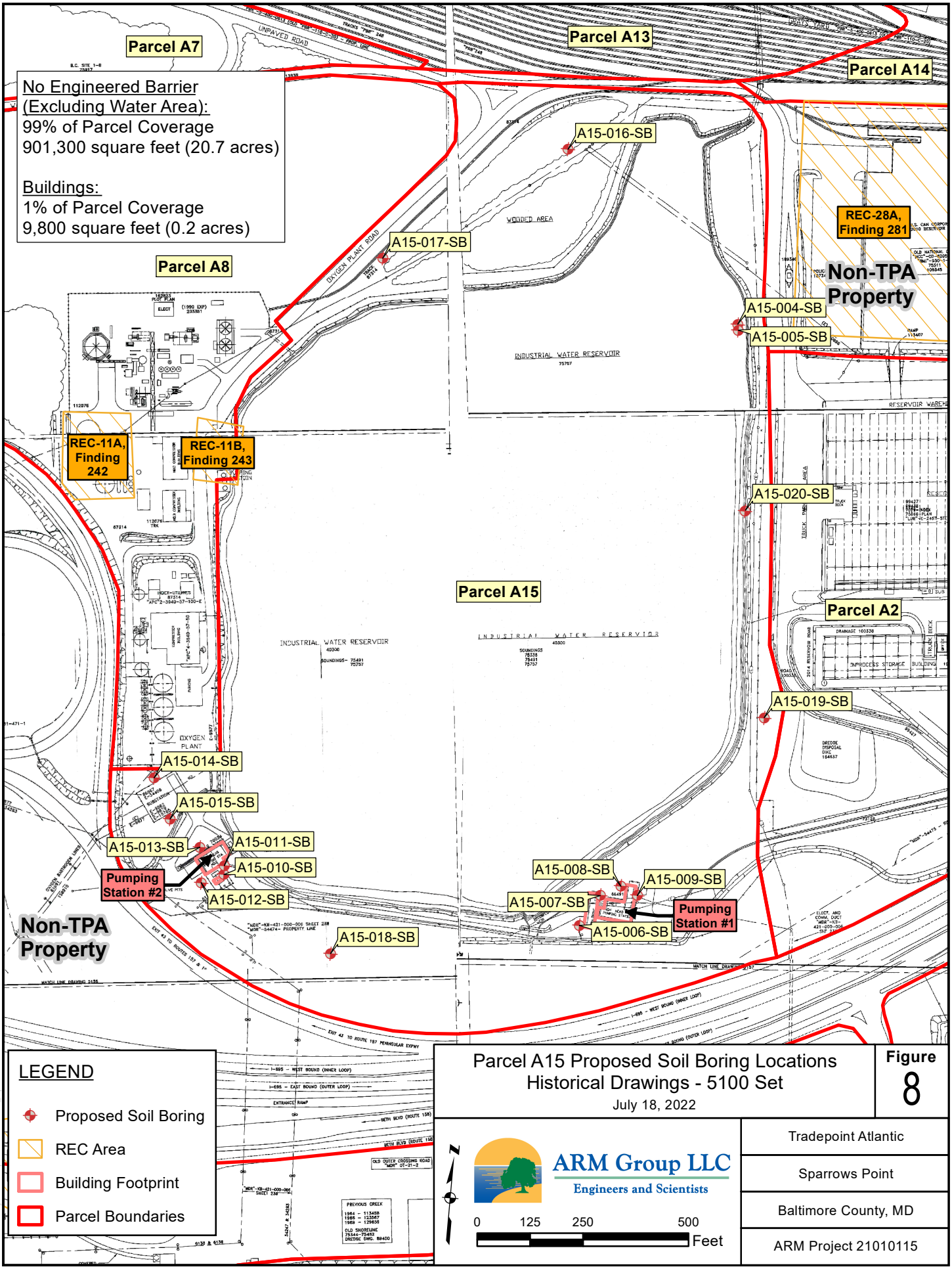


Parcel A15 Proposed Soil Boring Locations
Historical Drawings - 5000 Set
July 18, 2022

Figure 7

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 21010115

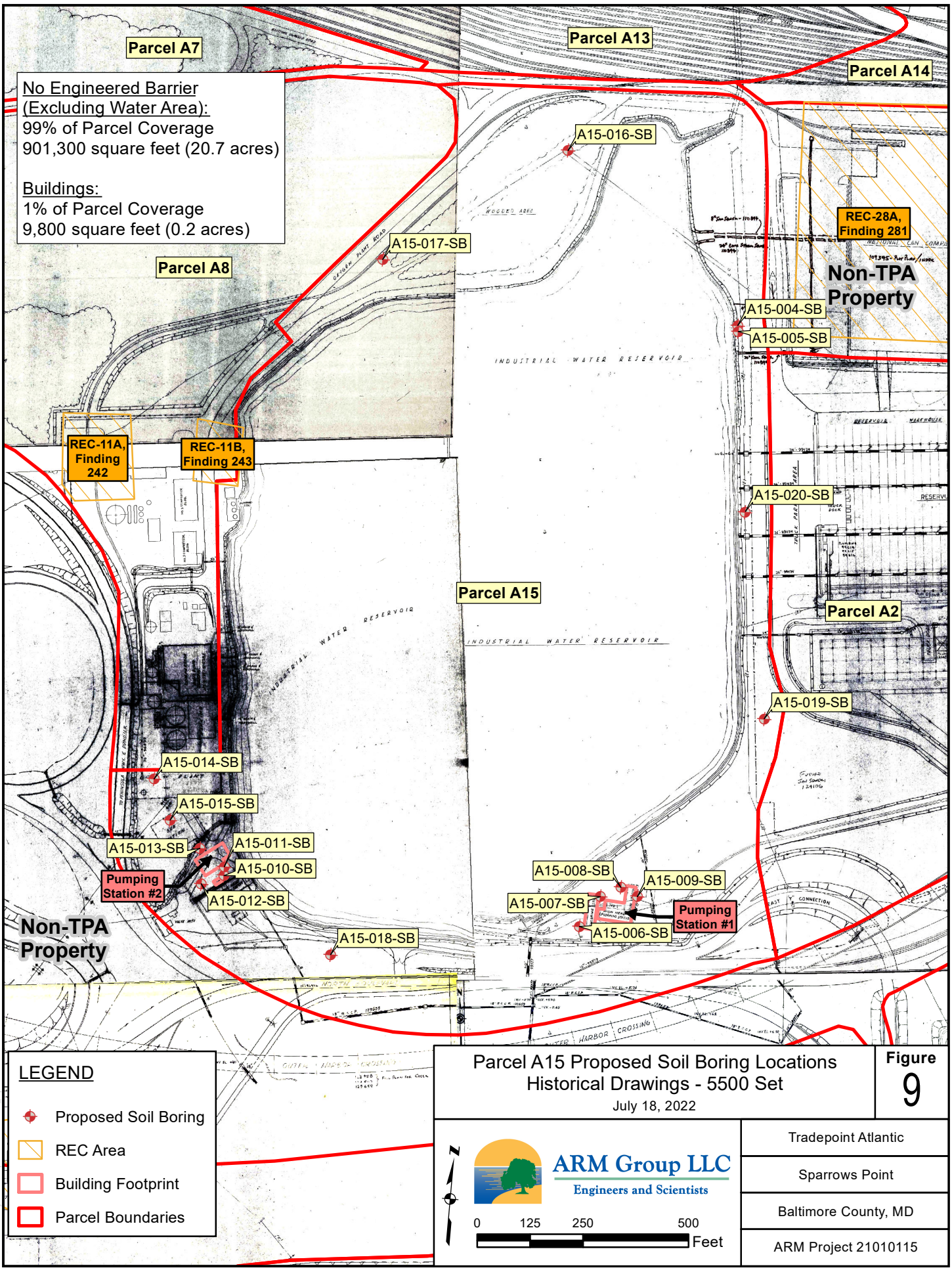


Parcel A15 Proposed Soil Boring Locations
Historical Drawings - 5100 Set
July 18, 2022

Figure 8

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 21010115

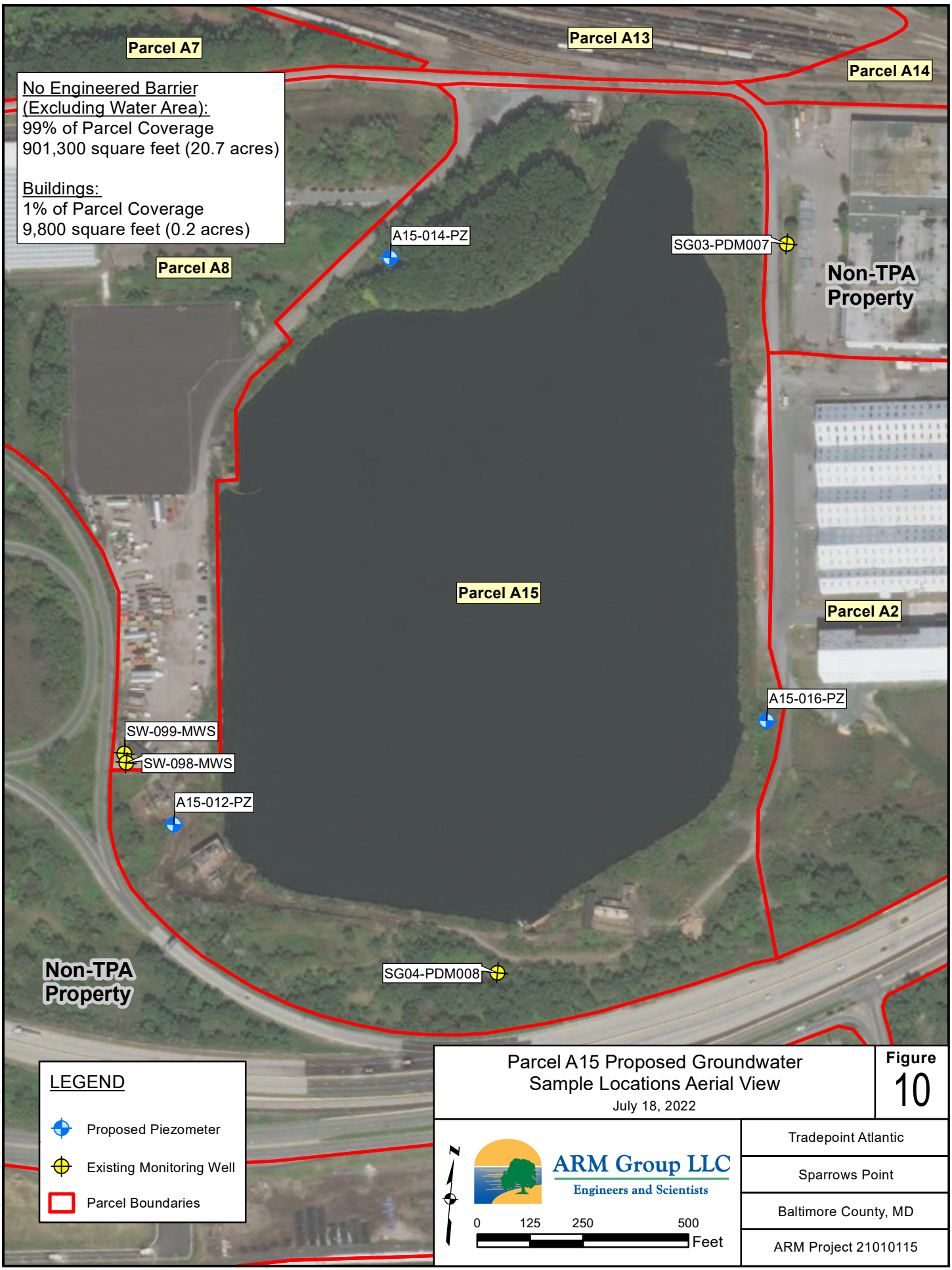


Parcel A15 Proposed Soil Boring Locations
Historical Drawings - 5500 Set
July 18, 2022

Figure 9

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 21010115



Parcel A15 Proposed Groundwater Sample Locations Aerial View

July 18, 2022

Figure 10

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic

Sparrows Point

Baltimore County, MD

ARM Project 21010115

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Parcel A15 Proposed Sediment and SW Sample Locations

September 19, 2022

Figure 11

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic

Sparrows Point

Baltimore County, MD

ARM Project 21010115

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APPENDIX A

Parcel A15 Site Visit Photograph Log
Former Sparrows Point Steel Mill
Sparrows Point, Maryland



062722-1: Area of fly dumping observed near northern boundary of Site.



062722-2: View of partially overgrown area in northern portion of Site originally cleared for utility lines.



062722-3: Southeastern portion of reservoir, viewed from infrastructure adjacent to Pump Station #1.



062722-4: Outfall or intake structure adjacent to Pump Station #1.



062722-5: Standing tank along eastern edge of the Site. Its contents are unknown.



062722-6: An unknown vault structure located in the southeastern portion of the Site.



062722-7: A mechanized outfall or intake structure located on the eastern edge of the reservoir.



062722-8: Dumpsters in overgrown area just east of Pump Station #1.



062722-9: View of refuse behind the eastern side of Pump Station #1 and its associated sub-station.



062722-10: View of the outfall structure adjacent to Pump Station #1.



062722-11: Eastern side of Pump Station #2. A tank labeled “NaOCL” (sodium hypochlorite) is connected to the building.



062722-12: Pump Station #2 and electrical sub-station equipment.



062722-13: A vault and control panel structure, believed to be a pumping station, west of Pump Station #2.

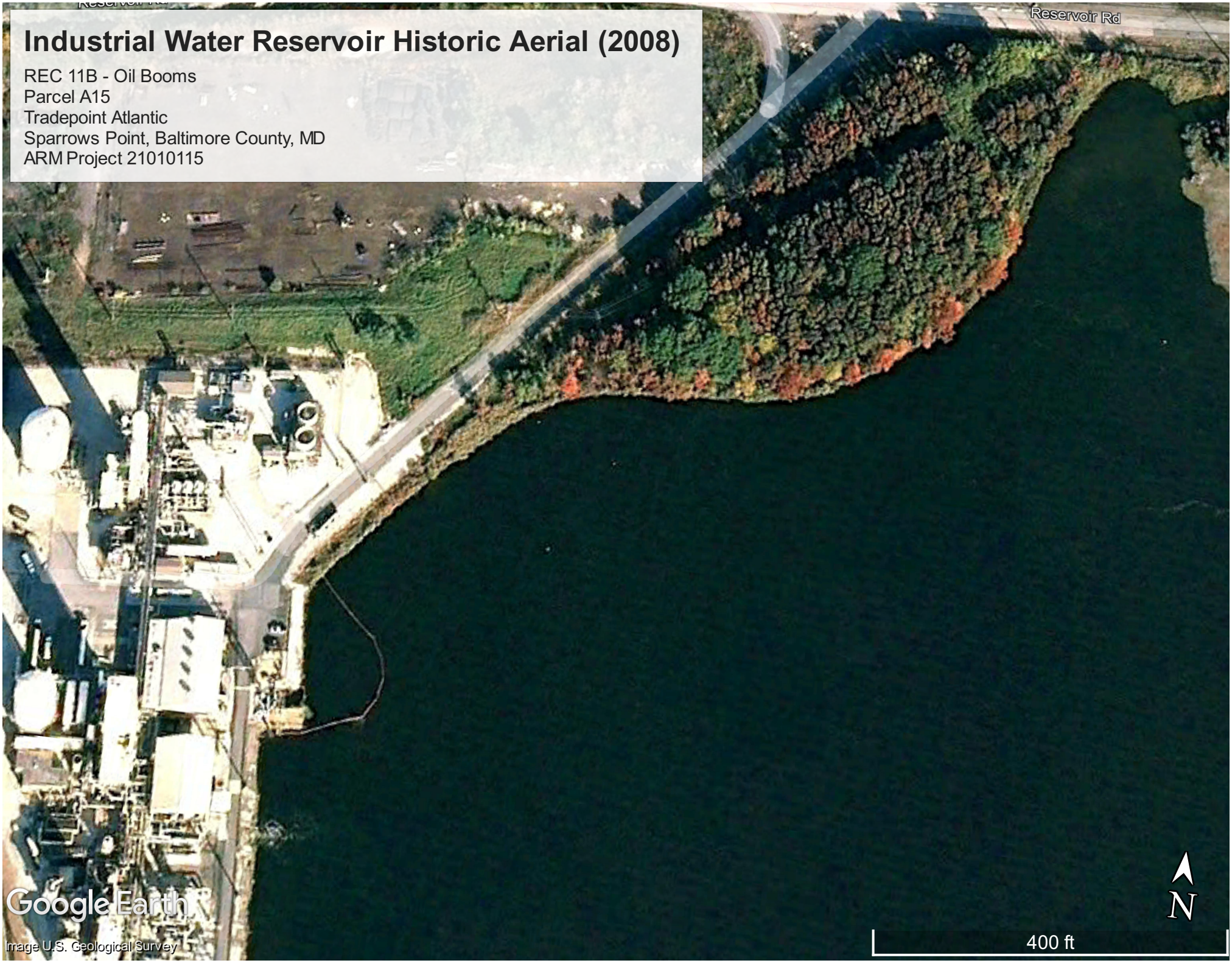


062722-14: Outfall/intake structure outside of Pump Station #2. The partially overgrown blue structure is positioned on the shore of the reservoir.

APPENDIX B

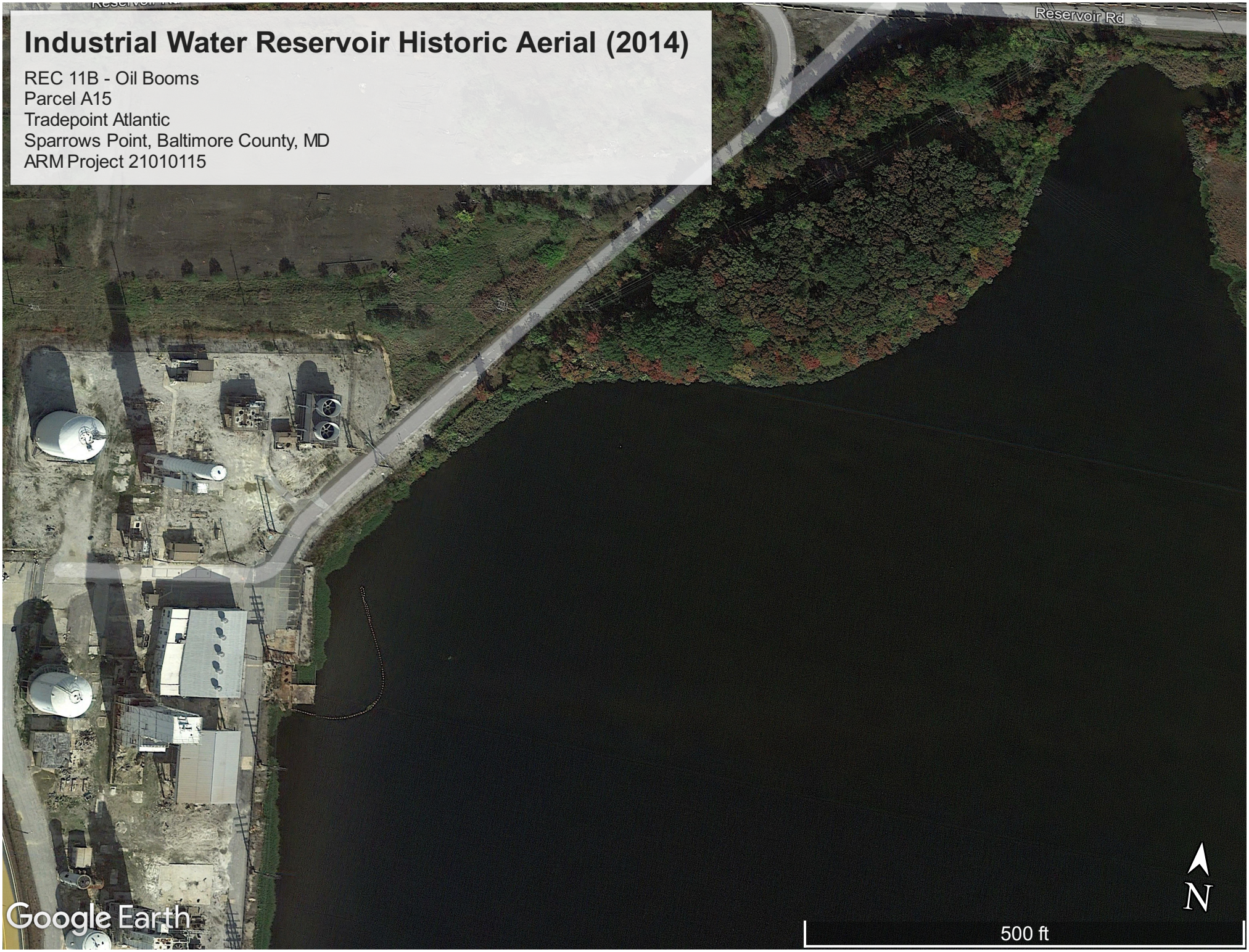
Industrial Water Reservoir Historic Aerial (2008)

REC 11B - Oil Booms
Parcel A15
Tradepoint Atlantic
Sparrows Point, Baltimore County, MD
ARM Project 21010115



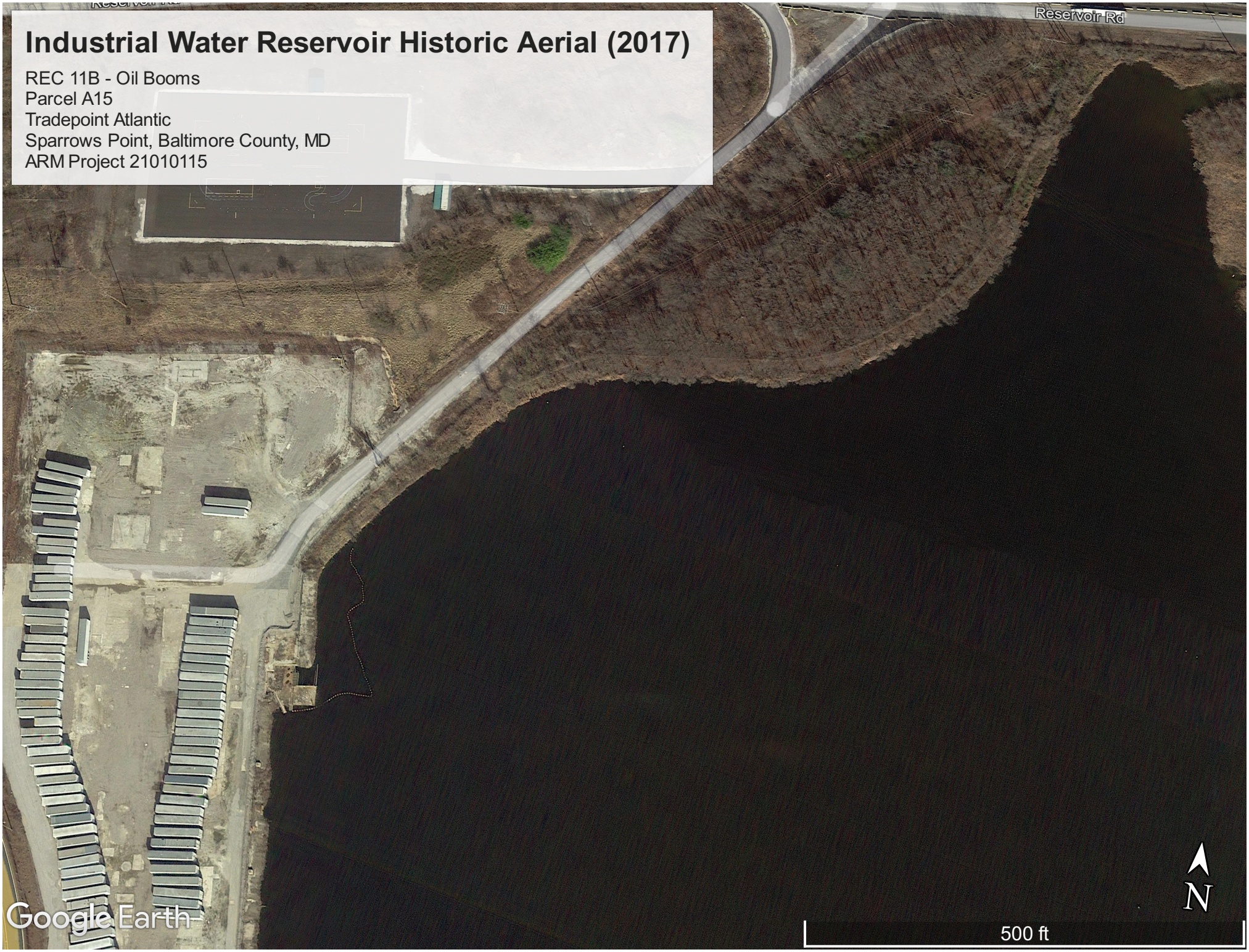
Industrial Water Reservoir Historic Aerial (2014)

REC 11B - Oil Booms
Parcel A15
Tradepoint Atlantic
Sparrows Point, Baltimore County, MD
ARM Project 21010115



Industrial Water Reservoir Historic Aerial (2017)

REC 11B - Oil Booms
Parcel A15
Tradepoint Atlantic
Sparrows Point, Baltimore County, MD
ARM Project 21010115



APPENDIX C

WELL INSPECTION FORM

Site: SPT Location of Well: along road in front of WM transport

Project Number: _____ Date: 1/24/22

WELL INFORMATION

Well ID: SG03-PDM007 Well Permit No.: missing

Coordinates:

Latitude/Northing _____ Longitude/Easting _____

Condition of pad and/or cover: unknown Buried Flush Mount or Stick-Up? Stu

Well ID Marked? Y If yes, where? casing

Locking cap? Y Lock? N Diameter of Well: 2"

Structural integrity of well: Good

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)	5.10	—
Depth to Bottom (feet BGS/TOC)	19.95	18.5 bgs

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: no barrier needed

Vent cap installed

correct master SS – it says this is in HF area but it is not

PICTURE OF WELL DURING INSPECTION

WELL INSPECTION FORM

Site: SPT Location of Well: Between pond and GWS

Project Number: _____ Date: 11/24/22

WELL INFORMATION

Well ID: ~~SG04-2PRMD12~~ SG04-PDM008 Well Permit No.: missing

Coordinates:

Latitude/Northing _____ Longitude/Easting _____

Condition of pad and/or cover: unknown Buried Flush Mount or Stick-Up? stu

Well ID Marked? Y If yes, where? casing

Locking cap? Y Lock? N Diameter of Well: 2"

Structural integrity of well: Good ~~but seems more~~ shallow

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)	5.90	—
Depth to Bottom (feet BGS/TOC)	14.92	12 ~~BGS~~ bgs

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: no barriers needed

Vent cap added

~~X~~ correct master SS - says it is in HI area but it is not

PICTURE OF WELL DURING INSPECTION

WELL INSPECTION FORM

Site: SPT Location of Well: AB

Project Number: _____ Date: 1/24/22

WELL INFORMATION

Well ID: SW-098-MWS Well Permit No.: missing

Coordinates:

Latitude/Northing_____ Longitude/Easting_____

Condition of pad and/or cover: good some crumbling at edges Flush Mount or Stick-Up? FM

Well ID Marked? N If yes, where? _____

Locking cap? N (FM) Lock? N Diameter of Well: 2"

Structural integrity of well: Good

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)	1.54	
Depth to Bottom (feet BGS/TOC)	12.55	

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: No barriers needed
FM - no vent cap needed

PICTURE OF WELL DURING INSPECTION

WELL INSPECTION FORM

Site: SPT Location of Well: A8

Project Number: _____ Date: 11/24/22

WELL INFORMATION

Well ID: SW-099-MWS Well Permit No.: missing

Coordinates:

Latitude/Northing_____ Longitude/Easting_____

Condition of pad and/or cover: good but some crumbling at edges Flush Mount or Stick-Up? FM

Well ID Marked? N If yes, where? _____

Locking cap? FM Lock? N Diameter of Well: 2"

Structural integrity of well: Good

WELL MEASUREMENTS

	Measured (Current)	Historic Reported
Depth to Water (feet BGS/TOC)	5.62	
Depth to Bottom (feet BGS/TOC)	21.85	

Notes: BGS = below ground surface, TOC = top of casing

Additional Comments: no barriers needed

FM - no vent cap needed

PICTURE OF WELL DURING INSPECTION

APPENDIX D

Parcel A15 Historical Well Data (Site-wide Wells)
Former Sparrows Point Steel Mill
Sparrows Point, Maryland

Well	Zone	Screen Interval (feet bgs)	Parameter	CAS #	Sample Date	Detection Limit (mg/L)	Result (mg/L)	Flag	PAL (mg/L)	Exceeds PAL?
SG03-PDM007	Shallow	8.5 - 18.5	Sulfate	14808-79-8	11/10/2000	25	300			No
SG03-PDM007	Shallow	8.5 - 18.5	Chloride	16887-00-6	11/10/2000	2	140			No
SG03-PDM007	Shallow	8.5 - 18.5	Bicarbonate	71-52-3	11/10/2000	1	14	B		No
SG03-PDM007	Shallow	8.5 - 18.5	Iron	7439-89-6	11/10/2000	0.1	13		14	No
SG03-PDM007	Shallow	8.5 - 18.5	Magnesium	7439-95-4	11/10/2000	0.1	25			No
SG03-PDM007	Shallow	8.5 - 18.5	Manganese	7439-96-5	11/10/2000	0.01	0.26		0.43	No
SG03-PDM007	Shallow	8.5 - 18.5	Potassium	7440-09-7	11/10/2000	0.1	21			No
SG03-PDM007	Shallow	8.5 - 18.5	Sodium	7440-23-5	11/10/2000	0.5	110			No
SG03-PDM007	Shallow	8.5 - 18.5	Calcium	7440-70-2	11/10/2000	0.5	50			No
SG03-PDM007	Shallow	8.5 - 18.5	Total dissolved solids (TDS)	TDS	11/10/2000	10	690			No
SG03-PPM012	Shallow	12-22	Sulfate	14808-79-8	11/10/2000	10	240			No
SG03-PPM012	Shallow	12-22	Chloride	16887-00-6	11/10/2000	2	91			No
SG03-PPM012	Shallow	12-22	Bicarbonate	71-52-3	11/10/2000	1	44			No
SG03-PPM012	Shallow	12-22	Iron	7439-89-6	11/10/2000	0.1	55		14	Yes
SG03-PPM012	Shallow	12-22	Magnesium	7439-95-4	11/10/2000	0.1	21			No
SG03-PPM012	Shallow	12-22	Manganese	7439-96-5	11/10/2000	0.01	0.78		0.43	Yes
SG03-PPM012	Shallow	12-22	Potassium	7440-09-7	11/10/2000	0.1	6.4			No
SG03-PPM012	Shallow	12-22	Sodium	7440-23-5	11/10/2000	0.5	57			No
SG03-PPM012	Shallow	12-22	Calcium	7440-70-2	11/10/2000	0.5	44			No
SG03-PPM012	Shallow	12-22	Total dissolved solids (TDS)	TDS	11/10/2000	10	560			No

Parcel A15 Historical Well Data (Site-wide Wells)
Former Sparrows Point Steel Mill
Sparrows Point, Maryland

Well	Zone	Screen Interval (feet bgs)	Parameter	CAS #	Sample Date	Detection Limit (mg/L)	Result (mg/L)	Flag	PAL (mg/L)	Exceeds PAL?
SG04-PDM008	Shallow	2 - 12	Sulfate	14808-79-8	11/10/2000	10	200			No
SG04-PDM008	Shallow	2 - 12	Chloride	16887-00-6	11/10/2000	2	130			No
SG04-PDM008	Shallow	2 - 12	Bicarbonate	71-52-3	11/10/2000	2	2	U		No
SG04-PDM008	Shallow	2 - 12	Iron	7439-89-6	11/10/2000	0.1	0.1	U	14	No
SG04-PDM008	Shallow	2 - 12	Magnesium	7439-95-4	11/10/2000	0.1	0.1	U		No
SG04-PDM008	Shallow	2 - 12	Manganese	7439-96-5	11/10/2000	0.01	0.01		0.43	No
SG04-PDM008	Shallow	2 - 12	Potassium	7440-09-7	11/10/2000	0.1	25			No
SG04-PDM008	Shallow	2 - 12	Sodium	7440-23-5	11/10/2000	0.5	110			No
SG04-PDM008	Shallow	2 - 12	Calcium	7440-70-2	11/10/2000	0.5	93			No
SG04-PDM008	Shallow	2 - 12	Total dissolved solids (TDS)	TDS	11/10/2000	10	620			No
SG04-PPM011	Intermediate	10 - 20	Sulfate	14808-79-8	11/10/2000	2	63			No
SG04-PPM011	Intermediate	10 - 20	Chloride	16887-00-6	11/10/2000	2	170			No
SG04-PPM011	Intermediate	10 - 20	Bicarbonate	71-52-3	11/10/2000	1	560			No
SG04-PPM011	Intermediate	10 - 20	Iron	7439-89-6	11/10/2000	0.1	24		14	Yes
SG04-PPM011	Intermediate	10 - 20	Magnesium	7439-95-4	11/10/2000	0.1	49			No
SG04-PPM011	Intermediate	10 - 20	Manganese	7439-96-5	11/10/2000	0.01	0.82		0.43	Yes
SG04-PPM011	Intermediate	10 - 20	Potassium	7440-09-7	11/10/2000	0.1	16			No
SG04-PPM011	Intermediate	10 - 20	Sodium	7440-23-5	11/10/2000	0.5	160			No
SG04-PPM011	Intermediate	10 - 20	Calcium	7440-70-2	11/10/2000	0.5	97			No
SG04-PPM011	Intermediate	10 - 20	Total dissolved solids (TDS)	TDS	11/10/2000	10	910			No

Highlighting indicates an exceedance of the Project Action Limit (PAL)
B: The analyte was not detected substantially above the level of the associated method blank or field blank.
U: The analyte was not detected above the reporting limit.

APPENDIX E

Parcel A15 Recent Phase II Investigation Groundwater Data
Summary of Detected Organics and Inorganics

Parameter	Units	PAL	A2-022-PZ 10/29/2015	A8-004-PZ 11/4/2015	A8-007-PZ 11/5/2015	A8-007-PZ* 9/27/2019	A8-017-PZ 11/5/2015
Volatile Organic Compounds							
1,1,1-Trichloroethane	µg/L	200	*1 U*	*1 U*	**41.4**	*1 U*	*1 U*
1,1-Dichloroethane	µg/L	2.7	*1 U*	**2**	**409**	**24.2**	*1 U*
1,1-Dichloroethene	µg/L	7	*1 U*	*1 U*	**874**	**63.9**	*1 U*
1,2-Dichloroethane	µg/L	5	*1 U*	*1 U*	**2.4**	*1 U*	*1 U*
1,2-Dichloroethene (Total)	µg/L	70	*2 U*	*2 U*	**4.1**	**52.3**	*2 U*
Benzene	µg/L	5	*1 U*	*1 U*	**0.61 J**	*1 U*	**73.4**
Carbon disulfide	µg/L	810	*1 U*	*1 U*	**1.2**	*1 U*	*1 U*
Chloroform	µg/L	0.22	*1 U*	**14**	**0.55 J**	*1 U*	*1 U*
cis-1,2-Dichloroethene	µg/L	70	*1 U*	*1 U*	**3.4**	**50.3**	*1 U*
Cyclohexane	µg/L	13,000	*10 U*	*10 U*	*10 U*	*10 U*	**15.4**
Ethylbenzene	µg/L	700	*1 U*	*1 U*	*1 U*	*1 U*	**50.9**
Isopropylbenzene	µg/L	450	*1 U*	*1 U*	*1 U*	*1 U*	**12.8**
Tetrachloroethene	µg/L	5	*1 U*	**3.3**	**0.99 J**	*1 U*	*1 U*
Toluene	µg/L	1,000	*1 U*	**0.38 J**	*1 U*	*1 U*	**160**
trans-1,2-Dichloroethene	µg/L	100	*1 U*	*1 U*	**0.69 J**	**2**	*1 U*
Trichloroethene	µg/L	5	*1 U*	**1.3**	**28.3**	**9.7**	*1 U*
Trichlorofluoromethane	µg/L	1,100	*1 U*	**2.2**	**0.71 J**	*1 U*	*1 U*
Vinyl chloride	µg/L	2	*1 U*	*1 U*	**1.7**	**17**	*1 U*
Xylenes	µg/L	10,000	*3 U*	**1.6 J**	*3 U*	*3 U*	**241**
Semi-Volatile Organic Compounds^							
1,1-Biphenyl	µg/L	0.83	*1 U*	*1 U*	*1 U*	*N/A*	**12.7**
1,4-Dioxane	µg/L	0.46	**0.37**	**0.39**	**44.7**	*N/A*	*0.1 U*
2-Methylnaphthalene	µg/L	36	*0.1 U*	*0.1 U*	*0.1 U*	*N/A*	**352**
2-Methylphenol	µg/L	930	*1 U*	*1 U*	*1 U*	*N/A*	**0.36 J**
Acenaphthene	µg/L	530	**1.1**	*0.1 U*	*0.1 U*	*N/A*	**11.5**
Acenaphthylene	µg/L	530	*0.1 U*	*0.1 U*	*0.1 U*	*N/A*	**1.5 J**
Acetophenone	µg/L	1,900	*1 U*	*1 U*	*1 U*	*N/A*	**16**
Anthracene	µg/L	1,800	**0.026 J**	*0.1 U*	**0.014 J**	*N/A*	**0.91 J**
Benzo[a]pyrene	µg/L	0.2	*0.1 U*	*0.1 U*	**0.044 J**	*N/A*	*5.1 U*
Benzo[g,h,i]perylene	µg/L		*0.1 U*	*0.1 U*	**0.026 J**	*N/A*	*5.1 U*
bis(2-Ethylhexyl)phthalate	µg/L	6	**0.29 J**	0.25 B	*1 U*	*N/A*	**0.32 J**
Carbazole	µg/L		*1 U*	*1 U*	*1 U*	*N/A*	**10.8**
Di-n-butylphthalate	µg/L	900	*1 U*	*1 U*	*1 U*	*N/A*	**0.54 J**
Fluoranthene	µg/L	800	**0.26**	**0.079 J**	**0.074 J**	*N/A*	*5.1 U*
Fluorene	µg/L	290	**1.2**	**0.017 J**	**0.097 J**	*N/A*	**16**
Naphthalene	µg/L	0.12	**0.033 J**	**0.11**	**0.1**	*N/A*	**168**
Pentachlorophenol	µg/L	1	*2.6 U*	**0.65 J**	*2.6 U*	*N/A*	*2.6 U*
Phenanthrene	µg/L		**0.14**	*0.1 U*	**0.076 J**	*N/A*	**23.4**
Pyrene	µg/L	120	**0.15**	**0.077 J**	**0.069 J**	*N/A*	*5.1 U*

Parcel A15 Recent Phase II Investigation Groundwater Data
Summary of Detected Organics and Inorganics

Parameter	Units	PAL	A2-022-PZ	A8-004-PZ	A8-007-PZ	A8-007-PZ*	A8-017-PZ
			10/29/2015	11/4/2015	11/5/2015	9/27/2019	11/5/2015
Total Petroleum Hydrocarbons							
Diesel Range Organics	µg/L	47	*N/A*	**659 J**	*N/A*	*N/A*	**13,800**
Oil and Grease	µg/L	47	**1,500 J**	*4,800 U*	*4,850 U*	*N/A*	**23,700**
Metals							
Aluminum, Dissolved	µg/L	20,000	*50 U*	**362**	**19.3 J**	*N/A*	**823**
Arsenic, Dissolved	µg/L	10	**9.4 J**	*5 U*	*5 U*	*N/A*	**8.5**
Barium, Dissolved	µg/L	2,000	**46**	**20.6**	**29.6**	*N/A*	**39.3**
Beryllium, Dissolved	µg/L	4	*1 U*	*1 U*	0.45 B	*N/A*	*1 U*
Cadmium, Dissolved	µg/L	5	0.52 B	*3 U*	0.69 B	*N/A*	*3 U*
Chromium, Dissolved	µg/L	100	*5 U*	1.4 B	1.6 B	*N/A*	*5 U*
Cobalt, Dissolved	µg/L	6	*5 U*	*5 U*	**67.8**	*N/A*	*5 U*
Copper, Dissolved	µg/L	1,300	*5 U*	**1.6 J**	*5 U*	*N/A*	*5 U*
Iron, Dissolved	µg/L	14,000	**12,000**	44.8 B	**4,090**	*N/A*	**15.7 J**
Manganese, Dissolved	µg/L	430	**365**	**5.5 J**	**520**	*N/A*	*5 U*
Mercury, Dissolved	µg/L	2	*0.2 U*	0.05 B	0.07 B	*N/A*	0.07 B
Nickel, Dissolved	µg/L	390	**1.5 J**	1.3 B	**102**	*N/A*	1.4 B
Selenium, Dissolved	µg/L	50	*8 U*	6.3 B	*8 U*	*N/A*	*8 U*
Thallium, Dissolved	µg/L	2	*10 U*	5.1 B	*10 U*	*N/A*	*10 U*
Vanadium, Dissolved	µg/L	86	0.85 B	**673**	1.4 B	*N/A*	**40.3**
Zinc, Dissolved	µg/L	6,000	1.1 B	0.86 B	**58.2**	*N/A*	*10 U*

Detections in bold
Values in red indicate an exceedance of the Project Action Limit (PAL)
N/A indicates the parameter was not analyzed for this sample.
^PAH compounds were analyzed via SIM
U: This analyte was not detected in the sample. The numeric value represents the sampled detection limit.
J: The positive result reported for this analyte is a quantitative estimate.
B: The analyte was not detected substantially above the level of the associated method blank or field blank.
*: Indicates results did not undergo data validation.

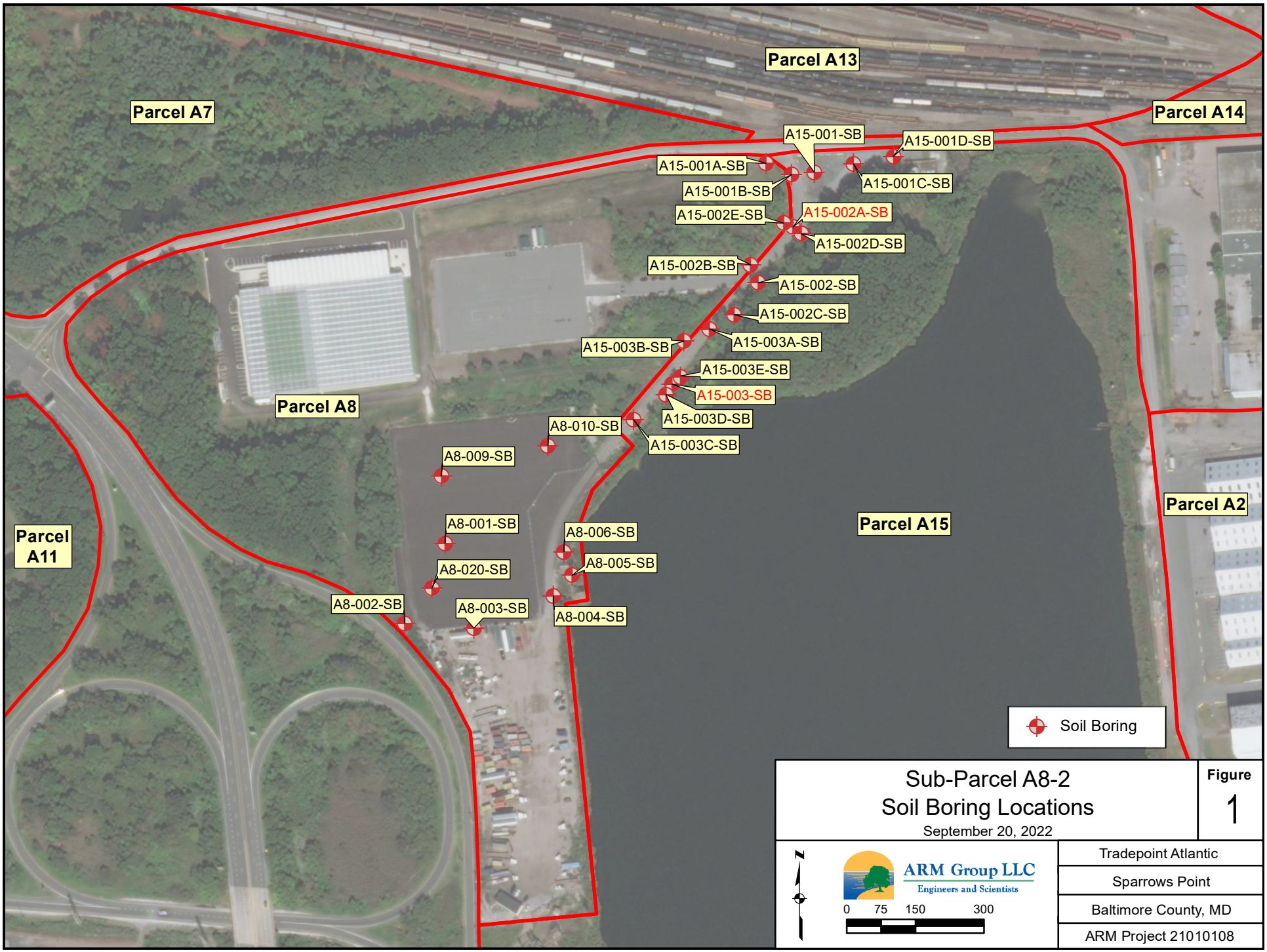
APPENDIX F

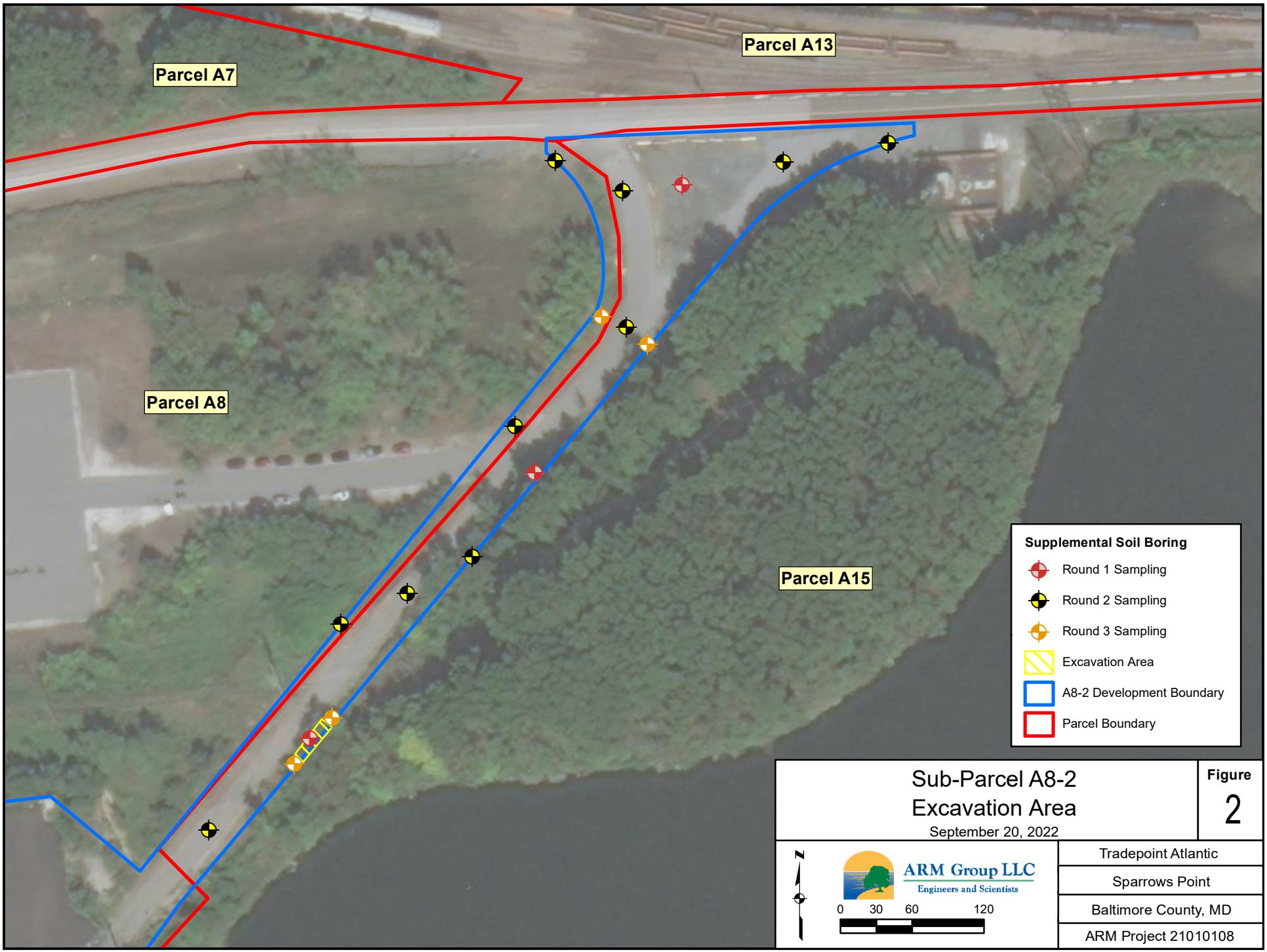
Table 1 - Parcel A8
A8-007-PZ CVOC Characterization
Summary of VOCs Detected in Groundwater

Parameter	Units	PAL	A8-004-PZ 11/4/2015	A8-007-PZ 11/5/2015	A8-007-PZ 9/27/2019	A8-007A-PZ 9/27/2019	A8-007B-PZ 9/27/2019	A8-007C-PZ 9/27/2019	A8-007D-PZ 9/27/2019	A8-007E-PZ 9/27/2019	A8-007F-PZ 9/27/2019
Volatile Organic Compounds											
1,1,1-Trichloroethane	ug/L	200	1 U	**41.4**	1 U	**3.6**	1 U	1 U	1 U	1 U	**104**
1,1-Dichloroethane	ug/L	2.7	**2**	**409**	**24.2**	**154**	**87**	**89.4**	**44.6**	**3.4**	**225**
1,1-Dichloroethene	ug/L	7	1 U	**874**	**63.9**	**390**	**402**	**387**	**162**	**8**	**1,440**
1,2-Dichloroethane	ug/L	5	1 U	**2.4**	1 U	1 U	**0.88 J**	**0.91 J**	1 U	1 U	**2.5**
1,2-Dichloroethene (Total)	ug/L	70	2 U	**4.1**	**52.3**	**6.4**	**6.3**	**5.7**	**2.7**	**7.4**	**3.9**
Acetone	ug/L	14,000	10 R	10 R	10 U	10 U	**5.6 J**	10 U	10 U	10 U	10 U
Benzene	ug/L	5	1 U	**0.61 J**	1 U	1 U	1 U	1 U	1 U	1 U	**0.74 J**
Carbon disulfide	ug/L	810	1 U	**1.2**	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	ug/L	0.22	**14**	**0.55 J**	1 U	1 U	1 U	1 U	1 U	1 U	**0.44 J**
cis-1,2-Dichloroethene	ug/L	70	1 U	**3.4**	**50.3**	**5.2**	**4.9**	**3.6**	**1.9**	**7.4**	**2.6**
Tetrachloroethene	ug/L	5	**3.3**	**0.99 J**	1 U	**0.74 J**	1 U	1 U	1 U	1 U	**1.1**
Toluene	ug/L	1,000	**0.38 J**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	ug/L	100	1 U	**0.69 J**	**2**	**1.1**	**1.4**	**2.2**	**0.78 J**	1 U	**1.3**
Trichloroethene	ug/L	5	**1.3**	**28.3**	**9.7**	**19.9**	**27**	**27.4**	**15.3**	**37.2**	**25.7**
Trichlorofluoromethane	ug/L	1,100	**2.2**	**0.71 J**	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl chloride	ug/L	2	1 U	**1.7**	**17**	**1.7**	**1.7**	**1.2**	**0.59 J**	**0.86 J**	**1.2**
Xylenes (Total)	ug/L	10,000	**1.6 J**	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U

Detections in bold
Values in red indicate an exceedance of the Project Action Limit (PAL)
U: This analyte was not detected in the sample. The numeric value represents that sample quantitation/detection limit.
J: The positive result reported for this analyte is a quantitative estimate.
R: The analytical result was rejected during validation.

APPENDIX G


Parcel A13
Parcel A7
Parcel A14
Parcel A8
Parcel A11
Parcel A15
Parcel A2
A15-001-SB
A15-001D-SB
A15-001A-SB
A15-001C-SB
A15-001B-SB
A15-002E-SB
A15-002A-SB
A15-002D-SB
A15-002B-SB
A15-002-SB
A15-002C-SB
A15-003B-SB
A15-003A-SB
A15-003E-SB
A15-003-SB
A15-003D-SB
A8-010-SB
A15-003C-SB
A8-009-SB
A8-001-SB
A8-006-SB
A8-020-SB
A8-005-SB
A8-002-SB
A8-003-SB
A8-004-SB
Soil Boring
Sub-Parcel A8-2
Soil Boring Locations
September 20, 2022
Figure
1
ARM Group LLC
Engineers and Scientists
0 75 150 300
Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 21010108


Parcel A7
Parcel A13
Parcel A8
Parcel A15
Supplemental Soil Boring
Round 1 Sampling
Round 2 Sampling
Round 3 Sampling
Excavation Area
A8-2 Development Boundary
Parcel Boundary
Sub-Parcel A8-2
Excavation Area
September 20, 2022
Figure
2
ARM Group LLC
Engineers and Scientists
0 30 60 120
Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 21010108

APPENDIX H

Parcel A15 Sampling Plan Summary
Former Sparrows Point Steel Mill
Sparrows Point, Maryland

Table 1 - Soil Sampling Summary

Source Area/ Description	REC & Finding/ SWMU/ AOC	Figure or Drawing of Reference	Rationale	Number of Locations	Sample Locations	Boring Depth	Sample Depth	Analytical Parameters: Soil Samples
Underground Storage Tank	REC 28A, Finding 281	2019 Site Visit	Investigate potential impacts related to a tank of unknown contents at the Site (potential leaks or releases).	2	A15-004 and A15-005	Total depth of 20 feet or groundwater.	0-2', 4-5', 9-10' bgs. 4-5' interval may be adjusted in the field based on observations or field screening.	VOC^, SVOC, PAHs, Metals, DRO/GRO, O&G, PCBs (0-2')
Pumping Station #1		Site Visit, Aerial, Drawings 5057, 5157, 5557	Investigate potential impacts related to the pumping station and its associated electrical equipment (potential leaks or releases).	4	A15-006 through A15-009	Total depth of 20 feet or groundwater.	0-2', 4-5', 9-10' bgs. 4-5' interval may be adjusted in the field based on observations or field screening.	VOC^, SVOC, PAHs, Metals, DRO/GRO, O&G, PCBs (0-2')
Pumping Station #2		Site Visit, Aerial, Drawings 5056, 5156, 5556	Investigate potential impacts related to the pumping station and its associated electrical equipment (potential leaks or releases).	4	A15-010 through A15-013	Total depth of 20 feet or groundwater.	0-2', 4-5', 9-10' bgs. 4-5' interval may be adjusted in the field based on observations or field screening.	VOC^, SVOC, PAHs, Metals, DRO/GRO, O&G, PCBs (0-2')
Electrical Sub-Station		Site Visit, Aerial, Drawings 5056, 5156, 5556	Investigate potential impacts related to the sub-station and its associated electrical equipment (potential leaks or releases).	2	A15-014 and A15-015	Total depth of 20 feet or groundwater.	0-2', 4-5', 9-10' bgs. 4-5' interval may be adjusted in the field based on observations or field screening.	VOC^, SVOC, PAHs, Metals, DRO/GRO, O&G, PCBs (0-2')
Parcel A15 Coverage		N/A	Investigate potential impacts related to unknown historical activities, and characterize soil in areas not previously sampled.	5	A15-016 through A15-020	Total depth of 20 feet or groundwater.	0-2', 4-5', 9-10' bgs. 4-5' interval may be adjusted in the field based on observations or field screening.	VOC^, SVOC, PAHs, Metals, DRO/GRO, O&G, PCBs (0-2')
			Total:	17				

Soil Borings Sampling Density Requirements (from **Worksheet 17 - Sampling Design and Rationale**)
No Engineered Barrier (16-40 acres): 1 boring per 1.5 acres with no less than 15 borings.
Engineered Barrier (N/A)
No Engineered Barrier (20.9 acres) = **14 borings required, 17 proposed**
Includes Building Footprints (0.2 acres)
Reservoir (40.4 acres)

VOCs - Volatile Organic Compounds (Target Compound List) by EPA Method 8260C
^VOCs are only collected if the PID reading exceeds 10 ppm
SVOCs - Semivolatile Organic Compounds (Target Compound List) by EPA Method 8270D
PAHs - Polycyclic Aromatic Hydrocarbons by EPA Method 8270D SIM
Metals - (Target Analyte List plus Hexavalent Chromium and Cyanide) by EPA Method 6010D/6010B; 7196A; 9012B
O&G - Oil and Grease by EPA Method 9071B
DRO/GRO - Diesel Range Organics/Gasoline Range Organics by EPA Method 8015D
PCBs - Polychlorinated Biphenyls by EPA Method 8082A
bgs - Below Ground Surface

Parcel A15 Sampling Plan Summary
Former Sparrows Point Steel Mill
Sparrows Point, Maryland

Table 2 - Groundwater Sampling Summary

Source Area/ Description	REC & Finding/ SWMU/ AOC	Figure or Drawing of Reference	Condition of Existing Well	Number of Locations	Sample Locations	Boring Depth	Screen Interval	Analytical Parameters: Groundwater Samples
Electrical Sub-Station		Site Visit, Aerial, Drawings 5056, 5156, 5556	N/A	1	A15-012	Total depth of 7 feet below water table.	7 feet below water table to 3 feet above water table.	VOC, SVOC, PAHs, Metals (total/dissolved), Cyanide (total/available), O&G, DRO/GRO
Parcel A15 Coverage		N/A	N/A	2	A15-014, A15-016-PZ	Total depth of 7 feet below water table.	7 feet below water table to 3 feet above water table.	VOC, SVOC, PAHs, Metals (total/dissolved), Cyanide (total/available), O&G, DRO/GRO
Existing Well SG03-PDM007		N/A	Refer to Well Inspection Form (**Appendix B**)	1	SG03-PDM007	18.5 feet bgs	8.5 ft to 18.5 ft bgs	VOC, SVOC, PAHs, Metals (total/dissolved), Cyanide (total/available), O&G, DRO/GRO
Existing Well SW-098-MWS		N/A	Refer to Well Inspection Form (**Appendix B**)	1	SW-098-MWS	23 feet bgs	3 ft to 23 ft bgs	VOC, SVOC, PAHs, Metals (total/dissolved), Cyanide (total/available), O&G, DRO/GRO
Existing Well SG04-PDM008		N/A	Refer to Well Inspection Form (**Appendix B**)	1	SG04-PDM008	12 feet bgs	2 ft to 12 ft bgs	VOC, SVOC, PAHs, Metals (total/dissolved), Cyanide (total/available), O&G, DRO/GRO
			Total:	6				

Field measurements include pH, DO, ORP, conductivity, temperature.
Metals analysis will include dissolved hexavalent chromium

VOCs - Volatile Organic Compounds (Target Compound List) by EPA Method 8260C
SVOCs - Semivolatile Organic Compounds (Target Compound List) by EPA Method 8270D
PAHs - Polycyclic Aromatic Hydrocarbons by EPA Method 8270D SIM
Metals - (Target Analyte List plus Hexavalent Chromium
by EPA Method 6010D/6010B; 7196A; 9012B
O&G - Oil and Grease by EPA Method 9071B
DRO/GRO - Diesel Range Organics/Gasoline Range Organics by EPA Method 8015D

Parcel A15 Sampling Plan Summary
Former Sparrows Point Steel Mill
Sparrows Point, Maryland

Table 3 - Sediment Sampling Summary

Source Area/ Description	REC & Finding/ SWMU/ AOC	Figure or Drawing of Reference	Rationale	Number of Locations	Sample Locations	Reservoir Depth	Sample Depth	Analytical Parameters: Sediment Samples
Historic Effluent Locations	N/A	Aerials, Drawing 5500	Investigate potential impacts in the vicinity of historic effluent locations.	2	A15-001-SD and A15-002-SD	Assumed <10'	0-6" below reservoir bed	VOC^, SVOC, PAHs, Metals, DRO/GRO, O&G, PCBs
Air Products Discharge Pipe	REC 11B	Aerials, site visit	Investigate potential impacts related to historic discharges and the previously identified REC	1	A15-004-SD	Assumed <10'	0-6" below reservoir bed	VOC^, SVOC, PAHs, Metals, DRO/GRO, O&G, PCBs
Pumping Stations	N/A	Aerials, site visit	Investigate potential impacts in the vicinity of historic and current effluent locations.	2	A15-011-SD and A15-012-SD	Assumed <10'	0-6" below reservoir bed	VOC^, SVOC, PAHs, Metals, DRO/GRO, O&G, PCBs
Parcel A15 Coverage	N/A	N/A	Investigate potential impacts in Industrial Water Reservoir sediment.	7	A15-003-SD, A15-005-SD through A15-010-SD	Assumed <10'	0-6" below reservoir bed	VOC^, SVOC, PAHs, Metals, DRO/GRO, O&G, PCBs
			Total:	12				

Total area of Reservoir: 40.4 acres

VOCs - Volatile Organic Compounds (Target Compound List) by EPA Method 8260C
^VOCs are only collected if the PID reading exceeds 10 ppm
SVOCs - Semivolatile Organic Compounds (Target Compound List) by EPA Method 8270D
PAHs - Polycyclic Aromatic Hydrocarbons by EPA Method 8270D SIM
Metals - (Target Analyte List plus Hexavalent Chromium and Cyanide) by EPA Method 6010D/6010B; 7196A; 9012B
O&G - Oil and Grease by EPA Method 9071B
DRO/GRO - Diesel Range Organics/Gasoline Range Organics by EPA Method 8015D
PCBs - Polychlorinated Biphenyls by EPA Method 8082A

Parcel A15 Sampling Plan Summary
Former Sparrows Point Steel Mill
Sparrows Point, Maryland

Table 4 - Surface Water Sampling Summary

Source Area/ Description	REC & Finding/ SWMU/ AOC	Figure or Drawing of Reference	Rationale	Number of Locations	Sample Locations	Reservoir Depth	Sample Depth	Analytical Parameters: Surface Water Samples
Historic Effluent Locations	N/A	Aerials, Drawing 5500	Investigate potential impacts in the vicinity of historic effluent locations.	2	A15-001-SW and A15-002-SW	Assumed <10'	Middle of water column	VOC, SVOC, PAHs, Metals (dissolved), Cyanide (total/available), O&G, DRO/GRO
Air Products Discharge Pipe	REC 11B	Aerials, site visit	Investigate potential impacts related to historic discharges and the previously identified REC	1	A15-004-SW	Assumed <10'	Middle of water column	VOC, SVOC, PAHs, Metals (dissolved), Cyanide (total/available), O&G, DRO/GRO
Parcel A15 Coverage	N/A	N/A	Investigate potential impacts in Industrial Water Reservoir surface water.	5	A15-006-SW, A15-007-SW, A15-008-SW, A15-010-SW and A15-012-SW (colocated with sediment locations)	Assumed <10'	Middle of water column	VOC, SVOC, PAHs, Metals (dissolved), Cyanide (total/available), O&G, DRO/GRO
			Total:	8				

Total area of Reservoir: 40.4 acres

Field measurements include pH, DO, ORP, conductivity, temperature.
Metals analysis will include dissolved hexavalent chromium

VOCs - Volatile Organic Compounds (Target Compound List) by EPA Method 8260C
SVOCs - Semivolatile Organic Compounds (Target Compound List) by EPA Method 8270D
PAHs - Polycyclic Aromatic Hydrocarbons by EPA Method 8270D SIM
Metals - (Target Analyte List plus Hexavalent Chromium and Cyanide) by EPA Method 6010D/6010B; 7196A; 9012B
O&G - Oil and Grease by EPA Method 9071B
DRO/GRO - Diesel Range Organics/Gasoline Range Organics by EPA Method 8015D

APPENDIX I

SEPTEMBER 22, 2020
PROJECT NO. 3774-300-01-14

HEALTH AND SAFETY PLAN

TRADEPOINT ATLANTIC
SPARROWS POINT FACILITY

SPARROWS POINT, MARYLAND

PREPARED BY

Weaver Consultants Group

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List of Attachments

Attachment A: Acknowledgement Form
Attachment B: Safety Data Sheets

1 INTRODUCTION

1.1 Background

The Tradepoint Atlantic (TPA) site has previously been utilized as 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 Edgemere. The facility is bounded to the north by the Sparrows Point Country Club. The entire facility is approximately 3,100 acres in size.

Pennsylvania Steel built the original 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 plating facilities. BSC filed for bankruptcy in 2001. A series of entities have since owned the site: 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. In 2014, the property and assets were sold to Sparrows Point Terminal LLC (SPT). Environmental liability was retained by SP. In 2016, SPT rebranded into the entity known as Tradepoint Atlantic, LLC (TPA).

The facility has been subdivided into various different parcels and sub-parcels based primarily on the redevelopment potential.

The purpose of this document is to provide a Health and Safety Plan (HASP) for TPA personnel who are engaged in various environmental, maintenance, and rail-related activities performed throughout the facility.

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 TPA Facility.

- Iron and steel production,
- Coal chemical recovery system,
- Other byproducts recovery systems,
- Wastewater treatment systems,

- Solid waste management, and
- Air pollution control.

The approximately 3,100 acre facility is being redeveloped into various different commercial/industrial land uses on a systematic parcel by parcel basis under the oversight of the Maryland Department of the Environment (MDE) and United States Environmental Protection Agency (USEPA). The redevelopment is proceeding in accordance with remediation plans approved by MDE and USEPA under Maryland's Voluntary Cleanup Program (VCP) and portions of the facility are also governed by the federal Resource Conservation and Recovery Act (RCRA).

Various historical environmental investigations have been performed throughout the site. The data collected from these investigations has been compiled and compared against the applicable Project Action Limits (PALs). Concentrations identified as exceeding PALs must be adequately addressed to the satisfaction of the regulators. The historical environmental data have been compiled in various Phase II Environmental Site Assessment (ESA) Reports and also presented in various documents intended to satisfy VCP requirements, including Response and Development Workplans (RADWP). The RADWP documents are generally specific to each individual sub-parcel being developed as part of the overall redevelopment project.

The historical environmental data has indicated that various constituents are present in either the soil and/or groundwater at concentrations exceeding the PALs, including:

- Various metals;
- Volatile organic compounds (VOCs);
- Semi-volatile organic compounds (SVOCs); and
- Polychlorinated biphenyls (PCBs).

While the construction projects associated with the redevelopment are typically performed by contractors hired by TPA, after the initial construction has been completed, TPA personnel perform various maintenance/repair activities throughout the site. The maintenance activities may involve excavation of impacted soils beneath engineered barriers, such as concrete or asphalt pavement. TPA personnel and their subcontractors may also perform a variety of environmental tasks including field investigations, sampling, system maintenance, and remedial excavations. TPA personnel also regularly perform various tasks related to railroad operations.

Procedures for controlling TPA worker exposure to the above constituents during execution of the various site maintenance and rail operations performed by TPA personnel is presented within this HASP.

2 PURPOSE, SCOPE AND ORGANIZATION

This section describes the purpose, scope and organization of this HASP and the health and safety responsibilities of TPA employees involved in various on-site environmental, maintenance, and rail-related operations described herein.

2.1 Scope

Site maintenance work performed by TPA personnel that could involve intrusive activities in impacted soils may include, but are not limited to:

- Soil regrading;
- Repair of subsurface utility lines, such as storm water piping, domestic water, sanitary lines, and possibly electric, or gas; and
- Repair of on-site sidewalks, driveways, or roadways.

The job tasks associated with rail-related operations on-site are generally performed in accordance with federal regulations found at 49 CFR. TPA personnel involved in rail-related operations include track workers (working in proximity of railroad tracks) and personnel working on the train cars themselves, including engineers and conductors. In general, the activities performed by TPA rail-related personnel covered under this HASP include:

- Track construction/maintenance. These tasks can be performed throughout the TPA facility and involve working with railroad ties, bolts, rails, etc.; and
- Operation of the train cars/engines themselves. These tasks include servicing, switching rail cars throughout the TPA property. The potentially hazardous materials transported in the rail cars includes: propane/butane (liquids), scrap metal (primarily zinc), aggregate, and coal.

Site environmental work includes, but is not limited to:

- Groundwater sampling and monitoring.
- Groundwater and remediation well installation, repair, closure, and abandonment.
- Surface water, pore water, and 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.
- In situ chemical and/or biological injections.
- Recovery of non-aqueous phase liquids (NAPL).

2.2 Organization of Document

This HASP includes health and safety procedures for generally anticipated job tasks related to the above site maintenance and rail-related activities. This HASP also meets the OSHA requirements contained in the CFR, specifically 29 CFR 1926 (Safety and Health Regulations for Construction), by including the following items:

- A description of staff organization, qualifications and responsibilities (Section 2.3);
- Hazard identification (Section 3.0);
- Health hazard information (Section 4.0), including references to applicable Safety Data Sheets (SDS) for materials that may be encountered during work at the TPA facility;
- Personal protective equipment (PPE), including available first aid, emergency, and safety equipment (Section 5.0);
- Employee training and standard safety procedures (Section 6.0);
- Exposure monitoring plan (Section 7.0);
- Site control measures and decontamination (Section 8.0); and
- Emergency response and contingency procedures (section 9.0)

2.3 TPA Health and Safety Personnel

Personnel responsible for implementing this HASP include:

TPA Contacts	
Mr. Pete Haid, Vice President – Environmental	(443) 649-5055 phaid@tradepointatlantic.com
Mr. Matthew Newman, P.E., Environmental Engineer	(410) 649-5063 mnewman@tradepointatlantic.com
Silvio Restivo, Tradepoint Rail General Manager	(443) 528-5697 srestivo@tradepointrail.com
Mike Vogler, Senior Vice President – Operations	(443) 386-3619 mvogler@tradepointatlantic.com
Chad Waskey, Director of Property Management	(443) 865-3722 cwaskey@tradepointpm.com

TPA will identify certain individuals as "Competent Persons" within the meaning of OSHA Standard 29 CFR 1926.32 (f). Within this context, a "Competent Person" is defined as "one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees and who has authorization to take prompt action to eliminate them."

A "Competent Person" is typically identified by virtue of education, training, and experience, or a combination and shall possess the skill of observation and the knowledge of the subject, including the applicable regulatory guidelines as to ensure that safety and health of the public, workers, and the environment.

3 HAZARD IDENTIFICATION

This section outlines the potential hazards associated with various jobs listed above in Section 2.1.

3.1 Hazard Analysis

The various jobs related to site environmental, maintenance, and rail operations may pose potential health and safety hazards for site workers. This section describes the hazards associated with these operations. Detailed hazard information is provided in Section 4.0 (Health Hazard Information).

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

3.1.1 Chemical Hazard

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 site maintenance or rail work, or ingestion of contaminants, if good personal hygiene practices are not followed.

Various metals, VOCs, SVOCs, and PCBs are the primary contaminants that have been identified in site soil and/or groundwater during previous environmental investigations at the site at concentrations exceeding Project Action Limits (PALs). The appropriate Safety Data Sheets (SDS) will be reviewed that apply to the various job tasks being conducted. Applicable SDS are located in **Attachment B**. A SDS for slag, which has been utilized for structural fill and could be encountered during excavation activities, is also included in **Attachment B**. Creosote is a chemical commonly used to preserve wood railroad ties and could also be encountered by TPA workers performing maintenance on railroad tracks. Finally, propane, butane, and coal are commonly transported in rail cars. Therefore, a SDS for these materials is also included in **Attachment B**.

Note that this is a dynamic document: should any additional chemicals be introduced or discovered during environmental, site maintenance or rail-related activities, the SDS will be added to **Attachment B**, as necessary. Further, some of the SDS apply to a pure form of the various compounds detected in the soils at the site. The actual concentrations of these chemicals in the site soil is substantially lower.

3.1.2 Physical Hazards

The potential physical hazards associated with site maintenance and rail-related activities include:

- Slips, trips, and falls;
- Exposure to extreme outside temperatures and weather;
- Equipment hazards;
- Noise;
- Dust and fumes;
- Injury from tools, equipment, rotating parts;
- Electrical hazards;
- Buried and overhead hazards;
- Railroad-specific hazards; and
- Driving to, from, and around the site (including working in trafficked areas).

It is possible that additional hazards may be encountered based on the various tasks at hand. It will be the responsibility of TPA's management to identify and address additional hazards on a "per task or job" basis. If a new job or task not mentioned in this HASP is required, then a job safety analysis (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 to familiarize the crew with potential hazards, discuss new situations, and assess how the associated risks can be managed. Further, good housekeeping practices will be employed to manage other risks potentially resulting from clutter and inattention to detail. In addition, internal field audits may be randomly conducted to document adherence to procedures described herein.

3.1.3 Biological Hazards

Biological hazards that may be encountered when conducting the planned maintenance and rail-related 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; and
- Blood borne 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 operations 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 HEALTH HAZARD INFORMATION

The following section provides a discussion of the health hazards for workers associated with the site environmental work, maintenance work, and rail-related work. Occupational hazards associated with the components of the chemicals of concern present in the soil may exist, along with physical and biological hazards related to the environmental work, maintenance work, and rail-related operations work, which 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 site 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. TPA 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 TPA-enforced exposure criteria during work-related activities covered by this HASP.

The following is a summary of the potential hazards created by the compounds that may be encountered during TPA's environmental, maintenance and/or rail-related activities. Contaminants of concern may include various metals, semi-volatile compounds [i.e., polycyclic aromatic hydrocarbons (PAHs)], volatile organic compounds, and PCBs. Table 4-1 below contains chemical information and exposure limits for various chemicals that could be present at concentrations exceeding Project Action Limits (PALs) during future maintenance and/or rail-related work activities. 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 personnel are upwind of the engine exhaust.

If other chemicals are encountered during the course of TPA's work activities, the SDS must be made available and added to **Attachment B**. Personnel must be trained in the hazards and use of chemicals. This training will be primarily accomplished through the review of this HASP.

Table 4-1, Chemical Contaminants of Potential Concern

Chemical Name Synonyms (trade name)	Exposure Limits	Characteristics	Route of Exposure	Symptoms of Exposure
Polycyclic aromatic hydrocarbons (PAHs) (coal tar pitch volatiles) (65996-93-2)	PEL: 0.2mg/m³ REL: 0.1mg/m³ TLV: 0.2 mg/m³ STEL: N/A IDLH: 80mg/m³(CA) Skin: NO	The pitch of coal tar is black or dark brown amorphous residue that remains after the predistillation process. LEL: N/A UEL: N/A IP: VARIES VP: 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/m³ REL: NONE TLV: 0.5 mg/m³ STEL: N/A IDLH: 5mg/m³ (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: 0.5 mg/m^3 STEL: 8 mg/m^3 IDLH: 50 mg/m3	White, odorless solid. Air odor threshold: N/D	ING INH CON	Irritated eyes, skin, upper respiratory system, skin burns, gastroenteritis, muscle spasm, slow pulse, cardiac arrhythmia
Chromium (III) Compounds (as Cr)	PEL: 0.5mg/m³ REL: 0.5mg/m³ TLV: 0.5mg/m³ STEL: N/A IDLH: 25mg/m³ Skin: NO	Varies, depending on specific compound	INH ING CON	Eye irritation, sensitivity, dermatitis
Cadmium (elemental)	PEL: 0.005mg/m³ REL: CA TLV: 0.01mg/m³ STEL: N/A IDLH: 9mg/m³ (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/m³ REL: 0.5mg/m³ TLV: 0.5mg/m³ STEL: N/A IDLH: 250mg/m³ 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.
Copper	PEL: 1mg/m³ REL: 1mg/m³ TLV: 1mg/m³ STEL: N/A IDLH: 100mg/m³ Skin: NO	Reddish, lustrous, malleable, odorless solid	INH ING CON	Irritation of eyes, nose, pharynx, nasal septum perforations, metallic taste, dermatitis

Chemical Name Synonyms (trade name)	Exposure Limits	Characteristics	Route of Exposure	Symptoms of Exposure
Lead (Elemental & Inorganic as Pb)	PEL: 0.05mg/m³ REL0.1mg/m³ TLV: 0.05mg/m³ STEL: N/A IDLH: 100mg/m³ 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.
Manganese	PEL: 5 mg/m3 TLV: 0.2 mg/m3	Gray metallic solid in various forms, odorless	INH SKIN EYES	Irritation. Chronic exposure to high levels may result in syndrome called manganism, which typically begins with feelings of weakness and lethargy and progresses to other symptoms such as gait disturbances, clumsiness, tremors, speech disturbances, a mask-like facial expression and psychological disturbances.
Nickel	PEL: 1 mg/m³ REL: 0.015 mg/m³ (Ca) TLV: 0.1 mg/m³ STEL: N/A IDLH: 10 mg/m³ Skin: NO	Lustrous, silvery, odorless solid. Air odor threshold: N/A VP: 0mm	INH CON ING	Sensitivity dermatitis, allergic asthma, pneumonitis
Vanadium Oxide	PEL: 0.5 mg/m3, respirable TLV: 0.05 mg/m3	Yellow-orange or dark gray in color	SKIN EYE INH ING	Repeated exposure may result in greenish discoloration of tongue.
Zinc oxide	PEL: 5mg/m³ REL: 5mg/m³ TLV: 2mg/m³ STEL: 10mg/m³ IDLH: 500mg/m³ 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
Trichloroethene	PEL: 100 mg/m^3 IDLH: 1,000 mg/m3	Colorless liquid (unless dyed blue) with chloroform-like odor LEL: 8% UEL: 10.5%	ING INH ABS SKIN EYE	Eye, skin irritation, headache, visual disturbance, weakness, exhaustion, dizziness, tremor, drowsiness, nausea, vomiting, dermatitis, cardiac arrhythmias
Benzene	PEL – 1 ppm STEL – 5 ppm IDLH – 500 ppm STEL – 1 ppm (NIOSH)	Colorless to light-yellow liquid with aromatic odor LEL: 1.2% UEL: 7.8% IP: 8.76 EV VP: 7mm Fl.Pt.: 55 deg F	ING INH CON	Irritation of eyes, skin, nose, respiratory system, giddiness, headache, nausea, fatigue, anorexia, dermatitis, bone marrow depression

Chemical Name Synonyms (trade name)	Exposure Limits	Characteristics	Route of Exposure	Symptoms of Exposure
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 FI.P: 55°F	INH ING CON	Irritation of eyes, skin, mucous membranes, headache, dermatitis
1,4-dichlorobenzene	PEL: 75 mg/m3 IDLH: 150 mg/m3	Colorless or white crystalline solid with a mothball-like odor LEL: 2.5% UEL: unknown	INH ABS ING SKIN EYE	Eye irritation, swelling, periorbital (situated around eye), profuse rhinitis, headache, anorexia, nausea, vomiting, weight loss, jaundice
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 FI.P: 56°F	INH ING CON	Irritation of eyes, CNS depression, liver, kidney, lung damage
1,2-dibromo-3-chloropropane	PEL: 0.001 mg/m3	Colorless liquid, with pungent odor	INH SKIN ING	Eye, skin, and respiratory irritation, lowered consciousness
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 FI.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 FI.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
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 FI.P: 88°F	INH ABS ING CON	Irritated eyes, nose, respiratory system, headache, fatigue, dizziness, confusion, malaise, drowsiness, weakness, narcosis, dermatitis
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 FI.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

Chemical Name Synonyms (trade name)	Exposure Limits	Characteristics	Route of Exposure	Symptoms of Exposure
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 FI.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
Polychlorinated biphenyls (PCBs)	PEL: 1 mg/m^3 (42% concen.) PEL: 0.5 mg/m^3 (54% concen.)	Clear to light yellow oils, viscous liquids, or sticky resin, may have mild hydrocarbon odor.	INH ABS ING	Short-term or acute health effects include skin, eye, and throat irritation, breathing difficulties, nausea and vomiting, loss of weight, and stomach pain.
Gases				
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/m³ (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

TPA workers may be exposed to a number of physical hazards during execution of site environmental, maintenance, and rail-related operations job tasks. 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,
- Excavation hazards,
- Noise,
- Use of hand and power tools,
- Buried hazards,
- Electrical hazards,
- Underground and overhead utilities,
- Railroad-specific hazards; and
- Travel to and from site.

The following sections provide additional discussion concerning each of the above potential physical hazards.

4.2.1 Heat Stress

Depending upon the time of year, local weather conditions may produce an environment that will require restricted work schedules in order to protect employees from heat stress. Supervisors 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 started 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 acclimated 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/or electrolyte-replenishing fluids; and
- Keep ice readily available to rapidly cool site workers.

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

Heat Stress Index

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

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HSI Temp	Category	Injury Threat
Above 130° F	Extreme Danger	No work unless emergency exists. Contact TPA senior management 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 TPA senior management prior to proceeding. Requires strict adherence to ACGIH Heat Stress Guidelines. 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.

Use appropriate cold weather clothing when temperatures are at or below 40^{o} F as exposed skin surfaces must be protected. These protective items can include facemask, hand wear, and foot wear. 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, TPA field personnel 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; and
- Avoid caffeine (which has diuretic and circulatory effects).

4.2.3 Lifting Hazards

Field personnel may be exposed to injury caused by lifting heavier objects and various pieces of large or unwieldy equipment. All TPA employees 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; and
- Use the buddy system for larger or heavy pieces of equipment.

4.2.4 Slips, Trips and Falls

The most common hazards encountered for workers outside vehicle cabs during site environmental, maintenance or rail-related activities is expected to be slips, trips and falls. TPA workers 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 may be utilized to mitigate slippery conditions. Other engineering controls may involve the use of footgear traction control devices. TAP workers will avoid slippery surfaces, use engineering controls as appropriate, not hurry, and maintain good housekeeping.

4.2.5 Buried Hazards

Whenever the ground surface is penetrated, the potential for contacting buried hazards exists. During the planning/mobilization phase, prior to excavation activities, TPA personnel 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, excavation activities will either need to be relocated or excavation should proceed carefully. 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 initiation of excavation activities.

4.2.6 Electrical Hazards

It may be possible that overhead power lines will be in proximate locations during environmental, maintenance or rail-related activities. At least a 20 foot clearance must be maintained from overhead power lines. No equipment such as dump trucks should be moved while buckets are in the upright position. Field personnel 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 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;
- If ground personal are endangered by equipment, operators will temporarily 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; and
- 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 hi-visibility orange or green protective vests, shirts, jackets, or equivalent 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; and
    - 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; and
- Require brakes to be set and wheels chocked (when applicable) when not in use.

Daily inspections of equipment will be performed. 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 Safety

Prior to any intrusive work, as previously mentioned above, 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 verifying all marked utilities are seen by those doing the intrusive work.

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. Project management 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 three consecutive attempts be made without success to offset a particular drilling location, the field personnel should stop and contact management 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, or cut off power to the lines.

The area around the drill rig will be inspected before the drill rig mast 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 measured 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.

4.2.9 Excavation Safety

Prior to excavating, the location of underground utilities, such as sewer, telephone, gas, water and electric lines must be identified and plainly marked. 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.

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

While the material being excavated is generally not expected to exhibit noticeable signs of impact in the field, if the material being excavated or graded exhibits any of the following characteristics, then TPA personnel shall stop excavation/grading activities within the immediate area and contact the TPA Environmental Department, so that the proper management procedures can be established:

- Visible staining;
- Visible free product; or
- Unusual odors emanating from the excavation are detected in vicinity of the excavation.

The TPA Environmental Department will determine the appropriate course of action, with regard to the visibly impacted material. If additional air monitoring is warranted, the air monitoring procedures are described below in Section 7.

4.2.10 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.

4.2.11 Noise

Exposure to high levels of noise may occur when working near 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.

4.2.12 Railroad-Specific Hazards

Working in close proximity to railroad facilities is inherently hazardous. In addition to the guidelines set forth herein, TPA personnel working in or near rail lines will follow all Federal Railroad Administration Rules.

The following safety rules will apply when working near railway tracks:

- Personnel shall be alert to train movement and shall expect the movement of trains, engines, cars, or other movable equipment at any time, on any track, and in any direction, even cars that appear to be stationary or in storage. Stay at least 50 feet away from the ends of stationary cars when crossing the track, and never climb on, under or between cars. To cross tracks, personnel shall look both ways, and if the tracks are clear, walk at a right angle across the tracks.
- Personnel shall not rely on others to protect them from train movement. The responsibility is theirs for safety on the railway.
- Personnel shall not stand on the track in front of an approaching engine, car or other equipment.
- Personnel shall be aware of the location of structures or obstructions where clearances are close.

- Personnel should not stand or walk on railroad tracks, either between the rails or on the ends of ties unless absolutely necessary. Personnel shall stay clear of tracks whenever possible.
- No work activities or processes are allowed within 50 feet of the track centerline while trains are passing through the work site, unless specifically authorized. Personnel shall always, where possible, stand at least 20 feet back from the track(s), to prevent injury from flying debris or loose rigging. Also, personnel shall observe the train as it passes and be prepared to take evasive action in the event of an emergency.
- Personnel shall not remain in a vehicle that is within 50 feet of a passing train, and shall not drive near moving trains. Personnel shall move vehicles away from the tracks at least 50 feet unless specifically authorized, or park the vehicle away from the tracks and walk to a safe distance whenever trains pass.
- Personnel shall not stand on or between adjacent tracks in multiple track territory when a train is passing. Personnel shall be especially alert in yards and terminal areas as engines may be pushing cars, cars may be moving without any engine attached and engines/cars change tracks often.
- Personnel shall not walk, stand or sit on the rails. As the rail surface can be extremely slippery, personnel must step over the rails when crossing tracks. Personnel shall also be aware railway ties can also be slippery and that railway ballast can shift while walking on top of it.

4.2.13 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 high visibility vests, shirts, jackets, or equivalent when working in these areas. Depending on frequency, proximity, and nature of traffic, a flag person may also be utilized.

4.2.14 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 environmental, maintenance and rail-related operations may expose workers working outside vehicle cabs to other hazards such as poisonous plants, insects, animals, and indigenous pathogens. Protective clothing and possibly respiratory protection, 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 possibly be encountered while performing site environmental, maintenance and rail-related job tasks:

BIOLOGICAL HAZARD and LOCATION	CONTROL MEASURES
Snakes typically are found in underbrush and tall grassy areas.	If a snake is encountered, 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 bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Seek medical attention immediately. **DO NOT** 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.
Poison ivy, poison oak and poison sumac typically are found in brush or wooded areas. They are more commonly found in moist areas or along the edges of wooded areas.	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.
Exposure to **blood borne pathogens** 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.	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.
Bees, spiders and other stinging insects may be encountered almost anywhere and may present a serious hazard particularly to people who are allergic.	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 TPA management 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.

BIOLOGICAL HAZARD and LOCATION	CONTROL MEASURES
Ticks 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.	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 bite to TPA management. Look for symptoms of Lyme disease that include a rash that looks like a bullseye and chills, fever, headache, fatigue, stiff neck or bone pain. If symptoms appear, seek medical attention.

As long as community spread of the COVID-19 virus is deemed a concern by state and local public health officials, to protect against this spread, if site workers must work within close proximity of other workers, face mask coverings must be utilized while working within the TPA facility. Further, TPA workers shall regularly wash hands with soap or utilize hand sanitizer during the course of the work day.

5 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) ensembles will be used to protect TPA workers from potential contamination hazards. Level D PPE is expected to be used for most activities that do not involve direct prolonged exposure to impacted soils. However, Modified Level D may be applicable if TPA workers are performing intrusive environmental or maintenance work within impacted soils for extended time periods. For purposes of this HASP, "intrusive maintenance work" is defined as work performed by TPA workers entering a trench or excavation that subsequently involves direct contact with impacted soils. Intrusive maintenance work does not include grading/excavation work performed by workers outside a trench or excavation/grading work inside enclosed vehicle/equipment cabs.

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 chemicals, Level D protection may be used. Level D PPE will be applicable for all job tasks performed by workers that are typically inside enclosed vehicle cabs and if the workers leave the cabs and remain in the operational area. The basic 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;
- Sturdy, high-ankle work boots, appropriate for the assigned tasks;
- Safety glasses with side shields;
- Hearing protection, as necessary;
- Hand protection, as appropriate;
- Hard hat will be required at all times for all personnel outside of vehicles cabs unless pre-authorized not to wear a hard hat due to operational difficulties; and
- Hi-visibility vests, shirts, jackets, or the equivalent will be required at all times for all personnel.

5.2 Modified Level D Protection

As mentioned above, construction activities involving intrusive environmental work as defined above may be performed by workers in upgraded Modified Level D PPE. If required, Modified Level D protection consists of the following:

- Disposable overalls such as polyethylene-coated Tyvek™;
- Latex, vinyl, or nitrite inner gloves;
- Nitrile outer gloves (taped to outer suit);
- Chemical-protective over-boots (taped to outer suit). However, if chemical-protective over-boots create increased slip/trip/fall hazards, then standard leather or rubber work boots could be used, but visible soils from the sides and bottoms of the boots must be removed immediately after working with impacted soils;
- Steel toe/steel shank, high-ankle work boots, appropriate for the assigned tasks;
- Hard hat;
- Safety glasses with side shields or goggles;
- Hearing protection, as necessary; and
- Dust mask.

5.3 Level C Protection

No activities requiring Level C protection will be performed by TPA personnel. If such an activity is contemplated, a full JSA and PPE review will be performed, and an appropriate PPE program will be implemented under a modified HASP.

5.4 First Aid, Emergency and Safety Equipment

The following first aid, emergency and safety equipment will be maintained in easily accessible areas throughout the TPA facility:

- A portable eye wash;
- Fire extinguishers as enforced by OSHA in 29 CFR 1926 Subpart F;
- Industrial first-aid kit (one 16-unit that complies with American National Standards Institute (ANSI) Z308A for every 25 persons or less);
- Blood borne pathogen precaution kit with CPR mouth shield;
- Instant cold packs;

- Soap or waterless hand cleaner and towels; and
- American Red Cross First Aid and CPR Instruction Manuals.

6 PERSONNEL TRAINING AND STANDARD SAFETY PROCEDURES

A safety orientation will be conducted for all TPA employees. The training will involve review of this HASP (and documenting completion of review) prior to initiation of work tasks for all employees and regular safety tailgate meetings during the course of regular operations. An Acknowledgement Form for documenting completion of the initial training activities is included in **Attachment A.**

In addition to the training requirements presented in this HASP, TPA employees involved in rail-related operations will be required to receive the applicable training specified in 49 CFR, which includes regular training on an annual to tri-annual basis.

6.1 Standard Safety Procedures

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

6.1.1 General Safety Work Practices

All TPA employees 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 near impacted soils;
- 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; and
- Good housekeeping of all work areas will be maintained on an ongoing basis.

6.1.2 Hand Safety

This standard is intended to protect TPA 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/tag out.

Guidelines for 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.
- Fixed open-blade knives are prohibited from use. Examples of fixed open-blade knives include pocket knives, multi-tools, 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, consider Kevlar® gloves in the PPE evaluation for the project.
- Do not remove guards on paper cutters.

6.1.3 Respiratory Protection

If an upgrade to Level C PPE is required, a full JSA and PPE review will be performed, and an appropriate PPE program will be implemented under a modified HASP. The action levels that would trigger upgraded respiratory protection are presented in Section 7 below.

6.1.4 Personal Hygiene Practices

TPA employees must pay strict attention to sanitation and personal hygiene requirements to adequately control personal contamination. The following instructions will be discussed and must be followed:

- During work 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. A foot pump handwashing station containing soap/paper towels will be located on site and available to workers. Alternatively, wet wipes could be utilized for washing;
- Smoking is prohibited, except in designated areas; and
- At the end of the day, all employees should shower upon leaving work.

6.1.5 Other Standard Safety Procedures

6.1.5.1 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 installed in all areas that contain flammable liquids.

6.1.5.2 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.

6.1.5.3 Sanitation

Adequate water and toilet facilities will be provided near the work areas 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 disposal of the used cups will also be provided.

7 CONTINGENT EXPOSURE MONITORING PLAN

7.1 Contingent Air Monitoring for Volatiles and Combustible Gases

If conditions in certain work area(s) warrant, the following surveillance/monitoring program will be employed to ensure the adequacy of the level of TPA worker protection. The site conditions that would warrant air monitoring are listed above in Section 4.2.9, and include:

- Visible soil staining;
- Visible free product in subsurface soil; or
- Unusual odors emanating from the excavation are detected in vicinity of the excavation.

If air monitoring is warranted, an Environmental Professional (EP) 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 personnel. The appropriate TPA supervisor(s) will be notified immediately of any contaminant levels that could trigger an upgrade in PPE or cause a suspension of work activities.

One or more of the following direct-reading instruments may be used to aid in this evaluation. 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 (O2) meters will detect fluctuations in oxygen concentrations. These instruments should be calibrated or bump tested regularly and whenever the measurements may be erratic.

7.1.1 Combustible Gas and Oxygen Deficiency / Excess Monitoring

Explosive gas concentrations are not expected to exceed 10% of the lower explosive limit (LEL). Should the need be indicated for air monitoring, action guidance for the CGI/O2 meter responses is contained in **Table 7-1** below.

Table 7-1

CGI/Oxygen Meter Action Levels	
Meter Response	**Action**
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 min. >10% and <20% LEL	Retreat from work area; notify TPA management
CGI response >20%	Discontinue operations; retreat from work area
Oxygen level <19.5%	Retreat from work area; notify TPA management
Oxygen level >23.5%	Retreat from work area; notify TPA management

7.1.2 Organic Vapor Concentrations

If warranted due to non-standard emergency conditions, real-time monitoring for organic vapor concentrations in the breathing zone will be conducted during field operations with a PID equipped with a 10.2 or 11.7-electron volt (eV) probe. Measurements will be made where ground intrusive work is being performed. The instrument will be calibrated using ultra-high purity air and isobutylene vapor of known concentration before each use. Air calibration measurements will be documented in writing and filed appropriately. Action guidance for PID responses is contained in **Table 7-2** below.

Table 7-2

PID Action Levels for General Site Work	
Meter Response in Breathing Zone (sustained concen., for minimum of 3 minutes)	**Action Required**
<5 ppm above background	Use Level D or Modified Level D PPE
>5 ppm above background	Cease work, notify supervisor and investigate source.
>50 ppm above background	Stop work

If air concentrations of organic vapors are greater than 5 ppm above background in the breathing zone continuously for a 3-minute period, personnel will stop work, retreat from the area, and allow time (at least 15 minutes) for vapors to dissipate. If subsequent monitoring indicates that concentrations still consistently exceed 5 ppm, workers will stop work and retreat from the area. TPA supervision will investigate the source and establish next steps.

These action levels are based on the assumption that the major volatile constituents of concern are benzene and naphthalene, which are the most common volatile constituents previously identified in the soils at the TPA facility.

7.2 Physical Conditions Monitoring

Site workers will be monitored by TPA management 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, TPA management will assess conditions that may cause heat stress in site workers.

8 SITE CONTROL MEASURES

To provide for the protection of public health and safety and minimize the possibility of transferring impacted soils from the site, contaminant control procedures are required. These procedures will consist of site control measures (i.e., delineation of work zones, communications, and site security) and decontamination procedures. Decontamination may be necessary for both personnel and equipment, if regular contact with visibly impacted soils and/or groundwater occurs during the course of site environmental work. Contaminants that may be uncovered during environmental soil re-grading operations must not be transferred outside the project area unless properly containerized, and must be removed from clothing, personnel, and equipment prior to relocation.

8.1 Environmental Site Control Measures

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

8.1.1 Environmental Work Zone Delineation

To control the transfer of hazardous substances from the work sites and allow for proper protection of TPA environmental employees and subcontractors, work zones will be established. The work zones will include:

- Exclusion Zone (EZ);
- Contamination Reduction Zone (CRZ); and
- Support Zone (SZ).

A description of each of the above work zones is presented 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. Workers and others 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 adequately 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 unimpacted 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, TPA environmental 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, 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.

8.1.2 Environmental Decontamination Procedures

Decontamination of environmental TPA employees, contractors, and equipment leaving the EZ will be performed to control human exposure to hazardous substances and to minimize the spread of contamination to surrounding areas. The primary purpose of the CRZ is to provide a set location for performing limited personnel decontamination and certain PPE and small equipment decontamination.

8.1.2.1 Environmental 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 applicable) at the boot washing station and place in the disposal container provided;
- Wash outer gloves and chemical resistant boots (if used) at the boot washing station;
- Remove wrist tape (if applicable) and outer gloves and place in appropriate container;
- Remove ankle tape (if applicable) and disposable coveralls (if applicable) and place in the appropriate container;
- Remove respirator (if applicable) and place in designated location in the CRZ;

- Remove inner gloves and discard to the appropriate container; and
- Wash hands and face before proceeding to the SZ.

Respirators (if warn) must be decontaminated after each use by the personnel who previously wore them. All TPA employees and subcontractors are required to take a thorough soap and water shower 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 TPA management as soon as the contaminated state has been discovered.

8.1.2.2 Environmental Equipment Decontamination

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. Vehicles working in an EZ will be decontaminated prior to 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 soil remaining on the tires or elsewhere. Vehicles will be cleaned to the satisfaction of the appropriate TPA supervisor prior to entering the SZ or leaving the site. TPA employees or subcontractors performing decontamination shall wear the appropriate level of PPE (refer to Section 5.0 above).

8.1.2.3 Environmental Waste Management Procedures

TPA management will be responsible for overseeing the containerization and disposal of any field derived wastes from environmental activities. 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 sampling or intrusive work found 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 TPA management for eventual disposal. For larger excavations, where excavated soil is stockpiled, it may be necessary to place soils on plastic and cover with plastic to control potential leachable runoff. The appropriate TPA supervisor(s) 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.

8.2 Communications

A loud and clear form of communication should be made available for TPA personnel to communicate with other appropriate personnel during work. 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, or inside the cab of a stationary vehicle.

8.3 Site Security

Access to the various work areas will be controlled with fencing or other physical barriers. No site visitors will be allowed to travel unescorted by TPA or their representative around the project area.

9 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 the various environmental, maintenance or rail-related tasks performed by TPA personnel.

9.1 Emergency Phone Numbers

Emergency telephone numbers are listed in table below.

Table 9-1
Emergency Telephone Numbers and Agencies

Agency	Telephone Number
Security (Sparrows Point facility)	(410) 388-7761
Ambulance	911
Fire	911
Occupational Health Clinic (Concentra Medical Center)	(410) 633-3600
Hospital (Johns Hopkins Bayview Hospital)	(410) 550-0100 (general) (410) 550-0350 (emergency)
National Response Center	(800) 424-8802
Poison Control Center – Maryland	(800) 222-1222
TPA Main Contacts	
Peter Haid, Vice President – Environmental	(443) 649-5055 phaid@tradepointatlantic.com
Matthew Newman, P.E., Environmental Engineer	(410) 709-1289 mnewman@tradepointatlantic.com

9.2 Injury/Illness Treatment

In the event of illness or injury to a TPA employee, the following steps will be taken:

- Evaluate the extent of injuries or seriousness of illness.
- When TPA staff 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 9-1 above lists site emergency telephone numbers. 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 TPA management for signs of worsening condition, if it is deemed that the person can return to work. Injured personnel who later suffer a worsening change in status are to immediately notify TPA management.

9.3 Occupational Health Clinic and Hospital Information

9.3.1 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 provided as **Figure 9-1** below. 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);

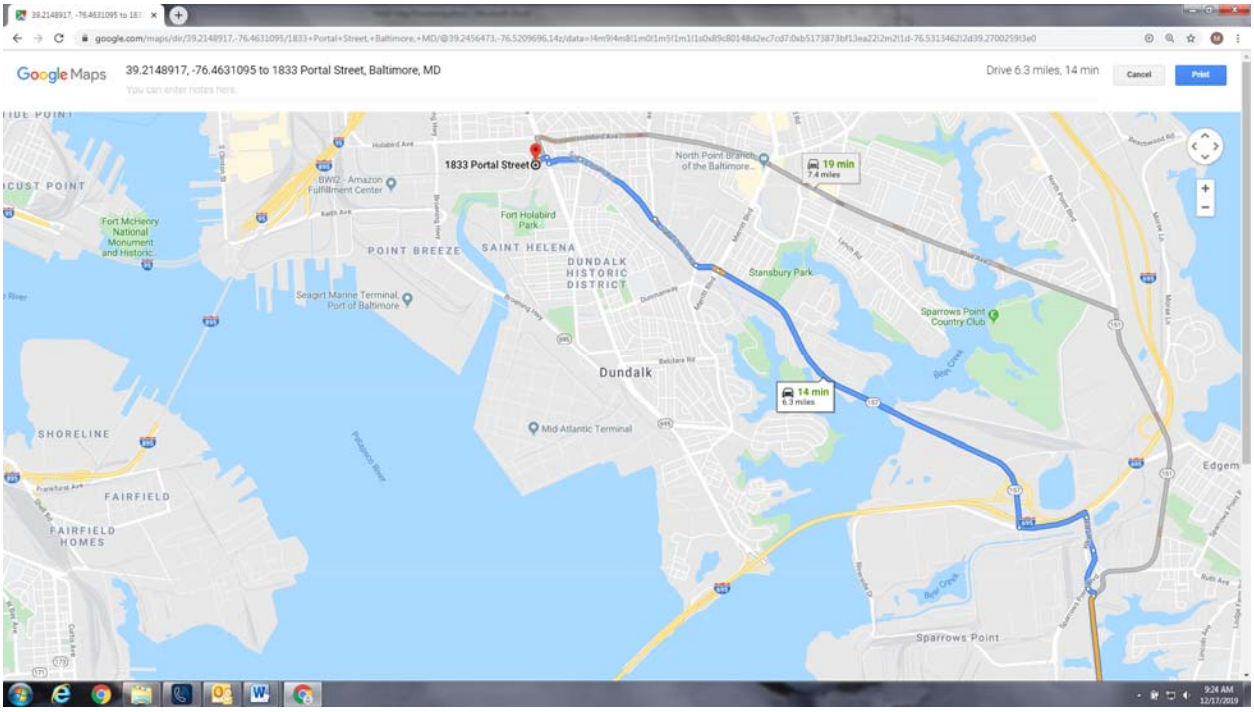
Turn left onto Williams Ave. (0.2 mile);

Turn right onto Dundalk Ave. (<0.1 miles);

Turn left onto Chandlery St. (0.1 mile);

Turn left onto Portal St.

Figure 9-1: Health Clinic (Non-Emergency) Map



9.3.2 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 9-2** below is a map to this hospital.

Directions:

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

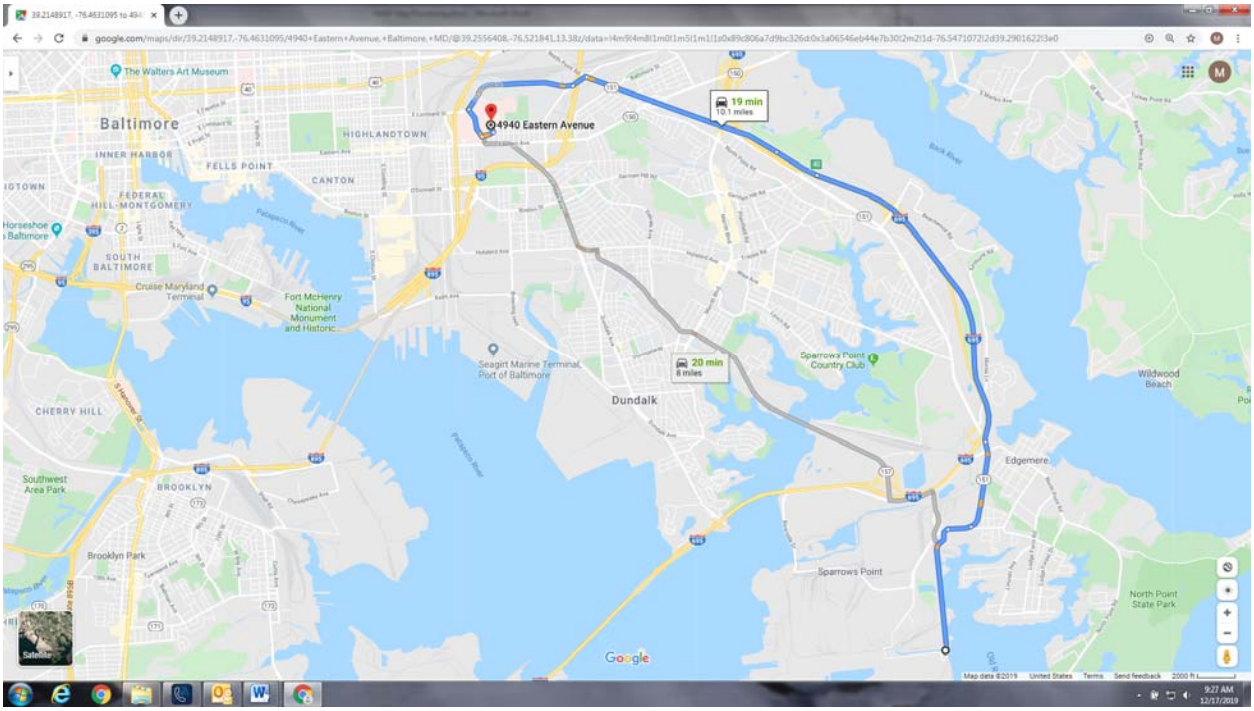
Take ramp (right) onto I-695 towards I-695/Essex.

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 9-2: Hospital Map



9.4 Accident and Emergency Medical Response

All TPA employees will be aware of the location of first aid kits 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 TPA employee's supervisor will ensure that each site worker 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. The telephone numbers of the local emergency services will be available at the project site, and TPA's management will brief workers on the procedures for calling for help in an emergency.

TPA employees will inform TPA management of any medications, allergies, or other medical information that may be applicable for their medical treatment. The employee's supervisor will supply this information to emergency response personnel, and will accompany the victim to the hospital, if possible.

9.4.1 Chemical Exposure

In case of accidental overexposure to a hazardous material, guidelines shown in the table below will be followed.

Table 9-2
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.

In the event of an incident with rail cars where potentially hazardous materials are released to the environment, TPA employees shall not be involved in the active cleanup of the hazardous materials. Rather, TPA employees should immediately notify the appropriate local authorities by calling 911. The local authorities with specific training and experience in hazardous materials emergency response and cleanup will handle the cleanup of the hazardous materials that may have been released to the environment.

9.4.2 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; and

- 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 TPA employee's supervisor will advise the medical staff as to the type of contamination possibly involved.

9.4.3 Small or Incipient Fire

A small fire is defined as a fire that can be extinguished with an available 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; and
- After the fire has been extinguished, or emergency response personnel have been contacted, notify the appropriate TPA management.

9.4.4 Large Fire or Explosion

An explosion, large fire or a small fire which cannot be extinguished is beyond the first line capabilities of TPA 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; and

- After emergency response personnel have been contacted, notify the appropriate TPA management.

9.4.5 Adverse Weather Conditions

In the event of adverse weather conditions, TPA's management will determine if work can continue without sacrificing the health and safety of TPA employees. Threatening weather conditions will be monitored by the TPA management 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, and
- Treacherous weather-related working conditions (i.e., heavy rainfall, icy conditions causing slippery footing hazards, etc.).

9.4.6 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, Sqwincher 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 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.

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.

9.4.7 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.

9.4.8 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.

9.4.9 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, and
- All TPA workers must report severe reactions to insect stings prior to the beginning of work to TPA management.

9.4.10 Poisonous Plants

Decontamination: Wash the skin immediately after contact with the plant. Proper washing may not be practical, 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.

9.4.11 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; this may help with diagnosis in the future, and

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

ATTACHMENT A

ACKNOWLEDGEMENT AGREEMENT

HEALTH AND SAFETY PLAN
Tradepoint Atlantic
Sparrows Point, MD

ACKNOWLEDGEMENT FORM

I _____, have received and/or reviewed Health & Safety Plan for the above referenced operation.

I understand TPA reserves the right to change or amend this 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.

_____ _____
TPA Employee Signature Date

_____ _____
TPA Management Signature Date

ATTACHMENT B

SAFETY DATA SHEETS (SDS)

Centers for Disease Control and Prevention
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1,1-Dichloroethane

Synonyms & Trade Names Asymmetrical dichloroethane; Ethylidene chloride; 1,1-Ethylidene dichloride

CAS No. 75-34-3	**RTECS No.** KI0175000 (/niosh-rtecs/KI2AB98.html)	**DOT ID & Guide** 2362 130 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=130) (http://www.cdc.gov/Other/disclaimer.html)
Formula $CHCl_2CH_3$	**Conversion** 1 ppm = 4.05 mg/m³	**IDLH** 3000 ppm See: 75343 (/niosh/idlh/75343.html)
Exposure Limits **NIOSH REL** : TWA 100 ppm (400 mg/m³) See Appendix C (nengapdxc.html) (Chloroethanes) **OSHA PEL** : TWA 100 ppm (400 mg/m³)		**Measurement Methods** **NIOSH** 1003 (/niosh/docs/2003-154/pdfs/1003.pdf) ; **OSHA** 7 (http://www.osha.gov/dts/sltc/methods/organic/org001/org001.html) (http://www.cdc.gov/Other/disclaimer.html) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html)

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Phys

MW:	BP:	FRZ:	Sol:	VP:	IP:
99.0	135°F	-143°F	0.6%	182 mmHg	11.06 eV
Sp.Gr:	**Fl.P:**	**UEL:**	**LEL:**		
1.18	2°F	11.4%	5.4%		

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities Strong oxidizers, strong caustics

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms irritation skin; central nervous system depression; liver, kidney, lung damage

Target Organs Skin, liver, kidneys, lungs, central nervous system

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap flush promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH/OSHA

Up to 1000 ppm:
(APF = 10) Any supplied-air respirator

Up to 2500 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

Up to 3000 ppm:
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0249 (/niosh/ipcsneng/neng0249.html)

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p-Dichlorobenzene

Synonyms & Trade Names p-DCB; 1,4-Dichlorobenzene; para-Dichlorobenzene; Dichlorocide

CAS No. 106-46-7	**RTECS No.** CZ4550000 (/niosh-rtecs/CZ456D70.html)	**DOT ID & Guide**
Formula $C_6H_4Cl_2$	**Conversion** 1 ppm = 6.01 mg/m3	**IDLH** Ca [150 ppm] See: 106467 (/niosh/idlh/106467.html)
Exposure Limits **NIOSH REL** : Ca See Appendix A (nengapdxa.html) **OSHA PEL** † (nengapdxg.html) : TWA 75 ppm		**Measurement Methods** **NIOSH** 1003 (/niosh/docs/2003-154/pdfs/1003.pdf) ; **OSHA** 7 (http://www.osha.gov/dts/sltc/methods/organic/org001/org001.html) er/disclaimer.html) 2003-154/) or OSHA Methods tc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

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Physical Description Colorless or white crystalline solid with a mothball-like odor. [insecticide]

MW: 147.0	**BP:** 345°F	MLT: 128°F	**Sol:** 0.008%	**VP:** 1.3 mmHg	**IP:** 8.98 eV
Sp.Gr: 1.25	**Fl.P:** 150°F	**UEL:** ?	**LEL:** 2.5%		

Combustible Solid, but may take some effort to ignite.

Incompatibilities & Reactivities Strong oxidizers (such as chlorine or permanganate)

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Eye irritation, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury; [potential occupational carcinogen]

Target Organs Liver, respiratory system, eyes, kidneys, skin

Cancer Site [in animals: liver & kidney cancer]

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated/Daily
Remove: When wet or contaminated
Change: Daily
Provide: Eyewash, Quick drench

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap wash
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0037 (/niosh/ipcsneng/neng0037.html) See MEDICAL TESTS: 0073 (/niosh/docs/2005-110/nmed0073.html)

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Chlorodiphenyl (42% chlorine)

Synonyms & Trade Names Aroclor® 1242, PCB, Polychlorinated biphenyl

CAS No. 53469-21-9	**RTECS No.** TQ1356000 (/niosh-rtecs/TQ14B0E0.html)	**DOT ID & Guide** 2315 171 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=171) (http://www.cdc.gov/Other/disclaimer.html)
Formula $C_6H_4ClC_6H_3Cl_2$ (approx)	**Conversion**	**IDLH** Ca [5 mg/m3] See: 53469219 (/niosh/idlh/53469219.html)

Exposure Limits

NIOSH REL *: Ca TWA 0.001 mg/m3 See Appendix A (nengapdxa.html) [*Note: The REL also applies to other PCBs.]

OSHA PEL : TWA 1 mg/m3 [skin]

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Measurement Methods

NIOSH 5503 (/niosh/docs/2003-154/pdfs/5503.pdf); **OSHA** PV2089 (http://www.osha.gov/dts/sltc/methods/partial/t-/t-pv2089-01-8812-ch.html) /Other/disclaimer.html) h/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Colorless to light-colored, viscous liquid with a mild, hydrocarbon odor.

MW: 258 (approx)	**BP:** 617-691°F	**FRZ:** -2°F	**Sol:** Insoluble	**VP:** 0.001 mmHg	**IP:** ?
Sp.Gr(77°F): 1.39	**Fl.P:** NA	**UEL:** NA	**LEL:** NA		

Nonflammable Liquid, but exposure in a fire results in the formation of a black soot containing PCBs, polychlorinated dibenzofurans & chlorinated dibenzo-p-dioxins.

Incompatibilities & Reactivities Strong oxidizers

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes; chloracne; liver damage; reproductive effects; [potential occupational carcinogen]

Target Organs Skin, eyes, liver, reproductive system

Cancer Site [in animals: tumors of the pituitary gland & liver, leukemia]

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: Daily
Provide: Eyewash, Quick drench

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap wash immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See MEDICAL TESTS: 0175 (/niosh/docs/2005-110/nmed0175.html)

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Chlorodiphenyl (54% chlorine)

Synonyms & Trade Names Aroclor® 1254, PCB, Polychlorinated biphenyl

CAS No. 11097-69-1	**RTECS No.** TQ1360000 (/niosh-rtecs/TQ14C080.html)	**DOT ID & Guide** 2315 171 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=171) (http://www.cdc.gov/Other/disclaimer.html)
Formula $C_6H_3Cl_2C_6H_2Cl_3$ (approx)	**Conversion**	**IDLH** Ca [5 mg/m³] See: IDLH INDEX (/idlh/intridl4.html)

Exposure Limits

NIOSH REL *: Ca TWA 0.001 mg/m³ See Appendix A (nengapdxa.html) [*Note: The REL also applies to other PCBs.]

OSHA PEL : TWA 0.5 mg/m³ [skin]

Measurement Methods

NIOSH 5503 (/niosh/docs/2003-154/pdfs/5503.pdf); **OSHA** PV2088 (http://www.osha.gov/dts/sltc/methods/partial/t-pv2088-01-8812-ch/t-pv2088-01-8812-ch.html) (http://www.cdc.gov/Other/disclaimer.html)

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sh/docs/2003-154/) or OSHA (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Colorless to pale-yellow, viscous liquid or solid (below 50°F) with a mild, hydrocarbon odor.

MW: 326 (approx)	**BP:** 689-734°F	**FRZ:** 50°F	**Sol:** Insoluble	**VP:** 0.00006 mmHg	**IP:** ?
Sp.Gr(77°F): 1.38	**Fl.P:** NA	**UEL:** NA	**LEL:** NA		

Nonflammable Liquid, but exposure in a fire results in the formation of a black soot containing PCBs, polychlorinated dibenzofurans, and chlorinated dibenzo-p-dioxins.

Incompatibilities & Reactivities Strong oxidizers

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, chloracne; liver damage; reproductive effects; [potential occupational carcinogen]

carcinogen]

Target Organs Skin, eyes, liver, reproductive system

Cancer Site [in animals: tumors of the pituitary gland & liver, leukemia]

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: Daily
Provide: Eyewash, Quick drench

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap wash immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0939 (/niosh/ipcsneng/neng0939.html) See MEDICAL TESTS: 0176 (/niosh/docs/2005-110/nmed0176.html)

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Arsenic (inorganic compounds, as As)

Synonyms & Trade Names Arsenic metal: Arsenia
Other synonyms vary depending upon the specific As compound. [Note: OSHA considers "Inorganic Arsenic" to mean copper acetoarsenite and all inorganic compounds containing arsenic except ARSINE.]

CAS No. 7440-38-2 (metal)	**RTECS No.** CG0525000 (metal) (/niosh-rtecs/CG802C8.html)	**DOT ID & Guide** 1558 152 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=152) (http://www.cdc.gov/Other/disclaimer.html) (metal) 1562 152 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=152) (http://www.cdc.gov/Other/disclaimer.html) (dust)
Formula As (metal)	**Conversion**	**IDLH** Ca [5 mg/m³ (as As)] See: 7440382 (/niosh/idlh/7440382.html)
Exposure Limits **NIOSH REL** : Ca C 0.002 mg/m³ [15-minute] See Appendix A (nengapdxa.html) **OSHA PEL** : [1910.1018] TWA 0.010 mg/m³		**Measurement Methods** **NIOSH** 7300 (/niosh/docs/2003-154/pdfs/7300.pdf), 7301 (/niosh/docs/2003-154/pdfs/7301.pdf), 7303 (/niosh/docs/2003-154/pdfs/7303.pdf), 7900 (/niosh/docs/2003-154/pdfs/7900.pdf), 9102 (/niosh/docs/2003-154/pdfs/9102.pdf); ;/sltc/methods/inorganic/id105/id105.html) (http://www.cdc.gov/Other/disclaimer.html) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

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Physical Description Metal: Silver-gray or tin-white, brittle, odorless solid.

MW: 74.9	**BP:** Sublimes	MLT: 1135°F (Sublimes)	**Sol:** Insoluble	**VP:** 0 mmHg (approx)	**IP:** NA
Sp.Gr: 5.73 (metal)	**Fl.P:** NA	**UEL:** NA	**LEL:** NA		

Metal: Noncombustible Solid in bulk form, but a slight explosion hazard in the form of dust when exposed to flame.

Incompatibilities & Reactivities Strong oxidizers, bromine azide [Note: Hydrogen gas can react with inorganic arsenic to form the highly toxic gas arsine.]

arsenic to form the highly toxic gas arsine.]

Exposure Routes inhalation, skin absorption, skin and/or eye contact, ingestion

Symptoms Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, resp irritation, hyperpigmentation of skin, [potential occupational carcinogen]

Target Organs Liver, kidneys, skin, lungs, lymphatic system

Cancer Site [lung & lymphatic cancer]

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated/Daily
Remove: When wet or contaminated
Change: Daily
Provide: Eyewash, Quick drench

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap wash immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations
(See Appendix E) (nengapdxe.html)

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted acid gas canister having an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0013 (/niosh/ipcsneng/neng0013.html) See MEDICAL TESTS: 0017 (/niosh/docs/2005-110/nmed0017.html)

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Barium chloride (as Ba)

Synonyms & Trade Names Barium dichloride

CAS No. 10361-37-2	**RTECS No.** CQ8750000 (/niosh-rtecs/CQ8583B0.html)	**DOT ID & Guide** 1564 154 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=154) (http://www.cdc.gov/Other/disclaimer.html) (barium compound, n.o.s.)
Formula $BaCl_2$	**Conversion**	**IDLH** 50 mg/m³ (as Ba) See: IDLH INDEX (/idlh/intridl4.html)
Exposure Limits **NIOSH REL** *: TWA 0.5 mg/m³ [*Note: The REL also applies to other soluble barium compounds (as Ba) except Barium sulfate.] **OSHA PEL** *: TWA 0.5 mg/m³ [*Note: The PEL also applies to other soluble barium compounds (as Ba) except Barium sulfate.]		**Measurement Methods** **NIOSH** 7056 (/niosh/docs/2003-154/pdfs/7056.pdf), 7303 (/niosh/docs/2003-154/pdfs/7303.pdf); **OSHA** ID121 (http://www.osha.gov/dts/sltc/methods/inorganic/id121/id121.html) (http://www.cdc.gov/Other/disclaimer.html) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description White, odorless solid.

MW:	BP:	MLT:	Sol:	VP:	IP:
208.2	2840°F	1765°F	38%	Low	?

Sp.Gr:	Fl.P:	UEL:	LEL:
3.86	NA	NA	NA

Noncombustible Solid

Incompatibilities & Reactivities Acids, oxidizers

Expo

Endpoint Security by Bitdefender
This page is safe

Symptoms irritation eyes, skin, [illegible] iratory system; skin burns; gastroenteritis; muscle spasm; slow pulse, extrasystoles; hypokalemia

Target Organs Eyes, skin, respiratory system, heart, central nervous system

Personal Protection/Sanitation (See protection codes (protect.html)) **Skin:** Prevent skin contact **Eyes:** Prevent eye contact	**First Aid** (See procedures (firstaid.html)) **Eye:** Irrigate immediately **Skin:** Water flush immediately **Breathing:** Respiratory support

Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: Daily

Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH/OSHA

Up to 5 mg/m3:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 12.5 mg/m3:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter.

Up to 25 mg/m3:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 50 mg/m3:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0614 (/niosh/ipcsneng/neng0614.html)

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Content source: National Institute for Occupational Safety and Health (NIOSH) Education and Information Division

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SEARCH

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Benzene

Synonyms & Trade Names Benzol, Phenyl hydride

CAS No. 71-43-2	RTECS No. CY1400000 (/niosh-rtecs/CY155CCo.html)	DOT ID & Guide 1114 130 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=130) (http://www.cdc.gov/Other/disclaimer.html)
Formula C_6H_6	Conversion 1 ppm = 3.19 mg/m³	IDLH Ca [500 ppm] See: 71432 (/niosh/idlh/71432.html)

Exposure Limits

NIOSH REL : Ca TWA 0.1 ppm ST 1 ppm See Appendix A (nengapdxa.html)
OSHA PEL : [1910.1028] TWA 1 ppm ST 5 ppm See Appendix F (nengapdxf.html)

Measurement Methods

NIOSH 1500 (/niosh/docs/2003-154/pdfs/1500.pdf), 1501 (/niosh/docs/2003-154/pdfs/1501.pdf), 3700 (/niosh/docs/2003-154/pdfs/3700.pdf), 3800 (/niosh/docs/2003-154/pdfs/3800.pdf);
OSHA 12 (http://www.osha.gov/dts/sltc/methods/organic/org012/org012.html) (http://www.cdc.gov/Other/disclaimer.html), 1005 methods/validated/1005/1005.html) disclaimer.html)
e: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

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Physical Description Colorless to light-yellow liquid with an aromatic odor. [Note: A solid below 42°F.]

MW: 78.1	BP: 176°F	FRZ: 42°F	Sol: 0.07%	VP: 75 mmHg	IP: 9.24 eV
Sp.Gr: 0.88	Fl.P: 12°F	UEL: 7.8%	LEL: 1.2%		

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities Strong oxidizers, many fluorides & perchlorates, nitric acid

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen]

Target Organs Eyes, skin, respiratory system, blood, central nervous system, bone marrow

Cancer Site [leukemia]

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation
Provide: Eyewash, Quick drench

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap wash immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations
(See Appendix E) (nengapdxe.html)

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0015 (/niosh/ipcsneng/neng0015.html) See MEDICAL TESTS: 0022 (/niosh/docs/2005-110/nmed0022.html)

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SAFETY DATA SHEET

N-Butane

Section 1. Identification

GHS product identifier : N-Butane

Chemical name : butane

Other means of identification : n-BUTANE; Methylethylmethane; Diethyl; Butyl hydride; normal-Butane; butane, pure

Product type : Gas.

Product use : Synthetic/Analytical chemistry.

Synonym : n-BUTANE; Methylethylmethane; Diethyl; Butyl hydride; normal-Butane; butane, pure

SDS # : 001007

Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

24-hour telephone : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : FLAMMABLE GASES - Category 1
GASES UNDER PRESSURE - Liquefied gas

GHS label elements

Hazard pictograms :



Signal word : Danger

Hazard statements : Extremely flammable gas.
May form explosive mixtures with air.
Contains gas under pressure; may explode if heated.
May displace oxygen and cause rapid suffocation.

Precautionary statements

General : Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction. Always keep container in upright position. Approach suspected leak area with caution.

Prevention : Never Put cylinders into unventilated areas of passenger vehicles. Keep away from heat, sparks, open flames and hot surfaces. - No smoking. Use and store only outdoors or in a well ventilated place.

Response : Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so.

Storage : Protect from sunlight. Store in a well-ventilated place.

Disposal : Not applicable.

Hazards not otherwise classified : In addition to any other important health or physical hazards, this product may displace oxygen and cause rapid suffocation.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : butane

Other means of identification : n-BUTANE; Methylethylmethane; Diethyl; Butyl hydride; normal-Butane; butane, pure

Product code : 001007

CAS number/other identifiers

CAS number : 106-97-8

Ingredient name	%	CAS number
N-Butane	100	106-97-8

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : As this product is a gas, refer to the inhalation section.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Ingestion : As this product is a gas, refer to the inhalation section.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Section 4. First aid measures

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : Contains gas under pressure. Extremely flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool. If involved in fire, shut off flow immediately if it can be done without risk. If this is impossible, withdraw from area and allow fire to burn. Fight fire from protected location or maximum possible distance. Eliminate all ignition sources if safe to do so.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : Accidental releases pose a serious fire or explosion hazard. No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment.

Large spill : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Avoid breathing gas. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

Use only non-sparking tools. Avoid contact with eyes, skin and clothing. Empty containers retain product residue and can be hazardous. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F). Keep container tightly closed and sealed until ready for use. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
N-Butane	**NIOSH REL (United States, 10/2016).** TWA: 1900 mg/m³ 10 hours. TWA: 800 ppm 10 hours. **OSHA PEL 1989 (United States, 3/1989).** TWA: 1900 mg/m³ 8 hours. TWA: 800 ppm 8 hours. **ACGIH TLV (United States, 3/2017).** STEL: 1000 ppm 15 minutes.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Section 8. Exposure controls/personal protection

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Gas. [Compressed gas.]

Color : Colorless.

Odor : Odorless.

Odor threshold : Not available.

pH : Not available.

Melting point : -138°C (-216.4°F)

Boiling point : -0.5°C (31.1°F)

Critical temperature : 151.85°C (305.3°F)

Flash point : Closed cup: -60°C (-76°F)

Evaporation rate : Not available.

Flammability (solid, gas) : Extremely flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and oxidizing materials.

Lower and upper explosive (flammable) limits : Lower: 1.8%
Upper: 8.4%

Vapor pressure : 16.3 (psig)

Vapor density : 2.1 (Air = 1)

Specific Volume (ft ^{3}/lb) : 6.435

Gas Density (lb/ft ^{3}) : 0.1554

Relative density : Not applicable.

Solubility : Not available.

Solubility in water : 0.06 g/l

Partition coefficient: n-octanol/water : 2.89

Auto-ignition temperature : 365°C (689°F)

Decomposition temperature : Not available.

Section 9. Physical and chemical properties

Viscosity : Not applicable.

Flow time (ISO 2431) : Not available.

Molecular weight : 58.14 g/mole

Aerosol product

Heat of combustion : -45384912 J/kg

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

Incompatible materials : Oxidizers

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
N-Butane	LC50 Inhalation Vapor	Rat	658000 mg/m³	4 hours

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Section 11. Toxicological information

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : As this product is a gas, refer to the inhalation section.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Section 12. Ecological information

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
N-Butane	2.89	-	low

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1011	UN1011	UN1011	UN1011	UN1011
UN proper shipping name	BUTANE	BUTANE	BUTANE	BUTANE	BUTANE
Transport hazard class(es)	2.1 	2.1 	2.1 	2.1 	2.1 
Packing group	-	-	-	-	-
Environmental hazards	No.	No.	No.	No.	No.

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Additional information

DOT Classification : **Limited quantity** Yes.
Quantity limitation Passenger aircraft/rail: Forbidden. Cargo aircraft: 150 kg.
Special provisions 19, T50

TDG Classification : Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.13-2.17 (Class 2).
Explosive Limit and Limited Quantity Index 0.125
ERAP Index 3000
Passenger Carrying Ship Index Forbidden
Passenger Carrying Road or Rail Index Forbidden
Special provisions 29

IATA : **Quantity limitation** Passenger and Cargo Aircraft: Forbidden. Cargo Aircraft Only: 150 kg.

Section 14. Transport information

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

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

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined

Clean Air Act (CAA) 112 regulated flammable substances: butane

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Refer to Section 2: Hazards Identification of this SDS for classification of substance.

State regulations

Massachusetts : This material is listed.

New York : This material is not listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol (Annexes A, B, C, E)

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Inventory list

Australia : This material is listed or exempted.

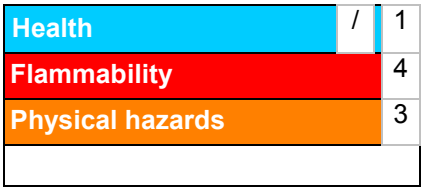
Canada : This material is listed or exempted.

Section 15. Regulatory information

China	:	This material is listed or exempted.
Europe	:	This material is listed or exempted.
Japan	:	**Japan inventory (ENCS)**: This material is listed or exempted. **Japan inventory (ISHL)**: This material is listed or exempted.
Malaysia	:	This material is listed or exempted.
New Zealand	:	This material is listed or exempted.
Philippines	:	This material is listed or exempted.
Republic of Korea	:	This material is listed or exempted.
Taiwan	:	This material is listed or exempted.
Thailand	:	Not determined.
Turkey	:	This material is listed or exempted.
United States	:	This material is listed or exempted.
Viet Nam	:	Not determined.

Section 16. Other information

Hazardous Material Information System (U.S.A.)



Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings and the associated label are not required on SDSs or products leaving a facility under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered trademark and service mark of the American Coatings Association, Inc.

The customer is responsible for determining the PPE code for this material. For more information on HMIS® Personal Protective Equipment (PPE) codes, consult the HMIS® Implementation Manual.

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



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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

Procedure used to derive the classification

Classification	Justification
FLAMMABLE GASES - Category 1 GASES UNDER PRESSURE - Liquefied gas	Expert judgment Expert judgment

History

Date of printing	:	1/6/2020
Date of issue/Date of revision	:	1/6/2020
Date of previous issue	:	10/5/2018

Section 16. Other information

Version : 2.01

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

References : Not available.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

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Cadmium dust (as Cd)

Synonyms & Trade Names Cadmium metal: Cadmium
Other synonyms vary depending upon the specific cadmium compound.

CAS No. 7440-43-9 (metal)	**RTECS No.** EU9800000 (metal) (/niosh-rtecs/EU958940.html)	**DOT ID & Guide** 2570 154 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=154) (http://www.cdc.gov/Other/disclaimer.html) (cadmium compound)
Formula Cd (metal)	**Conversion**	**IDLH** Ca [9 mg/m³ (as Cd)] See: 7440439 (/niosh/idlh/7440439.html)

Exposure Limits

NIOSH REL *: Ca See Appendix A (nengapdxa.html) [*Note: The REL applies to all Cadmium compounds (as Cd).]

OSHA PEL *: [1910.1027] TWA 0.005 mg/

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Cadı

Measurement Methods

NIOSH 7048 (/niosh/docs/2003-154/pdfs/7048.pdf), 7300 (/niosh/docs/2003-154/pdfs/7300.pdf), 7301 (/niosh/docs/2003-154/pdfs/7301.pdf), 7303 (/niosh/docs/2003-154/pdfs/7303.pdf), 9102 (/niosh/docs/2003-154/pdfs/9102.pdf)
.

tc/methods/inorganic/id121/id121.html) (http://www.cdc.gov/Other/disclaimer.html), ID125G (http://www.osha.gov/dts/sltc/methods/inorganic/id125g/id125g.html) (http://www.cdc.gov/Other/disclaimer.html), ID189 (http://www.osha.gov/dts/sltc/methods/inorganic/id189/id189.html) (http://www.cdc.gov/Other/disclaimer.html), ID206 (http://www.osha.gov/dts/sltc/methods/inorganic/id206/id206.html) (http://www.cdc.gov/Other/disclaimer.html)
See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Metal: Silver-white, blue-tinged lustrous, odorless solid.

MW:	BP:	MLT:	Sol:	VP:	IP:
112.4	1409°F	610°F	Insoluble	0 mmHg (approx)	NA

Sp.Gr:	Fl.P:	UEL:	LEL:
8.65 (metal)	NA	NA	NA

Metal: Noncombustible Solid in bulk form, but will burn in powder form.

Incompatibilities & Reactivities Strong oxidizers; elemental sulfur, selenium & tellurium

Exposure Routes inhalation, ingestion

Symptoms pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen]

Target Organs respiratory system, kidneys, prostate, blood

Cancer Site [prostatic & lung cancer]

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: No recommendation
Eyes: No recommendation
Wash skin: Daily
Remove: No recommendation
Change: Daily

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap wash
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations
(See Appendix E) (nengapdxe.html)

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0020 (/niosh/ipcsneng/neng0020.html) See MEDICAL TESTS: 0035 (/niosh/docs/2005-110/nmed0035.html)

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Chromium metal

Synonyms & Trade Names Chrome, Chromium

CAS No. 7440-47-3	**RTECS No.** GB4200000 (/niosh-rtecs/GB401640.html)	**DOT ID & Guide**
Formula Cr	**Conversion**	**IDLH** 250 mg/m3 (as Cr) See: 7440473 (/niosh/idlh/7440473.html)

Exposure Limits

NIOSH REL : TWA 0.5 mg/m3 See Appendix C (nengapdxc.html)
OSHA PEL *: TWA 1 mg/m3 See Appendix C (nengapdxc.html) [*Note: The PEL also applies to insoluble chromium salts.]

Measurement Methods

NIOSH 7024 (/niosh/docs/2003-154/pdfs/7024.pdf), 7300 (/niosh/docs/2003-154/pdfs/7300.pdf), 7301 (/niosh/docs/2003-154/pdfs/7301.pdf), 7303 (/niosh/docs/2003-154/pdfs/7303.pdf), 9102 (/niosh/docs/2003-154/pdfs/9102.pdf) ;
OSHA ID121 (http://www.osha.gov/dts/sltc/methods/inorganic/id121/id121.html) (http://www.cdc.gov/Other/disclaimer.html), ID125G (http://www.osha.gov/dts/sltc/methods/inorganic/id125g/id125g.html) (http://www.cdc.gov/Other/disclaimer.html)
See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Blue-white to steel-gray, lustrous, brittle, hard, odorless solid.

MW: 52.0	**BP:** 4788°F	MLT: 3452°F	**Sol:** Insoluble	**VP:** 0 mmHg (approx)	**IP:** NA
Sp.Gr: 7.14	**Fl.P:**	UEL: NA	LEL: NA		

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Non[illegible]idly if heated in a flame.

Incompatibilities & Reactivities Strong oxidizers (such as hydrogen peroxide), alkalis

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin; lung fibrosis (histologic)

Target Organs Eyes, skin, respiratory system

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: No recommendation
Eyes: No recommendation
Wash skin: No recommendation
Remove: No recommendation
Change: No recommendation

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap wash
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH

Up to 2.5 mg/m3:
(APF = 5) Any quarter-mask respirator.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.*

Up to 5 mg/m3:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.*
(APF = 10) Any supplied-air respirator*

Up to 12.5 mg/m3:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter.*

Up to 25 mg/m3:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 250 mg/m3:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0029 (/niosh/ipcsneng/neng0029.html)

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Chromium(III) compounds (as Cr)

Synonyms & Trade Names Synonyms vary depending upon the specific Chromium(III) compound. [Note: Chromium(III) compounds include soluble chromic salts.]

CAS No.	RTECS No.	DOT ID & Guide
	Conversion	IDLH 25 mg/m3 [as Cr(III)] See: cr3m3 (/niosh/idlh/cr3m3.html)

Exposure Limits

NIOSH REL : TWA 0.5 mg/m3 See Appendix C (nengapdxc.html)

OSHA PEL : TWA 0.5 mg/m3 See Appendix C (nengapdxc.html)

Measurement Methods

NIOSH 7024 (/niosh/docs/2003-154/pdfs/7024.pdf), 7300 (/niosh/docs/2003-154/pdfs/7300.pdf), 7301 (/niosh/docs/2003-154/pdfs/7301.pdf), 7303 (/niosh/docs/2003-154/pdfs/7303.pdf), 9102 (/niosh/docs/2003-154/pdfs/9102.pdf);

OSHA ID121 (http://www.osha.gov/dts/sltc/methods/inorganic/id121/id121.html) (http://www.cdc.gov/Other/disclaimer.html), ID125G (http://www.osha.gov/dts/sltc/methods/inorganic/id125g/id125g.html) (http://www.cdc.gov/Other/disclaimer.html)

See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Appearance and odor vary depending upon the specific compound.

Properties vary depending upon the specific compound.

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Incompatibilities & Reactivities Varies

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms irritation eyes; sensitization dermatitis

Target Organs Eyes, skin

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Water flush promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations
NIOSH/OSHA

Up to 2.5 mg/m3:
(APF = 5) Any quarter-mask respirator.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.*

Up to 5 mg/m3:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.*
(APF = 10) Any supplied-air respirator*

Up to 12.5 mg/m3:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter.*

Up to 25 mg/m3:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-

contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See MEDICAL TESTS: 0052 (/niosh/docs/2005-110/nmed0052.html)

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Coal tar pitch volatiles

Synonyms & Trade Names Synonyms vary depending upon the specific compound (e.g., pyrene, phenanthrene, acridine, chrysene, anthracene & benzo(a)pyrene). [Note: NIOSH considers coal tar, coal tar pitch, and creosote to be coal tar products.]

CAS No.	RTECS No.	DOT ID & Guide
65996-93-2	GF8655000 (/niosh-rtecs/GF841098.html)	2713 153 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=153) (http://www.cdc.gov/Other/disclaimer.html) (acridine)
	Conversion	**IDLH** Ca [80 mg/m3] See: 65996932 (/niosh/idlh/65996932.html)

Exposure Limits

NIOSH REL : Ca TWA 0.1 mg/m3 (cyclohexane-extractable fraction)
See Appendix A (nengapdxa.html)
See Appendix C (nengapdxc.html)

OSHA
(ben
[1910.1002] See Appendix C (nengapdxc.html)

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Measurement Methods
OSHA 58 (http://www.osha.gov/dts/sltc/methods/organic/org058/org058.html) (http://www.cdc.gov/Other/disclaimer.html)
See: NMAM (/niosh/docs/2003-154/) or OSHA Methods ethods/index.html) aimer.html)

Physical Description Black or dark-brown amorphous residue.

Properties vary depending upon the specific compound.					

Combustible Solids

Incompatibilities & Reactivities Strong oxidizers

Exposure Routes inhalation, skin and/or eye contact

Symptoms dermatitis, bronchitis, [potential occupational carcinogen]

Target Organs respiratory system, skin, bladder, kidneys

Cancer Site [lung, kidney & skin cancer]

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: No recommendation
Change: Daily

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap wash immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 1415 (/niosh/ipcsneng/neng1415.html) See MEDICAL TESTS: 0054 (/niosh/docs/2005-110/nmed0054.html)

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Safety Data Sheet

Coal, Bituminous

CAROLINA®
www.carolina.com

Section 1 Product Description

Product Name:	Coal, Bituminous
Recommended Use:	Science education applications
Synonyms:	Washed Coal, Clean Coal, Soft Coal
Distributor:	Carolina Biological Supply Company 2700 York Road, Burlington, NC 27215 1-800-227-1150
Chemical Information:	800-227-1150 (8am-5pm (ET) M-F)
Chemtrec:	800-424-9300 (Transportation Spill Response 24 hours)

Section 2 Hazard Identification

Classification of the chemical in accordance with paragraph (d) of §1910.1200;

WARNING



Causes eye irritation. May cause damage to organs through prolonged or repeated exposure.

GHS Classification:
Serious Eye Damage/Eye Irritation Category 2B, Specific Target Organ Systemic Toxicity (STOT) - Repeated Exposure Category 2

Section 3 Composition / Information on Ingredients

Chemical Name	CAS #	%
Coal, Bituminous	RR-14976-8	100

Section 4 First Aid Measures

Emergency and First Aid Procedures

Inhalation:	In case of accident by inhalation: remove casualty to fresh air and keep at rest.
Eyes:	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
Skin Contact:	After contact with skin, wash immediately with plenty of water.
Ingestion:	If swallowed, do not induce vomiting: seek medical advice immediately and show this container or label.

Section 5 Firefighting Procedures

Extinguishing Media:	Use dry chemical, CO2 or appropriate foam.
Fire Fighting Methods and Protection:	Firefighters should wear full protective equipment and NIOSH approved self-contained breathing apparatus.
Fire and/or Explosion Hazards:	Avoid Dusting. May become explosive when dispersed in air.
Hazardous Combustion Products:	Carbon dioxide, Carbon monoxide

Section 6 Spill or Leak Procedures

Steps to Take in Case Material Is Released or Spilled: Exposure to the spilled material may be irritating or harmful. Follow personal protective equipment recommendations found in Section 8 of this SDS. Additional precautions may be necessary based on special circumstances created by the spill including; the material spilled, the quantity of the spill, the area in which the spill occurred. Also consider the expertise of employees in the area responding to the spill. Avoid the generation of dusts during clean-up. Prevent the spread of any spill to minimize harm to human health and the environment if safe to do so. Wear complete and proper personal protective equipment following the recommendation of Section 8 at a minimum. Dike with suitable absorbent material like granulated clay. Gather and store in a sealed container pending a waste disposal evaluation. Avoid creating dusts. Eliminate ignition sources. If a vacuum is used, ensure that the material is wetted or otherwise treated so an explosive dust atmosphere is not created within the vacuum.

Section 7 Handling and Storage

Handling: Do not breathe dust/fume/gas/mist/vapors/spray. Wash thoroughly after handling. Keep away from sources of ignition - No smoking. Do not breathe dust.
Storage: Suitable for any general chemical storage.
Storage Code: Green - general chemical storage

Section 8 Protection Information

	ACGIH		OSHA PEL	
Chemical Name	**(TWA)**	**(STEL)**	**(TWA)**	**(STEL)**
No data available	N/A	N/A	N/A	N/A

Control Parameters
Engineering Measures: No exposure limits exist for the constituents of this product. General room ventilation might be required to maintain operator comfort under normal conditions of use.
Personal Protective Equipment (PPE): Lab coat, apron, eye wash, safety shower.
Respiratory Protection: No respiratory protection required under normal conditions of use.
Eye Protection: Wear chemical splash goggles when handling this product. Have an eye wash station available.
Skin Protection: Avoid skin contact by wearing chemically resistant gloves, an apron and other protective equipment depending upon conditions of use. Inspect gloves for chemical break-through and replace at regular intervals. Clean protective equipment regularly. Wash hands and other exposed areas with mild soap and water before eating, drinking, and when leaving work.
Gloves: No information available

Section 9 Physical Data

Formula: N/A
Molecular Weight: N/A
Appearance: Lumps
Odor: Mild
Odor Threshold: No data available
pH: No data available
Melting Point: 399 C
Boiling Point: No data available
Flash Point: 260 C
Flammable Limits in Air: N/A
Vapor Pressure: N/A
Evaporation Rate (BuAc=1): N/A
Vapor Density (Air=1): N/A
Specific Gravity: 1.2
Solubility in Water: Practically Insoluble
Log Pow (calculated): No data available
Autoignition Temperature: No data available
Decomposition Temperature: No data available
Viscosity: No data available
Percent Volatile by Volume: N/A

Section 10 Reactivity Data

Reactivity: Not generally reactive under normal conditions.
Chemical Stability: Stable under normal conditions.
Conditions to Avoid: Sparks, open flame, other ignition sources, and elevated temperatures.
Incompatible Materials: Strong oxidizing agents
Hazardous Polymerization: Will not occur

Section 11 Toxicity Data

Routes of Entry Inhalation.

Symptoms (Acute): Respiratory disorders
Delayed Effects: No data available

Acute Toxicity:

Chemical Name	CAS Number	Oral LD50	Dermal LD50	Inhalation LC50
No data available	RR-14976-8	Not determined	Not determined	Not determined

Carcinogenicity:

Chemical Name	CAS Number	IARC	NTP	OSHA
No data available	RR-14976-8	Not listed	Not listed	Not listed

Chronic Effects:
Mutagenicity: No evidence of a mutagenic effect.
Teratogenicity: No evidence of a teratogenic effect (birth defect).
Sensitization: No evidence of a sensitization effect.
Reproductive: No evidence of negative reproductive effects.
Target Organ Effects:
Acute: No information available
Chronic: Certain components or species of this product are considered potential carcinogens.

Section 12 Ecological Data

Overview: This material is not expected to be harmful to the ecology.
Mobility: No data
Persistence: No data
Bioaccumulation: No data
Degradability: No data
Other Adverse Effects: No data

Chemical Name	CAS Number	Eco Toxicity
N/A	RR-14976-8	

Section 13 Disposal Information

Disposal Methods: Dispose in accordance with all applicable Federal, State and Local regulations. Always contact a permitted waste disposer (TSD) to assure compliance.
Waste Disposal Code(s): Not Determined

Section 14 Transport Information

Ground - DOT Proper Shipping Name:
Not regulated for transport by DOT

Air - IATA Proper Shipping Name:
Not regulated for air transport by IATA.

Section 15 Regulatory Information

TSCA Status: A component (or components) of this product is not listed on the TSCA Inventory of Existing Chemical Substances. Product is for research and development use only.

Chemical Name	CAS Number	§ 313 Name	§ 304 RQ	CERCLA RQ	§ 302 TPQ	CAA 112(2) TQ
No data available	RR-14976-8	No	No	No	No	No

California Prop 65: No California Proposition 65 ingredients

Section 16 Additional Information

Safety Data Sheet

Revised: 08/21/2018 **Replaces: 06/15/2018** **Printed: 08-25-2018**

The information provided in this (Material) Safety Data Sheet represents a compilation of data drawn directly from various sources available to us. Carolina Biological Supply makes no representation or guarantee as to the suitability of this information to a particular application of the substance covered in the (Material) Safety Data Sheet.

Glossary

ACGIH	American Conference of Governmental Industrial Hygienists
CAS	Chemical Abstract Service Number
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOT	U.S. Department of Transportation
IARC	International Agency for Research on Cancer
N/A	Not Available
NTP	National Toxicology Program
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
ppm	Parts per million
RCRA	Resource Conservation and Recovery Act
SARA	Superfund Amendments and Reauthorization Act
TLV	Threshold Limit Value
TSCA	Toxic Substances Control Act
IDLH	Immediately dangerous to life and health

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People.™

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Enter search terms separated by spaces.

Copper (dusts and mists, as Cu)

Synonyms & Trade Names Copper metal dusts, Copper metal fumes

CAS No. 7440-50-8	RTECS No. GL5325000 (/niosh-rtecs/GL5140C8.html)	DOT ID & Guide
Formula Cu	**Conversion**	**IDLH** 100 mg/m3 (as Cu) See: 7440508 (/niosh/idlh/7440508.html)

Exposure Limits

NIOSH REL *: TWA 1 mg/m3 [*Note: The REL also applies to other copper compounds (as Cu) except Copper fume.]

OSHA PEL *: TWA 1 mg/m3 [*Note: The PEL also applies to other copper compounds (as Cu) except copper fume.]

Measurement Methods

NIOSH 7029 (/niosh/docs/2003-154/pdfs/7029.pdf), 7300 (/niosh/docs/2003-154/pdfs/7300.pdf), 7301 (/niosh/docs/2003-154/pdfs/7301.pdf), 7303 (/niosh/docs/2003-154/pdfs/7303.pdf), 9102 (/niosh/docs/2003-154/pdfs/9102.pdf) ;

OSHA ID121 (http://www.osha.gov/dts/sltc/methods/inorganic/id121/id121.html) (http://www.cdc.gov/Other/disclaimer.html), ID125G (http://www.osha.gov/dts/sltc/methods/inorganic/id125g/id125g.html) (http://www.cdc.gov/Other/disclaimer.html)

See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Reddish, lustrous, malleable, odorless solid.

MW: 63.5	BP: 4703°F	MLT: 1981°F	Sol: Insoluble	VP: 0 mmHg (approx)	IP: NA
Sp.Gr: 8.94	Fl.P: NA	UEL: NA	LEL: NA		

Noncombustible Solid in bulk form, but powdered form may ignite.

Incor lene

Endpoint Security by Bitdefender
This page is safe

Exposure Routes inhalation, inge and/or eye contact

Symptoms irritation eyes, nose, pharynx; nasal septum perforation; metallic taste; dermatitis; in animals: lung, liver, kidney damage; anemia

Target Organs Eyes, skin, respiratory system, liver, kidneys (increased risk with Wilson's disease)

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: Daily

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH/OSHA

Up to 5 mg/m3:
(APF = 5) Any quarter-mask respirator.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.*

Up to 10 mg/m3:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.*
(APF = 10) Any supplied-air respirator*

Up to 25 mg/m3:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter.*

Up to 50 mg/m3:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 100 mg/m3:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0240 (/niosh/ipcsneng/neng0240.html) See MEDICAL TESTS: 0057 (/niosh/docs/2005-110/nmed0057.html)

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Centers for Disease Control and Prevention 1600 Clifton Rd. Atlanta, GA 30333, USA
800-CDC-INFO (800-232-4636) TTY: (888) 232-6348 - Contact CDC–INFO

Section 1 - PRODUCT AND COMPANY IDENTIFICATION

Material Name
CREOSOTE - PETROLEUM PRESSURE TREATED WOOD

Product Use
Used for industrial wood products, specifically Railroad ties.

Restrictions on Use
Creosote treated wood is intended for exterior/outdoor uses and only those applications approved by the American Wood Protection Association (AWPA) Use Category System as set forth in the most current edition of the AWPA Book of Standards. Refer to preservative label for more details.

Details of the supplier of the safety data sheet

KOPPERS INC.
436 Seventh Avenue
Pittsburgh, PA 15219-1800
Mfg Contact: 412-227-2001 (SDS Requests: 866-852-5239)

CHEMTREC: 800-424-9300 (Outside USA: +1 703-527-3887)
Emergencies: (Medical in USA): 877-737-9047
Emergencies: (Medical Outside of USA): 651-632-9269
E-mail: naorgmsds@koppers.com

Section 2 - HAZARDS IDENTIFICATION

Classification in accordance with paragraph (d) of 29 CFR 1910.1200.
Combustible Dust
Acute Toxicity - Inhalation - Dust/Mist - Category 4
Skin Corrosion/Irritation - Category 2
Serious Eye Damage/Eye Irritation - Category 2A
Respiratory Sensitization - Category 1
Skin Sensitization - Category 1
Carcinogenicity - Category 1A
Specific target organ toxicity - Single exposure - Category 3 (respiratory system)

GHS Label Elements

Symbol(s)



Signal Word
Danger

Hazard Statement(s)
May form combustible dust concentrations in air (during handling or processing).
Harmful if inhaled.
Causes skin irritation.
Causes serious eye irritation.
May cause allergy or asthma symptoms or breathing difficulties if inhaled.

May cause an allergic skin reaction.
May cause cancer.
May cause respiratory irritation.

Precautionary Statement(s)

Prevention
Avoid breathing dust.
Wash thoroughly after handling.
Wear respiratory protection.
Contaminated work clothing should not be allowed out of the workplace.
Use only outdoors or in a well-ventilated area.
Wear protective gloves/clothing and eye/face protection.
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.

Response
IF exposed or concerned: Get medical advice/attention.
IF INHALED: Remove person to fresh air and keep comfortable for breathing.
Call a POISON CENTER or doctor/physician if you feel unwell.
If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician.
IF ON SKIN: Wash with plenty of soap and water.
If skin irritation or rash occurs: Get medical advice/attention.
Take off contaminated clothing and wash before reuse.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
If eye irritation persists: Get medical advice/attention.

Storage
Store in a well-ventilated place.
Store locked up.

Disposal
Dispose of contents/container in accordance with local/regional/national/international regulations.

Statement(s) of Unknown Acute Toxicity
Inhalation 84% of the mixture consists of ingredient(s) of unknown acute toxicity.

Other Hazards
None known.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

CAS	Component Name	Percent
Not Available	WOOD DUST, HARDWOODS	<85
8001-58-9	COAL TAR CREOSOTE	<13
64741-59-9	Petroleum distillates, light catalytic cracked	<3

Component Related Regulatory Information
This product may be regulated, have exposure limits or other information identified as the following: Wood dusts hard wood, Wood dusts (birch, mahogany, teak, walnut), Wood dusts (all other wood dusts), Wood dust, western red cedar, Wood dust, all soft and hard woods, Particulates not otherwise classified (PNOC), Creosotes, Aromatic hydrocarbons, polycyclic (130489-29-2).

Section 4 - FIRST AID MEASURES

Inhalation
If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

Skin
Take off contaminated clothing. Wash with plenty of soap and water. Thoroughly clean and dry contaminated clothing and shoes before reuse. Skin contact causes photosensitization which can last for 36-72 hours after exposure. Keep out of direct sunlight for the next two to three days to avoid sunburn to the photosensitized skin areas. Use a broad spectrum blockout cream to protect against UV alpha ray exposure. Get medical attention, if needed.

Eyes
DO NOT rub eyes. Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Then get immediate medical attention.

Ingestion
If swallowed, get medical attention.

Most Important Symptoms/Effects

Acute
harmful if inhaled, respiratory tract irritation, skin irritation, eye irritation, allergic reactions

Delayed
allergic reactions, nasal cancer, skin cancer

Indication of any immediate medical attention and special treatment needed
For inhalation, consider oxygen.

Section 5 - FIRE FIGHTING MEASURES

Extinguishing Media

Suitable Extinguishing Media
water stream, water spray or fog

Unsuitable Extinguishing Media
Do not scatter spilled material with high-pressure water streams.

Special Hazards Arising from the Chemical
Slight fire hazard. Avoid generating dust.

Hazardous Combustion Products
Oxides of carbon, oxides of nitrogen

Fire Fighting Measures
Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Keep unnecessary people away, isolate hazard area and deny entry.

Special Protective Equipment and Precautions for Firefighters
Wear full protective firefighting gear including self-contained breathing apparatus (SCBA) for protection against possible exposure.

Section 6 - ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures
Wear personal protective clothing and equipment, see Section 8. Avoid release to the environment. Collect spillage.

Methods and Materials for Containment and Cleaning Up

Collect material in appropriate container for disposal. Avoid dispersal of dust in the air (i.e., clearing dust surfaces with compressed air). Collect using a vacuum cleaner with a HEPA filter or wet and scoop up dry spills. Dust deposits should not be allowed to accumulate on surfaces, as these may form an explosive mixture if they are released into the atmosphere in sufficient concentration. Avoid sweeping spilled dry material. If sweeping of a contaminated area is necessary, use a dust suppressant agent. Eliminate all sources of ignition. Keep unnecessary people away, isolate hazard area and deny entry. Due to the concentration of Creosote and the CERCLA (40 CFR 302.4) reportable quantity of 1 pound, the release of 6 pounds of this product requires National Response Center notification.

Section 7 - HANDLING AND STORAGE

Precautions for Safe Handling

Avoid breathing dust. Wash thoroughly after handling. Wear respiratory protection. Contaminated work clothing should not be allowed out of the workplace. Do not eat, drink, or smoke when using this product. Use only outdoors or in a well-ventilated area. Wear protective gloves/clothing and eye/face protection. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Minimize dust generation and accumulation. Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces. Avoid significant deposits of material, especially on horizontal surfaces, which may become airborne and form combustible dust clouds and may contribute to secondary explosions. Dry wood dust material is defined as having a water content less than 25% by weight. Avoid frequent or prolonged inhalation of sawdust from treated wood. When sawing and machining treated wood, wear a dust mask. When power-sawing and machining, wear goggles to protect eyes from flying particles. Whenever possible, these operations should be performed outdoors to avoid indoor accumulations of airborne sawdust from treated wood. Avoid frequent or prolonged skin contact with creosote-treated wood; when handling the treated wood, wear long-sleeved shirts and long pants and use gloves impervious to the chemicals (for example, gloves that are vinyl-coated). Use protective skin cream on exposed skin before and during work shift. To reduce sun sensitivity a sun-blocking lotion can also be applied prior to application of a protective cream. After working with the wood, and before eating, drinking and use of tobacco products, wash exposed areas thoroughly. If oily preservative or sawdust accumulate on clothes, launder before reuse. Wash work clothes separately from other household clothing.

Conditions for Safe Storage, Including any Incompatibilities

Store in a well-ventilated place.
Store locked up.
Store and handle in accordance with all current regulations and standards. Avoid heat, flames, sparks and other sources of ignition. Keep container tightly closed.

Incompatible Materials

oxidizing materials, acids

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

In AFL-CIO v OSHA, 965 F. 2d 962 (11th Cir. 1992), the Court overturned OSHA's 1989 Air Contaminants Rule, including the specific PEL's for wood dust that OSHA had established at that time. The 1989 vacated PEL's were: 5 mg/m3 PEL-TWA and 10 mg/m3 STEL (15 min), all softwood and hardwood except Western Red Cedar. Wood dust is now regulated by OSHA as "Particulates Not Otherwise Regulated" (PNOR), which is also referred to as "nuisance dust". However, some states have incorporated the 1989 OSHA PEL's in their state plans. Additionally, OSHA indicated that it may cite employers under the OSHA general duty clause in appropriate circumstances for noncompliance with the 1989 PEL's. Creosote is a complex mixture of variable composition, and while no odor threshold for creosote has been established, work done at the University of California has measured the odor thresholds for one of the more volatile components in creosote and determined that the involved odor threshold is in the part per billion range, and well below applicable exposure limits. On the basis of these data the perception of creosote odor in and of itself should not be taken as an indication of exposure in excess of accepted exposure limits. Exposure to wood dust would not be expected under normal use conditions. If handling or use patterns associated with creosote treated wood involve the use of a power saw, sander, drill or any tool or activity resulting in the generation of airborne particulate the wood dust exposure limits should be observed and appropriate steps taken to minimize exposure.

Component Exposure Limits

WOOD DUST, HARDWOODS	**Not Available**
ACGIH:	1 mg/m3 TWA inhalable particulate matter (related to Wood dusts (all other wood dusts))
OSHA (US):	15 mg/m3 TWA total dust ; 5 mg/m3 TWA respirable fraction (related to Particulates not otherwise classified (PNOC))
	15 mppcf TWA respirable fraction ; 5 mg/m3 TWA respirable fraction ; 50 mppcf TWA total dust ; 15 mg/m3 TWA total dust (related to Particulates not otherwise classified (PNOC))
COAL TAR CREOSOTE	**8001-58-9**
ACGIH:	0.2 mg/m3 TWA as benzene-soluble aerosol (related to Pitch, coal tar, high-temperature)
OSHA (US):	0.2 mg/m3 TWA (benzene soluble fraction) (related to Pitch, coal tar, high-temperature)
Petroleum distillates, light catalytic cracked	**64741-59-9**
ACGIH:	0.2 mg/m3 TWA as benzene-soluble aerosol (related to Pitch, coal tar, high-temperature)
OSHA (US):	0.2 mg/m3 TWA (benzene soluble fraction) (related to Pitch, coal tar, high-temperature)

ACGIH - Threshold Limit Values - Biological Exposure Indices (BEI)

COAL TAR CREOSOTE (8001-58-9)

2.5 µg/l Medium: urine Time: end of shift at end of workweek Parameter: 1-Hydroxypyrene with hydrolysis (background); Medium: urine Time: end of shift at end of workweek Parameter: 3-Hydroxybenzo(a)pyrene with hydrolysis (nonquantitative) (related to Polycyclic aromatic hydrocarbons)

Petroleum distillates, light catalytic cracked (64741-59-9)

2.5 µg/l Medium: urine Time: end of shift at end of workweek Parameter: 1-Hydroxypyrene with hydrolysis (background); Medium: urine Time: end of shift at end of workweek Parameter: 3-Hydroxybenzo(a)pyrene with hydrolysis (nonquantitative) (related to Polycyclic aromatic hydrocarbons)

Engineering Controls

Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Provide local exhaust or process enclosure ventilation system. Ensure that dust-handling systems (such as exhaust ducts, dust collectors, vessels, and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e., there is no leakage from the equipment). Ensure compliance with applicable exposure limits.

Individual Protection Measures, such as Personal Protective Equipment

Eye/face protection

ANSI Z87.1-1989 approved safety glasses with side shields.

Skin Protection

Wear tightly woven long-sleeved shirts and long pants. Remove and launder contaminated clothing separately from other laundry before reuse.

Respiratory Protection
Any air-purifying respirator with a high-efficiency particulate filter.

Glove Recommendations
Individuals must wear gloves impervious to the wood treatment formulations in all situations where dermal contact with creosote is expected.

Protective Materials
Examples of impervious materials for protective clothing (e.g. overalls, jackets, gloves and boots) required during application and handling of creosote are polyvinyl acetate (PVA), polyvinyl chloride (PVC), Neoprene and NBR (Buna-N). Protective clothing must be changed when it shows signs of contamination.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance	dark brown to black solid	**Physical State**	solid
Odor	tar odor	**Color**	dark , brown to black
Odor Threshold	Not available	**pH**	Not applicable
Melting Point	Not applicable	**Boiling Point**	Not applicable
Boiling Point Range	Not available	**Freezing point**	Not applicable
Evaporation Rate	Not applicable	**Flammability (solid, gas)**	Not flammable
Autoignition Temperature	Not available	**Flash Point**	Not applicable
Lower Explosive Limit	Not available	**Decomposition temperature**	Not available
Upper Explosive Limit	Not available	**Vapor Pressure**	Not applicable
Vapor Density (air=1)	Not applicable	**Specific Gravity (water=1)**	Not available
Water Solubility	Not available	**Partition coefficient: n-octanol/water**	Not available
Viscosity	Not applicable	**Kinematic viscosity**	Not available
Solubility (Other)	Not available	**Density**	Not available
Physical Form	Pressure crossties – treated at a retention level of 6 lbs/ft3, with a wood density of 45-55 lbs/ft3 , Actual	**Molecular Weight**	Not available

	retention level dependent on wood stock, moisture levels, and customer specifications		

Other Information
No additional information is available.

Section 10 - STABILITY AND REACTIVITY

Reactivity
No reactivity hazard is expected.

Chemical Stability
Stable at normal temperatures and pressure.

Possibility of Hazardous Reactions
Will not polymerize.

Conditions to Avoid
Avoid heat, flames, sparks and other sources of ignition. Avoid accumulation of airborne dusts. Avoid contact with incompatible materials.

Incompatible Materials
oxidizing materials, Acids

Hazardous decomposition products
oxides of carbon, oxides of nitrogen

Section 11 - TOXICOLOGICAL INFORMATION

Information on Likely Routes of Exposure

Inhalation
irritation, allergic reactions, nasal cancer

Skin Contact
irritation, allergic reactions, skin cancer

Eye Contact
irritation

Ingestion
gastrointestinal irritation, bloating

Acute and Chronic Toxicity

Component Analysis - LD50/LC50
The components of this material have been reviewed in various sources and the following selected endpoints are published:
COAL TAR CREOSOTE (8001-58-9)
Oral LD50 Rat 2197 mg/kg
Dermal Rabbit >2000 mg/kg LD50
Inhalation Rat >5 mg/L 4 hr LC50
Petroleum distillates, light catalytic cracked (64741-59-9)
Oral LD50 Rat 6790 - 7180 mg/kg
Dermal LD50 Rabbit >2000 mg/kg (no deaths occurred)
Inhalation LC50 Rat 5.4 g/L 4 h

Product Toxicity Data

Acute Toxicity Estimate

Dermal	>2000 mg/kg
Inhalation - Dust and Mist	4.67 mg/L
Oral	>2000 mg/kg

Immediate Effects
harmful if inhaled, respiratory tract irritation, skin irritation, eye irritation, allergic reactions

Delayed Effects
allergic reactions, nasal cancer, skin cancer

Irritation/Corrosivity Data
No data available.

Respiratory Sensitization
Component data indicate the substance is sensitizing.

Dermal Sensitization
Component data indicate the substance is sensitizing.

Component Carcinogenicity

WOOD DUST, HARDWOODS	**Not Available**
ACGIH:	A1 - Confirmed Human Carcinogen (related to Wood dusts-hard wood)
IARC:	Monograph 100C [2012] ; Monograph 62 [1995] (related to Wood dust, all soft and hard woods) (Group 1 (carcinogenic to humans))
NTP:	Known Human Carcinogen (related to Wood dust, all soft and hard woods)
NIOSH:	potential occupational carcinogen (related to Wood dust, all soft and hard woods)
COAL TAR CREOSOTE	**8001-58-9**
ACGIH:	A1 - Confirmed Human Carcinogen (related to Pitch, coal tar, high-temperature)
IARC:	Monograph 100F [2012] ; Supplement 7 [1987] ; Monograph 35 [1985] (related to Pitch, coal tar, high-temperature) (Group 1 (carcinogenic to humans))
IARC:	Monograph 92 [2010] ; Supplement 7 [1987] ; Monograph 35 [1985] (Group 2A (probably carcinogenic to humans))
NTP:	Known Human Carcinogen (related to Pitch, coal tar, high-temperature)
NIOSH:	potential occupational carcinogen
Petroleum distillates, light catalytic cracked	**64741-59-9**

ACGIH:	A1 - Confirmed Human Carcinogen (related to Pitch, coal tar, high-temperature)
IARC:	Monograph 100F [2012] ; Supplement 7 [1987] ; Monograph 35 [1985] (related to Pitch, coal tar, high-temperature) (Group 1 (carcinogenic to humans))
NTP:	Known Human Carcinogen (related to Pitch, coal tar, high-temperature)
NIOSH:	potential occupational carcinogen (related to Pitch, coal tar, high-temperature)

Germ Cell Mutagenicity
No data available.

Tumorigenic Data
No data available

Reproductive Toxicity
No data available.

Specific Target Organ Toxicity - Single Exposure
respiratory system

Specific Target Organ Toxicity - Repeated Exposure
No data available.

Aspiration hazard
No data available.

Medical Conditions Aggravated by Exposure
respiratory disorders, skin disorders and allergies

Additional Data
COAL TAR CREOSOTE: This product contains coal tar creosote. Volume 35 of the IARC monograph states that there is limited evidence that coal tar derived creosotes are carcinogenic in humans and sufficient evidence for the carcinogenicity of creosote in experimental animals. Limitations in the human exposure studies reviewed by IARC (including the presence of other chemicals, small study populations and not well documented exposure levels) contributed to IARC's conclusions regarding human exposure to creosote. When applied to the skin of mice in experimental studies, creosote produced skin tumors and in one study produced lung tumors. Most available information on the effects of coal tar creosote in humans comes from older occupational studies in the wood-preserving and construction industries. Today, with the use of engineering controls and personal protective equipment, occupational exposure to creosote components is expected to be below permissible exposure limits (measured as Coal Tar Pitch Volatiles). Wood dust is particles of varying size produced from processing or handling wood. Cancer of the nasal cavities and sinuses is associated with exposure to hardwood dust. IARC concluded that there were too few studies to evaluate cancer risks attributable to exposure to softwood alone and to any particular species of wood. In view of the overall lack of consistent findings, IARC also concluded that there is no indication that occupational exposure to wood dust has a causal role in cancers of the throat, lung, lymphatic and blood systems, stomach, colon or rectum. PETROLEUM DISTILLATES, LIGHT CATALYTIC CRACKED: High incidences of benign and malignant skin tumors have been reported in mouse skin application testing and IARC reports there is sufficient evidence for the carcinogencity in animals of light catalytically cracked distillates. IARC determined there is sufficient evidence for carcinogenicity in experimental animals of light and heavy vacuum distillates, of light and heavy catalytically cracked distillates and of cracked residues (including heavy thermocracked distillates/residues) from the refining of crude oil. Different woods produce different health effects and there is evidence that wood from different trees of the same species can produce varying health effects. Woods other than Western Red Cedar (WRC) seem unlikely to be responsible for large numbers of cases of respiratory

allergies. Other common wood dusts produce asthma/pulmonary effects that are less well described than the responses to WRC. These other wood species (e.g., oak and pine) are considered somewhat allergenic.

Section 12 - ECOLOGICAL INFORMATION

Component Analysis - Aquatic Toxicity

COAL TAR CREOSOTE	**8001-58-9**
Fish:	LC50 96 h Brachydanio rerio 2.6 - 6.6 mg/L [static]; LC50 96 h Oncorhynchus mykiss 0.57 mg/L [static]
Invertebrate:	EC50 48 h Daphnia magna 1.04 mg/L IUCLID ; EC50 48 h Daphnia magna 0.065 - 0.082 mg/L [Static] EPA
Petroleum distillates, light catalytic cracked	**64741-59-9**
Fish:	LC50 96 h Brachydanio rerio 7.3 mg/L [semi-static]

Persistence and Degradability
No information available for the product.

Bioaccumulative Potential
No information available for the product.

Mobility
No information available for the product.

Other Toxicity
No data available.

Section 13 - DISPOSAL CONSIDERATIONS

Disposal Methods
Dispose in accordance with all applicable regulations. Treated wood should not be burned in open fires or in stoves, fireplaces or residential boilers, because toxic chemicals may be produced as part of the smoke and ashes. Treated wood from commercial or industrial use (e.g., construction sites) may be burned only in commercial or industrial incinerators or boilers in accordance with state and federal regulations. For more information please see Koppers Consumer Information Sheet for this product. RCRA Waste Number U051 – applies only to creosote in liquid form.

Component Waste Numbers
The U.S. EPA has not published waste numbers for this product's components.

Section 14 - TRANSPORT INFORMATION

US DOT Information:
Further information: No classification assigned

IATA Information:
Further information: No classification assigned

TDG Information:
Further information: No classification assigned

International Bulk Chemical Code
This material contains one or more of the following chemicals required by the IBC Code to be identified as dangerous chemicals in bulk.

COAL TAR CREOSOTE	**8001-58-9**
IBC Code:	Category X (coal tar)
Petroleum distillates, light catalytic cracked	**64741-59-9**
IBC Code:	Category X (related to Polycyclic aromatic hydrocarbons)

Further information

Component Marine Pollutants This material does not contain any chemicals listed on the Hazardous Materials Table required by US DOT to be identified as a marine pollutant.

Section 15 - REGULATORY INFORMATION

U.S. Federal Regulations

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65), CERCLA (40 CFR 302.4), TSCA 12(b), and/or require an OSHA process safety plan.

COAL TAR CREOSOTE	**8001-58-9**
SARA 313:	0.1 % de minimis concentration
CERCLA:	1 lb final RQ ; 0.454 kg final RQ

SARA Section 311/312 (40 CFR 370 Subparts B and C) reporting categories

Combustible Dust; Carcinogenicity; Skin Corrosion/Irritation; Respiratory/Skin Sensitization; Serious Eye Damage/Eye Irritation; Specific Target Organ Toxicity

U.S. State Regulations

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA
WOOD DUST, HARDWOODS	**Not Available**	No	No	Yes	Yes	Yes
COAL TAR CREOSOTE	**8001-58-9**	Yes	Yes	Yes	Yes	Yes
Petroleum distillates, light catalytic cracked	**64741-59-9**	Yes	Yes	Yes	Yes	Yes

California Safe Drinking Water and Toxic Enforcement Act (Proposition 65)



WARNING

This product can expose you to chemicals including WOOD DUST, HARDWOODS, COAL TAR CREOSOTE , which are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Canada Regulations

Canadian WHMIS Ingredient Disclosure List (IDL)

Components of this material have been checked against the Canadian WHMIS Ingredients Disclosure List. The List is composed of chemicals which must be identified on MSDSs if they are included in products which meet WHMIS criteria specified in the Controlled Products Regulations and are present above the threshold limits listed on the IDL

COAL TAR CREOSOTE	**8001-58-9**
	0.1 % (related to Pitch, coal tar, high-temperature)
Petroleum distillates, light catalytic cracked	**64741-59-9**
	0.1 % (related to Pitch, coal tar, high-temperature)

WHMIS Classification
D2A , D2B

Component Analysis - Inventory
WOOD DUST, HARDWOODS (Not Available)

US	CA	EU	AU	PH	JP - ENCS	JP - ISHL	KR KECI - Annex 1	KR KECI - Annex 2	KR - REACH CCA	CN	NZ	MX	TW	VN (Draft)
No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

COAL TAR CREOSOTE (8001-58-9)

US	CA	EU	AU	PH	JP - ENCS	JP - ISHL	KR KECI - Annex 1	KR KECI - Annex 2	KR - REACH CCA	CN	NZ	MX	TW	VN (Draft)
Yes	DSL	EIN	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	No

Petroleum distillates, light catalytic cracked (64741-59-9)

US	CA	EU	AU	PH	JP - ENCS	JP - ISHL	KR KECI - Annex 1	KR KECI - Annex 2	KR - REACH CCA	CN	NZ	MX	TW	VN (Draft)
Yes	DSL	EIN	Yes	Yes	No	No	Yes	No	No	Yes	No	Yes	Yes	Yes

U.S. Inventory (TSCA)
This product is exempt.

Section 16 - OTHER INFORMATION

Further information
This wood product contains a pesticide product registered by the United States Environmental Protection Agency and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the

classification criteria and hazard information required for safety data sheets, and for workplace labels of non-pesticide chemicals. The pesticide label also includes other important information, including directions for use.

NFPA Ratings

Health: 2 Fire: 1 Reactivity: 0
Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

Summary of Changes

Updated: 7/20/2018; MSDS SUMMARY OF CHANGES: SECTION 15 - CA Proposition 65

Key / Legend

ACGIH - American Conference of Governmental Industrial Hygienists; ADR - European Road Transport; AU - Australia; BOD - Biochemical Oxygen Demand; C - Celsius; CA - Canada; CA/MA/MN/NJ/PA - California/Massachusetts/Minnesota/New Jersey/Pennsylvania*; CAS - Chemical Abstracts Service; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CFR - Code of Federal Regulations (US); CLP - Classification, Labelling, and Packaging; CN - China; CPR - Controlled Products Regulations; DFG - Deutsche Forschungsgemeinschaft; DOT - Department of Transportation; DSD - Dangerous Substance Directive; DSL - Domestic Substances List; EC – European Commission; EEC - European Economic Community; EIN - European Inventory of (Existing Commercial Chemical Substances); EINECS - European Inventory of Existing Commercial Chemical Substances; ENCS - Japan Existing and New Chemical Substance Inventory; EPA - Environmental Protection Agency; EU - European Union; F - Fahrenheit; F - Background (for Venezuela Biological Exposure Indices); IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; ICAO - International Civil Aviation Organization; IDL - Ingredient Disclosure List; IDLH - Immediately Dangerous to Life and Health; IMDG - International Maritime Dangerous Goods; ISHL - Japan Industrial Safety and Health Law; IUCLID - International Uniform Chemical Information Database; JP - Japan; Kow - Octanol/water partition coefficient; KR KECI Annex 1 - Korea Existing Chemicals Inventory (KECI) / Korea Existing Chemicals List (KECL); KR KECI Annex 2 - Korea Existing Chemicals Inventory (KECI) / Korea Existing Chemicals List (KECL) , KR - Korea; LD50/LC50 - Lethal Dose/ Lethal Concentration; LEL - Lower Explosive Limit; LLV - Level Limit Value; LOLI - List Of LIsts™ - ChemADVISOR's Regulatory Database; MAK - Maximum Concentration Value in the Workplace; MEL - Maximum Exposure Limits; MX – Mexico; Ne- Non-specific; NFPA - National Fire Protection Agency; NIOSH - National Institute for Occupational Safety and Health; NJTSR - New Jersey Trade Secret Registry; Nq - Non-quantitative; NSL – Non-Domestic Substance List (Canada); NTP - National Toxicology Program; NZ - New Zealand; OSHA - Occupational Safety and Health Administration; PEL- Permissible Exposure Limit; PH - Philippines; RCRA - Resource Conservation and Recovery Act; REACH- Registration, Evaluation, Authorisation, and restriction of Chemicals; RID - European Rail Transport; SARA - Superfund Amendments and Reauthorization Act; Sc - Semi-quantitative; STEL - Short-term Exposure Limit; TCCA – Korea Toxic Chemicals Control Act; TDG - Transportation of Dangerous Goods; TLV - Threshold Limit Value; TSCA - Toxic Substances Control Act; TW – Taiwan; TWA - Time Weighted Average; UEL - Upper Explosive Limit; UN/NA - United Nations /North American; US - United States; VLE - Exposure Limit Value (Mexico); VN (Draft) - Vietnam (Draft); WHMIS - Workplace Hazardous Materials Information System (Canada).

Other Information

Disclaimer:

The information set forth in this Safety Data Sheet does not purport to be all-inclusive and should be used only as a guide. While the information and recommendations set forth herein are believed to be accurate, the company makes no warranty regarding such information and recommendations and disclaims all liability from reliance thereon.

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SEARCH

Enter search terms separated by spaces.

Ethyl benzene

Synonyms & Trade Names Ethylbenzol, Phenylethane

CAS No. 100-41-4	**RTECS No.** DA0700000 (/niosh-rtecs/DAAAE60.html)	**DOT ID & Guide** 1175 130 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=130) (http://www.cdc.gov/Other/disclaimer.html)
Formula $CH_3CH_2C_6H_5$	**Conversion** 1 ppm = 4.34 mg/m³	**IDLH** 800 ppm [10%LEL] See: 100414 (/niosh/idlh/100414.html)

Exposure Limits

NIOSH REL : TWA 100 ppm (435 mg/m³) ST 125 ppm (545 mg/m³)

OSHA PEL † (nengapdxg.html) : TWA 100 ppm (435 mg/m³)

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Measurement Methods

NIOSH 1501 (/niosh/docs/2003-154/pdfs/1501.pdf) ;
OSHA 7 (http://www.osha.gov/dts/sltc/methods/organic/org001/org001.html) (http://www.cdc.gov/Other/disclaimer.html) , 1002 (dts/sltc/methods/mdt/mdt1002/1002.html) (ther/disclaimer.html)
See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Colorless liquid with an aromatic odor.

MW:	BP:	FRZ:	Sol:	VP:	IP:
106.2	277°F	-139°F	0.01%	7 mmHg	8.76 eV

Sp.Gr:	Fl.P:	UEL:	LEL:
0.87	55°F	6.7%	0.8%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities Strong oxidizers

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma

Target Organs Eyes, skin, respiratory system, central nervous system

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Water flush promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH/OSHA

Up to 800 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0268 (/niosh/ipcsneng/neng0268.html) See MEDICAL TESTS: 0098 (/niosh/docs/2005-110/nmed0098.html)

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SEARCH

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Lead

Synonyms & Trade Names Lead metal, Plumbum

CAS No.	RTECS No.	DOT ID & Guide
7439-92-1	OF7525000 (/niosh-rtecs/OF72D288.html)	

Formula	Conversion	IDLH
Pb		100 mg/m3 (as Pb) See: 7439921 (/niosh/idlh/7439921.html)

Exposure Limits

NIOSH REL *: TWA (8-hour) 0.050 mg/m3 See Appendix C (nengapdxc.html) [*Note: The REL also applies to other lead compounds (as Pb) -- see Appendix C.]

OSHA PEL *: [1910.1025] TWA 0.050 mg/m3 See Appendix C (nengapdxc.html) [*Note: The PEL also applies to other lead compounds (as Pb) -- see Appendix C.]

Measurement Methods

NIOSH 7082 (/niosh/docs/2003-154/pdfs/7082.pdf), 7105 (/niosh/docs/2003-154/pdfs/7105.pdf), 7300 (/niosh/docs/2003-154/pdfs/7300.pdf), 7301 (/niosh/docs/2003-154/pdfs/7301.pdf), 7303 (/niosh/docs/2003-154/pdfs/7303.pdf), 7700 (/niosh/docs/2003-154/pdfs/7700.pdf), 7701 (/niosh/docs/2003-154/pdfs/7701.pdf), 7702 (/niosh/docs/2003-154/pdfs/7702.pdf), 9100 (/niosh/docs/2003-154/pdfs/9100.pdf), 9102 (/niosh/docs/2003-154/pdfs/9102.pdf), 9105 (/niosh/docs/2003-154/pdfs/9105.pdf);
OSHA ID121 (http://www.osha.gov/dts/sltc/methods/inorganic/id121/id121.html) (http://www.cdc.gov/Other/disclaimer.html), ID125G (http://www.osha.gov/dts/sltc/methods/inorganic/id125g/id125g.html) (http://www.cdc.gov/Other/disclaimer.html), ID206 (http://www.osha.gov/dts/sltc/methods/inorganic/id206/id206.html) (http://www.cdc.gov/Other/disclaimer.html)
See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description A heavy, ductile, soft, gray solid.

MW:	BP:	MLT:	Sol:	VP:	IP:
207.2	3164°F	621°F	Insoluble	0 mmHg (approx)	NA

Sp.Gr:	Fl.P:	UEL:	LEL:
11.3			NA

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Nonc[illegible]

Incompatibilities & Reactivities Strong oxidizers, hydrogen peroxide, acids

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension

Target Organs Eyes, gastrointestinal tract, central nervous system, kidneys, blood, gingival tissue

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: When wet or contaminated
Change: Daily

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap flush promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations
(See Appendix E) (nengapdxe.html)
NIOSH/OSHA

Up to 0.5 mg/m3:
(APF = 10) Any air-purifying respirator with an N100, R100, or P100 filter (including N100, R100, and P100 filtering facepieces) except quarter-mask respirators.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 1.25 mg/m3:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter.

Up to 2.5 mg/m3:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 50 mg/m3:
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Up to 100 mg/m3:
(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
Any appropriate escape-type, self-contained breathing apparatus

any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0052 (/niosh/ipcsneng/neng0052.html) See MEDICAL TESTS: 0127 (/niosh/docs/2005-110/nmed0127.html)

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SAFETY DATA SHEET

Version 5.4
Revision Date 06/29/2014
Print Date 12/11/2014

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	:	$C_{10}H_8$
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
Naphthalene		
	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

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

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) Lower explosion limit: 0.9 %(V)
k)	Vapour pressure	1.3 hPa (1.0 mmHg) at 53.0 °C (127.4 °F) 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

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/m3
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

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

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Nickel metal and other compounds (as Ni)

Synonyms & Trade Names **Nickel metal:** Elemental nickel, Nickel catalyst
Synonyms of other nickel compounds vary depending upon the specific compound.

CAS No. 7440-02-0 (Metal)	RTECS No. QR5950000 (Metal) (/niosh-rtecs/QR5ACA30.html)	DOT ID & Guide
Formula Ni (Metal)	Conversion	IDLH Ca [10 mg/m³ (as Ni)] See: 7440020 (/niosh/idlh/7440020.html)

Exposure Limits

NIOSH REL *: Ca TWA 0.015 mg/m³ See Appendix A (nengapdxa.html) [*Note: The REL does not apply to Nickel carbonyl.]

OSHA PEL *† (nengapdxg.html): TWA 1 mg/m3 [*Note: The PEL does not apply to N

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Measurement Methods

NIOSH 7300 (/niosh/docs/2003-154/pdfs/7300.pdf), 7301 (/niosh/docs/2003-154/pdfs/7301.pdf), 7303 (/niosh/docs/2003-154/pdfs/7303.pdf), 9102 (/niosh/docs/2003-154/pdfs/9102.pdf) ;

OSHA ID121 ltc/methods/inorganic/id121/id121.html) er/disclaimer.html), ID125G (http://www.osha.gov/dts/sltc/methods/inorganic/id125g/id125g.html) (http://www.cdc.gov/Other/disclaimer.html)

See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Metal: Lustrous, silvery, odorless solid.

MW: 58.7	BP: 5139°F	MLT: 2831°F	Sol: Insoluble	VP: 0 mmHg (approx)	IP: NA
Sp.Gr: 8.90 (Metal)	Fl.P: NA	UEL: NA	LEL: NA		

Metal: Combustible Solid; nickel sponge catalyst may ignite SPONTANEOUSLY in air.

Incompatibilities & Reactivities Strong acids, sulfur, selenium, wood & other combustibles, nickel nitrate

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]

Target Organs Nasal cavities, lungs, skin

Cancer Site [lung and nasal cancer]

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: No recommendation
Wash skin: When contaminated/Daily
Remove: When wet or contaminated
Change: Daily

First Aid (See procedures (firstaid.html))

Skin: Water flush immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0062 (/niosh/ipcsneng/neng0062.html) See MEDICAL TESTS: 0156 (/niosh/docs/2005-110/nmed0156.html)

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Phenol

Synonyms & Trade Names Carbolic acid, Hydroxybenzene, Monohydroxybenzene, Phenyl alcohol, Phenyl hydroxide

CAS No. 108-95-2	**RTECS No.** SJ3325000 (/niosh-rtecs/SJ32BC48.html)	**DOT ID & Guide** 1671 153 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=153) (http://www.cdc.gov/Other/disclaimer.html) (solid) 2312 153 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=153) (http://www.cdc.gov/Other/disclaimer.html) (molten) 2821 153 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=153) (http://www.cdc.gov/Other/disclaimer.html) (solution)
Formula C_6H_5OH	**Conversion** 1 ppm = 3.85 mg/m3	**IDLH** 250 ppm See: 108952 (/niosh/idlh/108952.html)
Exposure Limits **NIOSH REL** : TWA 5 ppm (19 mg/m3) C 15.6 ppm (60 mg/m3) [15-minute] [skin] **OSHA PEL** : TWA 5 ppm (19 mg/m3) [skin]		**Measurement Methods** **NIOSH** 2546 (/niosh/docs/2003-154/pdfs/2546.pdf); **OSHA** 32 See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Colorless to light-pink, crystalline solid with a sweet, acrid odor. [Note: Phenol liquefies by mixing with about 8% water.]

MW: 94.1	**BP:** 359°F	MLT: 109°F	Sol(77°F): 9%	**VP:** 0.4 mmHg	**IP:** 8.50 eV
Sp.Gr: 1.06	**Fl.P:** 175°F	**UEL:** 8.6%	**LEL:** 1.8%		

Combustible Solid

Incor , aluminum chloride, acids

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Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, nose, throat; anorexia, weight loss; lassitude (weakness, exhaustion), muscle ache, pain; dark urine; cyanosis; liver, kidney damage; skin burns; dermatitis; ochronosis; tremor, convulsions, twitching

Target Organs Eyes, skin, respiratory system, liver, kidneys

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: Daily
Provide: Eyewash, Quick drench

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap wash immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH/OSHA

Up to 50 ppm:
(APF = 10) Any air-purifying half-mask respirator with organic vapor cartridge(s) in combination with an N95, R95, or P95 filter. The following filters may also be used: N99, R99, P99, N100, R100, P100.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 125 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with an organic vapor cartridge in combination with a high-efficiency particulate filter.

Up to 250 ppm:
(APF = 50) Any air-purifying full-facepiece respirator equipped with organic vapor cartridge(s) in combination with an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0070 (/niosh/ipcsneng/neng0070.html) See MEDICAL TESTS: 0182 (/niosh/docs/2005-110/nmed0182.html)

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SAFETY DATA SHEET

Propane

Section 1. Identification

GHS product identifier : Propane

Chemical name : propane

Other means of identification : Propyl hydride; n-Propane; Dimethyl methane; Bottled gas; propane in gaseous state; propane liquefied, n-Propane; Dimethylmethane; Freon 290; Liquefied petroleum gas; Lpg; Propyl hydride; R 290; C3H8; UN 1075; UN 1978; A-108; Hydrocarbon propellant.

Product type : Liquefied gas

Product use : Synthetic/Analytical chemistry.

Synonym : Propyl hydride; n-Propane; Dimethyl methane; Bottled gas; propane in gaseous state; propane liquefied, n-Propane; Dimethylmethane; Freon 290; Liquefied petroleum gas; Lpg; Propyl hydride; R 290; C3H8; UN 1075; UN 1978; A-108; Hydrocarbon propellant.

SDS # : 001045

Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

24-hour telephone : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : FLAMMABLE GASES - Category 1
GASES UNDER PRESSURE - Liquefied gas

GHS label elements

Hazard pictograms :



Signal word : Danger

Hazard statements : Extremely flammable gas.
May form explosive mixtures with air.
Contains gas under pressure; may explode if heated.
May cause frostbite.
May displace oxygen and cause rapid suffocation.

Precautionary statements

General : Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction. Always keep container in upright position. Approach suspected leak area with caution.

Prevention : Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

Response : Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so.

Storage : Protect from sunlight. Store in a well-ventilated place.

Section 2. Hazards identification

Disposal : Not applicable.

Hazards not otherwise classified : Liquid can cause burns similar to frostbite.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : propane

Other means of identification : Propyl hydride; n-Propane; Dimethyl methane; Bottled gas; propane in gaseous state; propane liquefied, n-Propane; Dimethylmethane; Freon 290; Liquefied petroleum gas; Lpg; Propyl hydride; R 290; C3H8; UN 1075; UN 1978; A-108; Hydrocarbon propellant.

Product code : 001045

CAS number/other identifiers

CAS number : 74-98-6

Ingredient name	%	CAS number
Propane	100	74-98-6

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Skin contact : Wash contaminated skin with soap and water. Remove contaminated clothing and shoes. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Get medical attention if symptoms occur. In case of contact with liquid, warm frozen tissues slowly with lukewarm water and get medical attention. Do not rub affected area. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if adverse health effects persist or are severe. Ingestion of liquid can cause burns similar to frostbite. If frostbite occurs, get medical attention. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. As this product rapidly becomes a gas when released, refer to the inhalation section.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Liquid can cause burns similar to frostbite.

Inhalation : No known significant effects or critical hazards.

Skin contact : Dermal contact with rapidly evaporating liquid could result in freezing of the tissues or frostbite.

Section 4. First aid measures

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Ingestion : Ingestion of liquid can cause burns similar to frostbite.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:, frostbite

Inhalation : No specific data.

Skin contact : Adverse symptoms may include the following:, frostbite

Ingestion : Adverse symptoms may include the following:, frostbite

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : Contains gas under pressure. Extremely flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapor/gas is heavier than air and will spread along the ground. Gas may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back, causing fire or explosion.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool. If involved in fire, shut off flow immediately if it can be done without risk. If this is impossible, withdraw from area and allow fire to burn. Fight fire from protected location or maximum possible distance. Eliminate all ignition sources if safe to do so.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode. For incidents involving large quantities, thermally insulated undergarments and thick textile or leather gloves should be worn.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : Accidental releases pose a serious fire or explosion hazard. No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

Section 6. Accidental release measures

For emergency responders : If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment.

Large spill : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Do not get in eyes or on skin or clothing. Avoid breathing gas. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

Use only non-sparking tools. Empty containers retain product residue and can be hazardous. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F). Keep container tightly closed and sealed until ready for use. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Propane	**NIOSH REL (United States, 10/2016).** TWA: 1800 mg/m³ 10 hours. TWA: 1000 ppm 10 hours. **OSHA PEL (United States, 6/2016).** TWA: 1800 mg/m³ 8 hours. TWA: 1000 ppm 8 hours. **OSHA PEL 1989 (United States, 3/1989).** TWA: 1800 mg/m³ 8 hours. TWA: 1000 ppm 8 hours. **ACGIH TLV (United States, 3/2017). Oxygen Depletion [Asphyxiant].**

Section 8. Exposure controls/personal protection

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. If contact with the liquid is possible, insulated gloves suitable for low temperatures should be worn. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Thermal hazards : If there is a risk of contact with the liquid, all protective equipment worn should be suitable for use with extremely low temperature materials.

Section 9. Physical and chemical properties

Appearance

Physical state : Gas. [Compressed gas.]

Color : Colorless.

Odor : Odorless.BUT MAY HAVE SKUNK ODOR ADDED.

Odor threshold : Not available.

pH : Not available.

Melting point : -187.6°C (-305.7°F)

Boiling point : -161.48°C (-258.7°F)

Section 9. Physical and chemical properties

Critical temperature	:	96.55°C (205.8°F)
Flash point	:	Closed cup: -104°C (-155.2°F) Open cup: -104°C (-155.2°F)
Evaporation rate	:	Not available.
Flammability (solid, gas)	:	Extremely flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and oxidizing materials.
Lower and upper explosive (flammable) limits	:	Lower: 1.8% Upper: 8.4%
Vapor pressure	:	109 (psig)
Vapor density	:	1.6 (Air = 1)
Specific Volume (ft^3/lb)	:	8.6206
Gas Density (lb/ft^3)	:	0.116 (25°C / 77 to °F)
Relative density	:	Not applicable.
Solubility	:	Not available.
Solubility in water	:	0.02 g/l
Partition coefficient: n-octanol/water	:	1.09
Auto-ignition temperature	:	287°C (548.6°F)
Decomposition temperature	:	Not available.
Viscosity	:	Not applicable.
Flow time (ISO 2431)	:	Not available.
Molecular weight	:	44.11 g/mole
Aerosol product		
Heat of combustion	:	-46012932 J/kg

Section 10. Stability and reactivity

Reactivity	:	No specific test data related to reactivity available for this product or its ingredients.
Chemical stability	:	The product is stable.
Possibility of hazardous reactions	:	Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid	:	Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Do not allow gas to accumulate in low or confined areas.
Incompatible materials	:	Oxidizers
Hazardous decomposition products	:	Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Hazardous polymerization	:	Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Not available.

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Liquid can cause burns similar to frostbite.

Inhalation : No known significant effects or critical hazards.

Skin contact : Dermal contact with rapidly evaporating liquid could result in freezing of the tissues or frostbite.

Ingestion : Ingestion of liquid can cause burns similar to frostbite.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:, frostbite

Inhalation : No specific data.

Skin contact : Adverse symptoms may include the following:, frostbite

Ingestion : Adverse symptoms may include the following:, frostbite

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Section 11. Toxicological information

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Propane	1.09	-	low

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1978	UN1978	UN1978	UN1978	UN1978
UN proper shipping name	PROPANE	PROPANE	PROPANE	PROPANE	PROPANE
Transport hazard class(es)	2.1 	2.1 	2.1 	2.1 	2.1 
Packing group	-	-	-	-	-
Environmental hazards	No.	No.	No.	No.	No.

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Additional information

DOT Classification : **Limited quantity**
Yes.

Packaging instruction
Passenger aircraft
Quantity limitation: Forbidden.

Cargo aircraft
Quantity limitation: 150 kg

Special provisions
19, T50

For domestic transportation only, UN1075 may be substituted for the UN number shown as long as the substitution is consistent on package markings, shipping papers, and emergency response information. See 49 CFR 172.102 Special Provision 19.
Containers of NON-ODORIZED liquefied petroleum gas must be marked either NON-ODORIZED or NOT ODORIZED as of September 30, 2006. [49 CFR 172.301(f), 326(d), 330(c) and 338(e)]

TDG Classification : Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.13-2.17 (Class 2).
Explosive Limit and Limited Quantity Index 0.125
ERAP Index 3000
Passenger Carrying Ship Index 65
Passenger Carrying Road or Rail Index Forbidden
Special provisions 29, 42

IATA : **Quantity limitation** Passenger and Cargo Aircraft: Forbidden. Cargo Aircraft Only: 150 kg.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

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

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined

Clean Air Act (CAA) 112 regulated flammable substances: propane

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Refer to Section 2: Hazards Identification of this SDS for classification of substance.

State regulations

Massachusetts : This material is listed.

New York : This material is not listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol (Annexes A, B, C, E)

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Inventory list

Australia : This material is listed or exempted.

Canada : This material is listed or exempted.

China : This material is listed or exempted.

Europe : This material is listed or exempted.

Japan : **Japan inventory (ENCS)**: This material is listed or exempted.
Japan inventory (ISHL): This material is listed or exempted.

Malaysia : This material is listed or exempted.

New Zealand : This material is listed or exempted.

Philippines : This material is listed or exempted.

Republic of Korea : This material is listed or exempted.

Section 15. Regulatory information

Taiwan : This material is listed or exempted.

Thailand : Not determined.

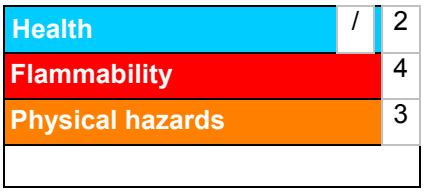
Turkey : This material is listed or exempted.

United States : This material is listed or exempted.

Viet Nam : Not determined.

Section 16. Other information

Hazardous Material Information System (U.S.A.)



Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings and the associated label are not required on SDSs or products leaving a facility under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered trademark and service mark of the American Coatings Association, Inc.

The customer is responsible for determining the PPE code for this material. For more information on HMIS® Personal Protective Equipment (PPE) codes, consult the HMIS® Implementation Manual.

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



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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

Procedure used to derive the classification

Classification	Justification
FLAMMABLE GASES - Category 1 GASES UNDER PRESSURE - Liquefied gas	Expert judgment Expert judgment

History

Date of printing : 5/6/2018

Date of issue/Date of revision : 5/6/2018

Date of previous issue : 6/28/2017

Version : 1

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973

Section 16. Other information

as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

References : Not available.

Other special considerations : The information below is given to call attention to the issue of “Naturally occurring radioactive materials”. Although Radon-222 levels in the product represented by this MSDS do not present any direct Radon exposure hazard, customers should be aware of the potential for Radon daughter build up within their processing systems, whatever the source of their product streams. Radon-222 is a naturally occurring radioactive gas which can be a contaminant in natural gas. During subsequent processing , Radon tends to be concentrated in Liquefied Petroleum Gas streams and in product streams having a similar boiling point range. Industry experience has shown that this product may contain small amounts of Radon-222 and its radioactive decay products, called Radon “daughters”. The actual concentration of Radon-222 and radioactive daughters in the delivered product is dependent on the geographical source of the natural gas and storage time prior to delivery. Process equipment (i.e. lines, filters, pumps and reaction units) may accumulate significant levels of radioactive daughters and show a gamma radiation reading during operation. A potential external radiation hazard exists at or near any pipe valve or vessel containing a Radon enriched stream, or containing internal deposits of radioactive material due to the transmission of gamma radiation through its wall. Field studies reported in the literature have not shown any conditions that subject workers to cumulative exposures in excess of general population limits. Equipment emitting gamma radiation should be presumed to be internally contaminated with alpha emitting decay products which may be a hazard if inhaled or ingested. Protective equipment such as coveralls, gloves, and respirator (NIOSH/MHSA approved for high efficiency particulates and radionuclides, or supplied air) should be worn by personnel entering a vessel or working on contaminated process equipment to prevent skin contamination, ingestion, or inhalation of any residues containing alpha radiation. Airborne contamination may be minimized by handling scale and/or contaminated materials in a wet state.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Revised January 1, 2014

MSDS

Material Safety Data Sheet

PRODUCT NAME: SLAG

1. CHEMICAL PRODUCT & COMPANY IDENTIFICATION

Supplier
Name: R. W. Sidley, Inc.
Address: 436 Casement Avenue
Painesville, OH 44077
Telephone: 440-352-9343

Product Identifier
Blast Furnace Slag, Steel Slag, Granulated Slag, Pelletized Slag, Metallic Slag, Air Cooled Slag, Non-metallic Slag, Mill Scale

Note: This MSDS covers many products. Individual composition of hazardous constituents will vary.

WHMIS Classification: D2A

Emergency Telephone Numbers 440-352-9343

2. INFORMATION ON COMPONENTS

Component Name	%	CAS No.
Amorphous Silica, Hydrated	30 - 50	7631-86-9
Calcium Compounds	30 - 50	various
Aluminum Compounds	0 - 20	various
Crystalline Silica	0 - 15	14808-60-7
Magnesium Compounds	0 - 20	various
Iron Compounds	0 - 10	various
Titanium Compounds	0 - 5	various
Manganese Compounds	0 - 2	various

Component Name	EXPOSURE LIMITS OSHA PEL TWA	ACGIH TLV TWA
*Amorphous Silica Hydrated	(80 mg/m^3)/%SiO_2	
Uncalcined Respirable		*3 mg/m^3
Particulate		*10 mg/m^3
Uncalcined Inhalable Particulate		
Calcium Oxide	5 mg/m^3	2 mg/m^3
Aluminum Oxide		
(Respirable Fraction)	5 mg/m^3	
(Total Dust)	15 mg/m^3	10 mg/m^3
Crystalline Silica Quartz		
Quartz (Respirable)	10 mg/m^3/(%SiO_2 +2)	
Quartz (Total Dust)	30 mg/m^3/(%SiO_2 +2)	0.05 mg/m^3
Magnesium Oxide	15 mg/m^3	10 mg/m^3
Iron Oxide	10 mg/m^3	5 mg/(Fe)/m^3
Titanium Oxide		
(Total Dust)	15 mg/m^3	10 mg/m^3
Manganese Oxide		5 mg/m^3
Nuisance Dust		
(Respirable)	5 mg/m^3	3 mg/m^3
(Total /Inhalable)	15 mg/m^3	10 mg/m^3

* These values are for particulate matter containing no asbestos and < 1% crystalline silica

3. HAZARD IDENTIFICATION

Emergency Overview
Solid; light grey/brown; odorless.
Potential Health Effects
INHALATION (acute): Breathing dust may cause nose, throat or lung irritation and choking. The described effect depends on the degree of exposure.
INHALATION (chronic): Prolonged or repeated exposure may cause lung injury including silicosis. This product may contain crystalline silica. Crystalline silica has been classified by IARC as a known human carcinogen. Some human studies indicate potential for lung cancer from crystalline silica exposure. Risk of injury depends on duration and level of exposure. Long term exposures which result in silicosis may result in additional health effects.
EYE CONTACT (acute/chronic): May cause eye irritation, burns and damage to cornea.
SKIN CONTACT (acute/chronic): May cause dry skin, redness, discomfort , irritation. Thickening of the skin (scleroderma) may be associated with exposure to high
levels of crystalline silica.
INGESTION (acute/chronic): Ingestion of large amounts may cause intestinal distress.

4. FIRST AID MEASURES

INHALATION: Move person to fresh air. Seek medical attention for discomfort.
EYE CONTACT: Rinse thoroughly with water. Seek medical attention for abrasions.
SKIN CONTACT: Wash with soap and water.
INGESTION: Do not induce vomiting, but drink plenty of water. Seek medical attention for discomfort.

5. FIREFIGHTING MEASURES

Flashpoint and Method: None.
Flammable Limits: Not combustible.
Autoignition Temperature: None.
General Hazard: Avoid breathing dust.
Firefighting Instructions: Treat adjacent material.
Firefighting Equipment: This product is not a fire hazard. Self contained breathing apparatus is recommended to limit exposures to smoke from any combustion source.
Hazardous Combustion Products: None.

6. ACCIDENTAL RELEASE MEASURES

General: Wind blown dust may cause the hazards identified in Section 3. Remove spilled material to limit potential harm.
Land Spill Clean up spilled material.
Water Spill: Clean up spilled material.

7. HANDLING AND STORAGE

General: Avoid accidental release.
Storage Temperature: Unlimited.
Storage Pressure: Unlimited.
Empty Containers: Dispose of containers in an approved landfill or incinerator.

8. EXPOSURE CONTROL & PERSONAL PROTECTION

Engineering Controls
Use exhaust ventilation to maintain dust levels below exposure limits in workplaces with poor ventilation and dusty conditions.
Personal Protection
RESPIRATORY PROTECTION: Under ordinary conditions no respiratory protection is required. Wear a NIOSH approved respirator when exposed to dust above exposure limits.
EYE PROTECTION: Wear glasses or safety goggles to prevent contact with eyes. Wearing contact lenses when using this product under dusty conditions is not recommended.
SKIN PROTECITON: Wear impervious gloves, shoes and protective clothing to prevent skin contact.

9. PHYSICAL AND CHEMICAL PROPERTIES

Vapor Pressure:	Not measurable
Vapor Density:	Not measurable
Specific Gravity:	2.5 - 3.0
Solubility in Water:	Negligible
Evaporation Rate:	Not measurable
pH (in water):	Neutral
Boiling Point:	>1000^{O} C
Freezing Point:	None, solid

Viscosity: None, solid

10. STABILITY AND REACTIVITY

General: Product is stable.
Incompatible Materials and Conditions to Avoid: Dissolves in hydrofluric acid producing corrosive silicon tetrafluoride gas. Silicates ract with powerful oxidizers such as fluorine, chlorine trifluoride and oxygen difluoride.
Hazardous Decomposition: None, solid.

11. MSDS PREPARATION AND TOXICOLOGICAL INFORMATION

For detailed toxicological information contact:

Environment , Health & Safety and Government Affairs
R. W. Sidley, Inc.
436 Casement Avenue
Painesville, OH 44077
440-352-9343

12. ECOLOGICAL INFORMATION

For detailed ecological information: See Section 11 above.

13. DISPOSAL CONSIDERATIONS

Dispose in landfill in accordance with all applicable regulations. Any disposal practice must be in compliance with local, provincial, state and federal laws and regulations. Contact local environmental agency for specific rules.

14. REQUIRED TRANSPORT INFORMATION

Not a hazardous material for DOT or TDG shipping.

15. REGULATORY INFORMATION

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

OSHA Hazard Communication Rule, 29 CFR 1910.1200:
Some conistituents identified in this product are considered by OSHA to be hazardous and should be included in the employer's hazard communication program.
CERCLA/SUPERFUND, 40 CFR 117,302:
Not listed.
SARA TITLE III, Sections 311-312 Hazard Category:
This product has been reviewed according to the EPA Hazard Categories promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 and is considered a hazardous chemical and a delayed health hazard.
SARA Section 313 Information:
This product contains NONE of the substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.
Toxic Substance Control Act (TSCA):
Some constituents identified in this product are listed on the TSCA Inventory.
California Proposition 65:
CHRYSTALLINE SILICA (CAS - 14808-60-7) is considered to be a carcinogen by the state of California.
WHMIS Information
This product contains substances considered to be hazardous by Health Canada and is a controlled product. Consult local authorities for acceptable exposure limits. WHMIS http://www.hc-sc.gc.ca/whmis

16. OTHER INFORMATION

Abbreviations:

CAS No	Chemical Abstract Service number
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
ACGIH	American Conference of Governmental Industrial Hygienists
TLV	Threshold Limit Value
TWA	Time Weighted Average (8 hour)
CL	Ceiling Limit
mg/m^3	milligrams per cubic meter
IARC	International Agency for Research on Cancer
NIOSH	National Institute for Occupational Safety and Health
pH	negative log of hydrogen ion
>	greater than
DOT	U.S. Department of Transportation
TDG	Transportation of Dangerous Goods
CFR	Code for Federal Regulations
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
SARA	Superfund Amendments and Reauthorization Act
WHMIS	Workplace Hazardous Materials Information System

Information in this MSDS is believed to be current and accurate at the time provided. It is the user's obligation to determine the conditions of safe use of this product.

Centers for Disease Control and Prevention
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SEARCH

Enter search terms separated by spaces.

Styrene

Synonyms & Trade Names Ethenyl benzene, Phenylethylene, Styrene monomer, Styrol, Vinyl benzene

CAS No. 100-42-5	**RTECS No.** WL3675000 (/niosh-rtecs/WL381378.html)	**DOT ID & Guide** 2055 128P (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=128&poly=1) (http://www.cdc.gov/Other/disclaimer.html) (inhibited)
Formula $C_6H_5CH=CH_2$	**Conversion** 1 ppm = 4.26 mg/m³	**IDLH** 700 ppm See: 100425 (/niosh/idlh/100425.html)

Exposure Limits

NIOSH REL : TWA 50 ppm (215 mg/m³) ST 100 ppm (425 mg/m³)
OSHA PEL † (nengapdxg.html): TWA 100 ppm C 200 ppm 600 ppm (5-minute maximum peak in any 3 hours)

Measurement Methods
NIOSH 1501 (/niosh/docs/2003-154/pdfs/1501.pdf), 3800 (/niosh/docs/2003-154/pdfs/3800.pdf);
OSHA 9 (http://www.osha.gov/dts/sltc/methods/organic/org009/org009.html) (http://www.cdc.gov/Other/disclaimer.html), 89 (http://www.osha.gov/dts/sltc/methods/organic/org089/org089.html) (http://www.cdc.gov/Other/disclaimer.html)
See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Colorless to yellow, oily liquid with a sweet, floral odor.

MW:	BP:	FRZ:	Sol:	VP:	IP:
104.2	293°F	-23°F	0.03%	5 mmHg	8.40 eV

Sp.Gr
0.91

Endpoint Security by Bitdefender
This page is safe

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

Incompatibilities & Reactivities Oxidizers, catalysts for vinyl polymers, peroxides, strong acids, aluminum chloride [Note: May polymerize if contaminated or subjected to heat. Usually contains an inhibitor such as tert-butylcatechol.]

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, nose, respiratory system; headache, lassitude (weakness, exhaustion), dizziness, confusion, malaise (vague feeling of discomfort), drowsiness, unsteady gait; narcosis; defatting dermatitis; possible liver injury; reproductive effects

Target Organs Eyes, skin, respiratory system, central nervous system, liver, reproductive system

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Water flush

Eyes: Prevent eye contact **Wash skin:** When contaminated **Remove:** When wet (flammable) **Change:** No recommendation	**Breathing:** Respiratory support **Swallow:** Medical attention immediately

Respirator Recommendations

NIOSH

Up to 500 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 10) Any supplied-air respirator*

Up to 700 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0073 (/niosh/ipcsneng/neng0073.html)
See MEDICAL TESTS: 0214 (/niosh/docs/2005-110/nmed0214.html)

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Page last updated: November 18, 2010
Content source: National Institute for Occupational Safety and Health (NIOSH) Education and Information Division

Centers for Disease Control and Prevention 1600 Clifton Rd. Atlanta, GA 30333, USA
800-CDC-INFO (800-232-4636) TTY: (888) 232-6348 - Contact CDC–INFO

USA.gov Government Made Easy

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People.™

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SEARCH

Enter search terms separated by spaces.

Toluene

Synonyms & Trade Names Methyl benzene, Methyl benzol, Phenyl methane, Toluol

CAS No. 108-88-3	**RTECS No.** XS5250000 (/niosh-rtecs/XS501BDo.html)	**DOT ID & Guide** 1294 130 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=130) (http://www.cdc.gov/Other/disclaimer.html)
Formula $C_6H_5CH_3$	**Conversion** 1 ppm = 3.77 mg/m3	**IDLH** 500 ppm See: 108883 (/niosh/idlh/108883.html)

Exposure Limits

NIOSH REL : TWA 100 ppm (375 mg/m3) ST 150 ppm (560 mg/m3)

OSHA PEL † (nengapdxg.html) : TWA 200 ppm C 300 ppm 500 ppm (10-minute maximum peak)

Measurement Methods

NIOSH 1500 (/niosh/docs/2003-154/pdfs/1500.pdf), 1501 (/niosh/docs/2003-154/pdfs/1501.pdf), 3800 (/niosh/docs/2003-154/pdfs/3800.pdf), 4000 (/niosh/docs/2003-154/pdfs/4000.pdf);

OSHA 111 (http://www.osha.gov/dts/sltc/methods/organic/org111/org111.html) (http://www.cdc.gov/Other/disclaimer.html)

See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (sltc/methods/index.html) /disclaimer.html)

Endpoint Security by Bitdefender
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Physical Description Colorless liquid with a sweet, pungent, benzene-like odor.

MW: 92.1	**BP:** 232°F	**FRZ:** -139°F	Sol(74°F): 0.07%	**VP:** 21 mmHg	**IP:** 8.82 eV
Sp.Gr: 0.87	**Fl.P:** 40°F	**UEL:** 7.1%	**LEL:** 1.1%		

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities Strong oxidizers

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage

Target Organs Eyes, skin, respiratory system, central nervous system, liver, kidneys

Personal Protection/Sanitation (See protection codes (protect.html)) **Skin:** Prevent skin contact	**First Aid** (See procedures (firstaid.html)) **Eye:** Irrigate immediately **Skin:** Soap wash promptly

Eyes: Prevent eye contact **Wash skin:** When contaminated **Remove:** When wet (flammable) **Change:** No recommendation	**Breathing:** Respiratory support **Swallow:** Medical attention immediately

Respirator Recommendations

NIOSH

Up to 500 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0078 (/niosh/ipcsneng/neng0078.html) See MEDICAL TESTS: 0232 (/niosh/docs/2005-110/nmed0232.html)

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SEARCH

Enter search terms separated by spaces.

Trichloroethylene

Synonyms & Trade Names Ethylene trichloride, TCE, Trichloroethene, Trilene

CAS No. 79-01-6	**RTECS No.** KX4550000 (/niosh-rtecs/KX456D70.html)	**DOT ID & Guide** 1710 160 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=160) (http://www.cdc.gov/Other/disclaimer.html)
Formula $ClCH=CCl_2$	**Conversion** 1 ppm = 5.37 mg/m3	**IDLH** Ca [1000 ppm] See: 79016 (/niosh/idlh/79016.html)

Exposure Limits

NIOSH REL : Ca See Appendix A (nengapdxa.html) See Appendix C (nengapdxc.html)

OSHA PEL † (nengapdxg.html) : TWA 100 ppm C 200 in ar

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Measurement Methods

NIOSH 1022 (/niosh/docs/2003-154/pdfs/1022.pdf) , 3800 (/niosh/docs/2003-154/pdfs/3800.pdf) ; **OSHA** 1001 v/dts/sltc/methods/mdt/mdt1001/1001.html) gov/Other/disclaimer.html) ı/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Colorless liquid (unless dyed blue) with a chloroform-like odor.

MW: 131.4	**BP:** 189°F	**FRZ:** -99°F	**Sol:** 0.1%	**VP:** 58 mmHg	**IP:** 9.45 eV
Sp.Gr: 1.46	**Fl.P:** ?	UEL(77°F): 10.5%	LEL(77°F): 8%		

Combustible Liquid, but burns with difficulty.

Incompatibilities & Reactivities Strong caustics & alkalis; chemically-active metals (such as barium, lithium, sodium, magnesium, titanium & beryllium)

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]

Target Organs Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system

Cancer Site [in animals: liver & kidney cancer]

Personal Protection/Sanitation (See protection codes (protect.html))	**First Aid** (See procedures (firstaid.html)) **Eye:** Irrigate immediately

codes (protectionin)

Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation
Provide: Eyewash, Quick drench

Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0081 (/niosh/ipcsneng/neng0081.html) See MEDICAL TESTS: 0236 (/niosh/docs/2005-110/nmed0236.html)

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MATERIAL SAFETY DATA SHEET

Date Printed: 09-20-2010
Date Updated: 07-25-2007
Version 1.9

Section 1 - Product and Company Information

Product Name	VANADIUM(V) OXIDE
Product Number	V6881
Brand	SIGMA
Company	Sigma-Aldrich
Address	3050 Spruce Street SAINT LOUIS, MO 63103 USA
Technical Phone:	+1 800-325-5832
Fax:	+1 800-325-5052
Emergency Phone:	(314) 776-6555

Section 2 - Composition/Information on Ingredient

Substance Name	CAS #	SARA 313
VANADIUM (V) OXIDE	1314-62-1	Yes

Formula: V_2O_5

Synonyms: Anhydride vanadique (French) * C.I. 77938 * Divanadium pentoxide * RCRA waste number P120 * Vanadic anhydride * Vanadio, pentossido di (Italian) * Vanadium (OSHA) * Vanadium oxide (V_2O_5) * Vanadium pentaoxide * Vanadiumpentoxid (German) * Vanadium pentoxide (ACGIH) * Vanadiumpentoxyde (Dutch) * Vanadium, pentoxyde de (French) * Wanadu pieciotlenek (Polish)

RTECS Number: YW2450000

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Highly Toxic (USA) Very Toxic (EU). Dangerous for the environment. Very toxic by inhalation and if swallowed. Irritating to eyes and respiratory system. Limited evidence of a carcinogenic effect. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Possible risk of harm to the unborn child. Possible mutagen. Target organ(s): Lungs. Calif. Prop. 65 carcinogen.

HMIS RATING

HEALTH: 3*
FLAMMABILITY: 0
REACTIVITY: 0

NFPA RATING

HEALTH: 3
FLAMMABILITY: 0
REACTIVITY: 0

*additional chronic hazards present.

For additional information on toxicity, please refer to Section 11.

ORAL EXPOSURE
If swallowed, wash out mouth with water provided person is conscious. Call a physician immediately.

INHALATION EXPOSURE
If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen.

DERMAL EXPOSURE
In case of skin contact, flush with copious amounts of water for at least 15 minutes. Remove contaminated clothing and shoes. Call a physician.

EYE EXPOSURE
In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.

Section 5 - Fire Fighting Measures

FLASH POINT
N/A

AUTOIGNITION TEMP
N/A

FLAMMABILITY
N/A

EXTINGUISHING MEDIA
Suitable: Noncombustible. Use extinguishing media appropriate to surrounding fire conditions.

FIREFIGHTING
Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes. Specific Hazard(s): Emits toxic fumes under fire conditions.

Section 6 - Accidental Release Measures

PROCEDURE TO BE FOLLOWED IN CASE OF LEAK OR SPILL
Evacuate area.

PROCEDURE(S) OF PERSONAL PRECAUTION(S)
Wear self-contained breathing apparatus, rubber boots, and heavy rubber gloves.

METHODS FOR CLEANING UP
Sweep up, place in a bag and hold for waste disposal. Avoid raising dust. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

HANDLING
User Exposure: Do not breathe dust. Do not get in eyes, on skin, on clothing. Avoid prolonged or repeated exposure.

STORAGE
Suitable: Keep tightly closed.

ENGINEERING CONTROLS
Use only in a chemical fume hood. Safety shower and eye bath.

PERSONAL PROTECTIVE EQUIPMENT
Respiratory: Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N99 (US) or type P2 (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.
Hand: Compatible chemical-resistant gloves.
Eye: Chemical safety goggles.

GENERAL HYGIENE MEASURES
Wash contaminated clothing before reuse. Wash thoroughly after handling.

EXPOSURE LIMITS, RTECS

Country	Source	Type	Value
USA	ACGIH	TWA	0.05 MG/M3 (RESPIRABLE DUST)
USA	MSHA Standard-air	Ceiling co	0.5 MG/M3
USA	OSHA.	PEL	CL 0.5 MG(V2O5)/M3, RESPIRABLE
USA	NIOSH	Ceiling co	0.05 MG/M3/15M

EXPOSURE LIMITS

Country	Source	Type	Value
Poland		NDS	0.05 MG/M3
Poland		NDSCh	0.5 MG/M3
Poland		NDSP	-

Section 9 - Physical/Chemical Properties

Appearance — Physical State: Solid

Property	Value	At Temperature or Pressure
Molecular Weight	181.88 AMU	
pH	N/A	
BP/BP Range	N/A	
MP/MP Range	690 °C	
Freezing Point	N/A	
Vapor Pressure	N/A	
Vapor Density	N/A	
Saturated Vapor Conc.	N/A	
SG/Density	1.02 g/cm3	
Bulk Density	N/A	
Odor Threshold	N/A	
Volatile%	N/A	
VOC Content	N/A	
Water Content	N/A	
Solvent Content	N/A	
Evaporation Rate	N/A	
Viscosity	N/A	
Surface Tension	N/A	
Partition Coefficient	N/A	
Decomposition Temp.	N/A	
Flash Point	N/A	
Explosion Limits	N/A	
Flammability	N/A	
Autoignition Temp	N/A	

Miscellaneous Data	N/A
Solubility	N/A

N/A = not available

Section 10 - Stability and Reactivity

STABILITY

Stable: Stable.

Materials to Avoid: Strong acids.

HAZARDOUS DECOMPOSITION PRODUCTS

Hazardous Decomposition Products: Nature of decomposition products not known.

HAZARDOUS POLYMERIZATION

Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

ROUTE OF EXPOSURE

Skin Contact: May cause skin irritation.

Skin Absorption: Skin absorption may occur. May be harmful if absorbed through the skin.

Eye Contact: Causes eye irritation.

Inhalation: Material is irritating to mucous membranes and upper respiratory tract. Highly toxic by inhalation.

Ingestion: Highly toxic by ingestion.

SENSITIZATION

Sensitization: Prolonged or repeated exposure may cause allergic reactions in certain sensitive individuals.

TARGET ORGAN(S) OR SYSTEM(S)

Lungs.

SIGNS AND SYMPTOMS OF EXPOSURE

Repeated exposure may result in a greenish discoloration of the tongue and may result in sensitivity to vanadium and its compounds. To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

TOXICITY DATA

Oral
Rat
10 mg/kg
LD50
Remarks: Behavioral:Coma.

Inhalation
Rat
126 mg/m3
LC50
Remarks: Sense Organs and Special Senses (Nose, Eye, Ear, and Taste):Eye:Other. Behavioral:Ataxia. Lungs, Thorax, or Respiration:Dyspnea.

Intraperitoneal
Rat
12 MG/KG

Subcutaneous
Rat
14 MG/KG
LD50
Remarks: Behavioral:Coma.

Intratracheal
Rat
6 MG/KG
LD50

Oral
Mouse
5 mg/kg
LD50

Intraperitoneal
Mouse
23 MG/KG
LD50

Subcutaneous
Mouse
10 MG/KG
LD50

Skin
Rabbit
50 mg/kg
LD50
Remarks: Kidney, Ureter, Bladder:Other changes. Liver:Other changes.

IRRITATION DATA

Eyes
Rabbit
20 mg
24H
Remarks: Moderate irritation effect

ACGIH CARCINOGEN LIST

Rating: A4

CHRONIC EXPOSURE - TERATOGEN
Result: Possible risk of congenital malformation in the fetus.

Species: Rat
Dose: 180 MG/KG
Route of Application: Oral
Exposure Time: (6-15D PREG)
Result: Effects on Embryo or Fetus: Other effects to embryo.

Species: Rat
Dose: 50 MG/KG
Route of Application: Intraperitoneal
Exposure Time: (6-15D PREG)
Result: Specific Developmental Abnormalities: Musculoskeletal system. Specific Developmental Abnormalities: Other developmental abnormalities. Specific Developmental Abnormalities: Skin and skin appendages.

Dose: 5 MG/KG
Route of Application: Intraperitoneal
Exposure Time: (10D PREG)
Result: Specific Developmental Abnormalities: Skin and skin appendages. Specific Developmental Abnormalities: Other developmental abnormalities. Specific Developmental Abnormalities: Musculoskeletal system.

Species: Mouse
Dose: 85 MG/KG
Route of Application: Intraperitoneal
Exposure Time: (6-15D PREG)
Result: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Specific Developmental Abnormalities: Musculoskeletal system. Specific Developmental Abnormalities: Other developmental abnormalities.

Species: Mouse
Dose: 85 MG/KG
Route of Application: Intraperitoneal
Exposure Time: (6-15D PREG)
Result: Effects on Embryo or Fetus: Other effects to embryo.

Species: Mouse
Dose: 10900 MG/KG
Route of Application: Intravenous
Exposure Time: (8D PREG)
Result: Specific Developmental Abnormalities: Musculoskeletal system.

CHRONIC EXPOSURE - MUTAGEN
Result: Laboratory experiments have shown mutagenic effects.

Species: Human
Dose: 300 NMOL/L
Cell Type: leukocyte
Mutation test: DNA damage

Species: Human
Dose: 30 UMOL/L
Cell Type: lymphocyte
Mutation test: DNA damage

Species: Human
Dose: 10 NMOL/L
Cell Type: lymphocyte
Mutation test: SLN

Species: Hamster
Dose: 1 MG/L
Cell Type: lung
Mutation test: Micronucleus test

CHRONIC EXPOSURE - REPRODUCTIVE HAZARD

Species: Rat
Dose: 90 MG/KG
Route of Application: Oral
Exposure Time: (6-15D PREG)
Result: Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants). Effects on Embryo or Fetus: Fetal death.

Dose: 10 MG/KG
Route of Application: Intraperitoneal
Exposure Time: (6-15D PREG)
Result: Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants). Effects on Embryo or Fetus: Fetal death. Specific Developmental Abnormalities: Other developmental abnormalities.

Species: Rat
Dose: 10 MG/KG
Route of Application: Intraperitoneal
Exposure Time: (6-15D PREG)
Result: Effects on Fertility: Pre-implantation mortality (e.g., reduction in number of implants per female; total number of implants per corpora lutea). Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants).

Species: Mouse
Dose: 179 MG/KG
Route of Application: Intraperitoneal
Exposure Time: (60D MALE)
Result: Effects on Fertility: Male fertility index (e.g., # males impregnating females per # males exposed to fertile nonpregnant females). Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants).

Species: Mouse
Dose: 170 MG/KG
Route of Application: Intraperitoneal
Exposure Time: (60D MALE)
Result: Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants). Effects on Fertility: Litter size (e.g.; # fetuses per litter; measured before birth). Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus).

Species: Mouse
Dose: 170 MG/KG
Route of Application: Intraperitoneal
Exposure Time: (60D MALE)
Result: Effects on Fertility: Male fertility index (e.g., # males impregnating females per # males exposed to fertile nonpregnant females). Paternal Effects: Testes, epididymis, sperm duct. Paternal Effects: Spermatogenesis (including genetic material, sperm morphology,motility, and count).

Section 12 - Ecological Information

ACUTE ECOTOXICITY TESTS

Test Type: LC50 Fish
Species: Pimephales promelas (Fathead minnow)
Time: 96 h
Value: 1.8 mg/l

Test Type: LC50 Fish
Species: Onchorhynchus mykiss (Rainbow trout)
Time: 96 h
Value: 5.2 mg/l

Time: 48 h
Value: 0.94 mg/l

Section 13 - Disposal Considerations

APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION
Contact a licensed professional waste disposal service to dispose of this material. Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information

DOT
Proper Shipping Name: Vanadium pentoxide, [non-fused form]
UN#: 2862
Class: 6.1
Packing Group: Packing Group III
Hazard Label: Toxic substances.
PIH: Not PIH

IATA
Proper Shipping Name: Vanadium pentoxide
IATA UN Number: 2862
Hazard Class: 6.1
Packing Group: III

Section 15 - Regulatory Information

EU DIRECTIVES CLASSIFICATION
Symbol of Danger: T-N
Indication of Danger: Toxic. Dangerous for the environment.
R: 20/22-37-48/23-51/53-63-68
Risk Statements: Harmful by inhalation and if swallowed. Irritating to respiratory system. Toxic: danger of serious damage to health by prolonged exposure through inhalation. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Possible risk of harm to the unborn child. Possible risk of irreversible effects.
S: 36/37-38-45-61
Safety Statements: Wear suitable protective clothing and gloves. In case of insufficient ventilation, wear suitable respiratory equipment. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Avoid release to the environment. Refer to special instructions/safety data sheets.

US CLASSIFICATION AND LABEL TEXT
Indication of Danger: Highly Toxic (USA) Very Toxic (EU). Dangerous for the environment.
Risk Statements: Very toxic by inhalation and if swallowed. Irritating to eyes and respiratory system. Limited evidence of a carcinogenic effect. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Possible risk of harm to the unborn child.
Safety Statements: Wear suitable protective clothing and gloves. In case of insufficient ventilation, wear suitable respiratory equipment. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Avoid release to the environment. Refer to special instructions/safety data sheets.
US Statements: Possible mutagen. Target organ(s): Lungs. Calif.

UNITED STATES REGULATORY INFORMATION
SARA LISTED: Yes
NOTES: This product is subject to SARA section 313 reporting requirements.
TSCA INVENTORY ITEM: Yes

UNITED STATES - STATE REGULATORY INFORMATION

CALIFORNIA PROP - 65
California Prop - 65: This product is or contains chemical(s) known to the state of California to cause cancer.

CANADA REGULATORY INFORMATION
WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.
DSL: Yes
NDSL: No

Section 16 - Other Information

DISCLAIMER
For R&D use only. Not for drug, household or other uses.

WARRANTY
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 Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.
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m-Xylene

Synonyms & Trade Names 1,3-Dimethylbenzene; meta-Xylene; m-Xylol

CAS No. 108-38-3	**RTECS No.** ZE2275000 (/niosh-rtecs/ZE22B6B8.html)	**DOT ID & Guide** 1307 130 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=130) (http://www.cdc.gov/Other/disclaimer.html)
Formula $C_6H_4(CH_3)_2$	**Conversion** 1 ppm = 4.34 mg/m³	**IDLH** 900 ppm See: 95476 (/niosh/idlh/95476.html)

Exposure Limits
NIOSH REL : TWA 100 ppm (435 mg/m³) ST 150 ppm (655 mg/m³)
OSHA PEL † (nengapdxg.html) : TWA 100 ppm (435 mg/m³)

Measurement Methods
NIOSH 1501 (/niosh/docs/2003-154/pdfs/1501.pdf), 3800 (/niosh/docs/2003-154/pdfs/3800.pdf); **OSHA** 1002 (http://www.osha.gov/dts/sltc/methods/mdt/mdt1002/1002.html) (http://www.cdc.gov/Other/disclaimer.html)
...cs/2003-154/) or OSHA Methods ...s/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

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Physical Description Colorless liquid with an aromatic odor.

MW:	BP:	FRZ:	Sol:	VP:	IP:
106.2	282°F	-54°F	Slight	9 mmHg	8.56 eV
Sp.Gr:	**Fl.P:**	**UEL:**	**LEL:**		
0.86	82°F	7.0%	1.1%		

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

Incompatibilities & Reactivities Strong oxidizers, strong acids

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis

Target Organs Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Change: No recommendation

Respirator Recommendations

NIOSH/OSHA

Up to 900 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0085 (/niosh/ipcsneng/neng0085.html)

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o-Xylene

Synonyms & Trade Names 1,2-Dimethylbenzene; ortho-Xylene; o-Xylol

CAS No. 95-47-6	**RTECS No.** ZE2450000 (/niosh-rtecs/ZE256250.html)	**DOT ID & Guide** 1307 130 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=130) (http://www.cdc.gov/Other/disclaimer.html)
Formula $C_6H_4(CH_3)_2$	**Conversion** 1 ppm = 4.34 mg/m³	**IDLH** 900 ppm See: 95476 (/niosh/idlh/95476.html)

Exposure Limits

NIOSH REL : TWA 100 ppm (435 mg/m³) ST 150 ppm (655 mg/m³)

OSHA PEL † (nengapdxg.html) : TWA 100 ppm (435 mg/m³)

Measurement Methods

NIOSH 1501 (/niosh/docs/2003-154/pdfs/1501.pdf), 3800 (/niosh/docs/2003-154/pdfs/3800.pdf); **OSHA** 1002 (http://www.osha.gov/dts/sltc/methods/mdt/mdt1002/1002.html)

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(http://www.cdc.gov/Other/disclaimer.html)

cs/2003-154/) or OSHA Methods s/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Colorless liquid with an aromatic odor.

MW:	BP:	FRZ:	Sol:	VP:	IP:
106.2	292°F	-13°F	0.02%	7 mmHg	8.56 eV
Sp.Gr:	**Fl.P:**	**UEL:**	**LEL:**		
0.88	90°F	6.7%	0.9%		

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

Incompatibilities & Reactivities Strong oxidizers, strong acids

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis

Target Organs Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Remove: When wet (flammable)
Change: No recommendation

Respirator Recommendations

NIOSH/OSHA

Up to 900 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0084 (/niosh/ipcsneng/neng0084.html)

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p-Xylene

Synonyms & Trade Names 1,4-Dimethylbenzene; para-Xylene; p-Xylol

CAS No. 106-42-3	**RTECS No.** ZE2625000 (/niosh-rtecs/ZE280DE8.html)	**DOT ID & Guide** 1307 130 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=130) (http://www.cdc.gov/Other/disclaimer.html)
Formula $C_6H_4(CH_3)_2$	**Conversion** 1 ppm = 4.41 mg/m³	**IDLH** 900 ppm See: 95476 (/niosh/idlh/95476.html)

Exposure Limits

NIOSH REL : TWA 100 ppm (435 mg/m³) ST 150 ppm (655 mg/m³)

OSHA PEL † (nengapdxg.html) : TWA 100 ppm (435 mg/m³)

Measurement Methods

NIOSH 1501 (/niosh/docs/2003-154/pdfs/1501.pdf), 3800 (/niosh/docs/2003-154/pdfs/3800.pdf); **OSHA** 1002 (http://www.osha.gov/dts/sltc/methods/mdt/mdt1002/1002.html) (http://www.cdc.gov/Other/disclaimer.html)

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ocs/2003-154/) or OSHA Methods ts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Colorless liquid with an aromatic odor. [Note: A solid below 56°F.]

MW:	BP:	FRZ:	Sol:	VP:	IP:
106.2	281°F	56°F	0.02%	9 mmHg	8.44 eV

Sp.Gr:	Fl.P:	UEL:	LEL:		
0.86	81°F	7.0%	1.1%		

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

Incompatibilities & Reactivities Strong oxidizers, strong acids

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis

Target Organs Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Change: No recommendation

Respirator Recommendations

NIOSH/OSHA

Up to 900 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0086 (/niosh/ipcsneng/neng0086.html)

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Zinc oxide

Synonyms & Trade Names Zinc peroxide

CAS No.	RTECS No.	DOT ID & Guide
1314-13-2	ZH4810000 (/niosh-rtecs/ZH496510.html)	1516 143 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=143) (http://www.cdc.gov/Other/disclaimer.html)

Formula	Conversion	IDLH
ZnO		500 mg/m3 See: 1314132 (/niosh/idlh/1314132.html)

Exposure Limits

NIOSH REL : Dust: TWA 5 mg/m3 C 15 mg/m3
Fume: TWA 5 mg/m3 ST 10 mg/m3

OSHA PEL † (nengapdxg.html) : TWA 5 mg/m3 (fume) TWA 15 mg/m3 (total dust) TWA 5 mg/m3 (resp dust)

Measurement Methods

NIOSH 7303 (/niosh/docs/2003-154/pdfs/7303.pdf) , 7502 (/niosh/docs/2003-154/pdfs/7502.pdf) ;
OSHA ID121 (http://www.osha.gov/dts/sltc/methods/inorganic/id121/id121.html) (http://www.cdc.gov/Other/disclaimer.html) , ID143 (http://www.osha.gov/dts/sltc/methods/inorganic/id143/id143.html) (http://www.cdc.gov/Other/disclaimer.html)
See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description White, odorless solid.

MW:	BP:	MLT:	Sol(64°F):	VP:	IP:
81.4	?	3587°F	0.0004%	0 mmHg (approx)	NA

Sp.Gr:	Fl.P:	UEL:	LEL:
5.61	NA	NA	NA

Noncombustible Solid

Incompatibilities & Reactivities Chlorinated rubber (at 419°F), water [Note: Slowly decomposed by water.]

Expo

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Symptoms Metal fume fever: ch ache, nausea, fever, dry throat, cough; lassitude (weakness, exhaustion); metallic taste; headache; blurred vision; low back pain; vomiting; malaise (vague feeling of discomfort); chest tightness; dyspnea (breathing difficulty), rales, decreased pulmonary function

Target Organs respiratory system

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: No recommendation
Eyes: No recommendation
Wash skin: No recommendation
Remove: No recommendation
Change: No recommendation

First Aid (See procedures (firstaid.html))

Breathing: Respiratory support

Respirator Recommendations
NIOSH/OSHA

Up to 50 mg/m3:
(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 125 mg/m3:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter.

Up to 250 mg/m3:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 500 mg/m3:
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.

Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0208 (/niosh/ipcsneng/neng0208.html) See MEDICAL TESTS: 0246 (/niosh/docs/2005-110/nmed0246.html)

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